

2022 Student Research Case Study Challenge: Football/Soccer



ACTL4001 – Actuarial Theory & Practice A

T1 ASSIGNMENT

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1. Objectives of Analysis

This report details the construction of a “competitive” national football team for the country of Rarita in order to build their brand and achieve a positive economic impact for the country. A statistical analysis of the players' historic performance data was used to determine the selection criteria used to form the team. A 10-year projected forecasting analysis on the revenue and expenses of the formulated team was performed in order to predict the impacts on Rarita's economy; specifically, it's GDP, employment rate, and tourism industry. The report deconstructs the intrinsic and extrinsic risk factors arising from the launch of the new national team and highlights mitigation strategies, delves into data limitations and presents the documentation of the team construction process.

2. Team Selection

2.1 Criteria for Selection

The selection criteria for the Rarita National Team (RNT) established was based on the success of winning teams and which statistics reflected significant relevance that contributed to their accomplishments (Appendix A). Our analysis focused on four sub-categories, offense, passing, defense and goalkeeping based on the top teams' statistics in both 2020 and 2021. The top teams in 2020 and 2021 were determined to be Sobianitedrucy (SBD), Nganion (NGN), Dosqaly (DQL), and People's Land of Maneau (PLM).

2.1.1 Shooting

	2020			2021			
	<i>DQL</i>	<i>NGN</i>	<i>SBND</i>	<i>AVG</i>	<i>SBND</i>	<i>PLM</i>	<i>NGN</i>
<i>Games Played</i>	7.27	8.025	7.92	5.91	7.98	7.69	7.03
<i>Goals</i>	5.37	4.64	3.78	3.05	3.39	1.89	2.68
<i>Shots</i>	24.82	46.83	53.9	29.16	37.97	13.17	38.18
<i>Shots on Target</i>	9.59	17.5	8.29	9.66	10.01	4.68	13.29
<i>Shot on Target/Shot</i>	0.39	0.37	0.15	0.33	0.26	0.36	0.35
<i>Shots/Game</i>	26.12	47.49	54.57	29.91	38.57	12.4	38.35
<i>Shots on Target/Game</i>	9.47	18.16	8.67	10.06	10.46	4.76	13.47
<i>Shots/Goal</i>	4.62	10.09	14.26	9.55	11.20	6.97	14.25
<i>SoT/Goal</i>	2.59	2.68	6.50	3.02	3.79	2.81	2.87

From our analysis, the general trend reflected that winning teams averaged significantly higher goals relative to the mean as they were able to either effectively establish a strong offence with a higher number of shots per game or demonstrate a stronger finishing rate reflected in low shots on target to goal ratio relative to the average in the tournament.

2.1.2 Passing

	2021			
	<i>SBD</i>	<i>PLM</i>	<i>NGN</i>	<i>AVG</i>
<i>Completed Pass/Game</i>	126.80	107.69	187.95	166.17
<i>Attempts Pass/Game</i>	148.19	129.00	213.44	201.88
<i>Total Completion Percentage</i>	86%	86%	88%	82%
<i>Short Passes Completion Percentage</i>	92%	93%	92%	90%
<i>Medium Passes Completion Percentage</i>	90%	91%	92%	87%
<i>Long Pass Completion Percentage</i>	68%	64%	76%	62%
<i>Assists</i>	2.4	2.26	2.37	1.75

A common trend amongst winning teams is their ability to have high pass completion at all ranges and high number of assists. Upon further research, passing plays an integral part in a team's performance as it retains possession of the ball with the potential of advancing it towards the opposition's goal without allowing an opportunity to press back (Almazov, 2020).

2.1.3 Defense

	2020			
	<i>SBD</i>	<i>PLM</i>	<i>NGN</i>	<i>AVG</i>
<i>Tackles</i>	27.57	24.68	27.89	30.23
<i>Tackle & Possession</i>	16.58	11.95	20.00	18.24
<i>Percentage Success of Pressure</i>	26%	23%	36%	27%
<i>Blocking a shot</i>	4.03	4.89	1.96	6.08
<i>Blocking a Pass</i>	19.07	19.59	21.31	20.98
<i>Interceptions</i>	22.42	30.51	16.84	24.99
<i>Clearances</i>	35.29	33.36	20.74	36.05

2.1.4 Goalkeeping

	2020			2021			
	<i>SBD</i>	<i>NGN</i>	<i>AVG</i>	<i>SBD</i>	<i>PLM</i>	<i>NGN</i>	<i>AVG</i>
<i>Goals Against</i>	0.19	0.61	2.16	0.48	0.29	0.78	1.53
<i>Percentage saves/SoT</i>	91%	77%	72%	75%	77%	69%	66%

The findings behind the winning teams' defense shockingly unveiled slightly below average statistics such as tackles, blocking shots, clearances, and interceptions (except for PLM). However, these teams still manage to have a significantly lower number of goals conceded and higher percentages of save per shot on target. Hence, upon team selection, defense statistics should be weighted less into consideration but a strong goalkeeper with a high percentage save per shot on target is recommended.

2.2 Probability ranges

A "high probability" of a championship in any given year is 20%. This probability was deduced based on various statistical models on the previous two FIFA World Cups detailing the likelihood of favorites winning the tournament at 15-17% ranges. Therefore, 20% would be an excellent margin in terms of 'high probability'. These numbers were calculated through prediction models which ran 10,000 random simulations of the game while incorporating league data, squad statistics, player history, and match conditions. These simulations were run using the rating-based model which is similar to the FIFA world cup system.

2.3 Spending

Base Franchise Value		
	2022	2031
Year	1	10
Total Revenue	2,509,266,295	11,893,818,437
Total Expense	2,638,149,984	12,081,916,734
Operating Income	-128,883,689	-188,098,297
Total Cash Flow	866,116,311	-188,098,297
PV	778999265.2	-65884951.16
EV	-4320114293	
Ideal Franchise Value		
	2022	2031
Year	1	10
Total Revenue	2,727,246,293	26,627,220,763
Total Expense	2,896,645,151	18,967,006,753
Operating Income	-169,398,858	7,660,214,010
Total Cash Flow	825,601,142	7,660,214,010
PV	742559254.9	2683133415
EV	1826231349	

The initial spending required at 2022 was determined to be 2,896,274,482 Doubloons consisting of operating costs and player acquisition costs. Operating costs include wages, facility management, rent, and other overhead costs while player costs involve scouting and 1-year term contract purchases. Using our team selection metric alongside the assumption that player's salaries give an accurate representation of their performance, 22 players were contracted totalling 365,490,000 Doubloons (Appendix B). The total expense by 2031 was forecasted to be 18,967,006,753 Doubloons.

2.4 Direct Team Revenue

Growth Assumptions	2022-2031
Wage Increase	0.001
Player expense increase	0.01
Rev from increasing league attendance / fanbase	0.01
Rev from ranking top 10	0.02
Rev from high probability of FSA Championship	0.02

The revenue forecasting was also determined using a 3-year moving average and the initial revenue generation was determined to be 2,896,645,151 Doubloons. This revenue consists of merchandising revenue, gate receipts and revenue from matchday, media revenues, and franchising and other advertising income. Within the analysis, 2 scenarios were used - baseline and ideal. In both scenarios the team were expected to rank top 10 however, in the ideal scenario the team's revenue was determined with a high probability of achieving the FSA Championship. Additionally, Rarita are expected to rise up the ladder and induce greater average league attendance so calculations involving revenue were adjusted for. The revenue generated by 2031 was forecasted to be 29,627,220,763 Doubloons.

3. Economic Impact

3.1 Impact on GDP and other economic indices

The construction of a competitive team and the expansion of football in terms of sport leads to several notable impacts on the economy. Gross Domestic Product (GDP) is a commonly used metric to determine the economic presence of certain industries and products, which is applicable to Rarita and its national team, Sports to \$14.4 billion of the GDP and 128,443 Full-Time Equivalent (FTE) jobs of a country according to an Australian study, whereby football has a 7% stake in the Sales figure of \$32 million and Domestic Production of \$29 million. A pair of analytical models performed to gauge the economic impact of football indicated through an Economic Impact Analysis (EIA) that even medium sized events generated a net increase in economic activity in the medium sized city within the study of \$5.6 million (Taks et al. 2011). This accentuates Rarita's forecasted positive economic impact as a direct result of the competitive team, through a combination of its increasing GDP and employment.

However, it must be noted that stadiums are costly buildings to construct and the same study (Taks et al. 2011) showed that when conducting a Cost Benefit Analysis (CBA), there was a net negative of \$2.4 million, much of which is attributable to the costs associated with stadium construction, coming to \$9.6 million (Appendix C). New stadium structures or improvements evoke the novelty effect (Appendix D). Thus, Rarita is able to uphold such positive impacts by ensuring sustainability in the construction and renovation of the stadium.

3.2 Impact on related industries and Rarita provinces

There is an undeniable economic impact that winning and competitive teams have, despite the significant subsidy of the stadium that must be acknowledged, where teams create job opportunities, team sales, tax revenue, increases in tourism, and consumer spending. Winning teams have the highest average values for interest and, by a wide margin, willingness-to-pay from the fanbase. Both franchises in this study had also been the most successful teams in their cities in the years immediately preceding the survey. The Vikings, with one highly successful (15-1) season, garnered much more support (Owen et al. 2006). This further underlines the notion that cities with more than one sports team have higher per capita money incomes than cities without any teams (Gius et al. 2001).

Another aspect that must be considered in terms of economics is the intangibles that are difficult to gauge with traditional metrics. This includes cultural changes within the city which is further boosted through marketing and advertisements, which leads to a 'major team city' image that contributes to the economy and tourism, along with a 'civic pride' generated from being a part of such a city (Appendix E).

4. Implementation Plan

4.1 Proposal

Team selection of Rarita's National Team will be conducted based on the criteria discussed previously whereby the focus will surround a player's salary and key skills. As there are enough capable players from Rarita, seeking player loans are unnecessary, hence the squad selection is as follows, (Appendix F). In the future, the Rarita National Team should constantly adapt to the rapidly changing football world either by investing into fostering young talent in academy teams or scouting promising players.

A general timeline which the RNT should follow within the next ten years is:

1. In one to two years identify weaknesses behind the squad, revenue and expense stream and seek replacements for improvement. Potential for success and profit is required otherwise a total rebuild is necessary to achieve the long-term goals.
2. From years three to five, aim to develop a competitive squad that will achieve a top ten position consistently.
3. In the final five years, with a 20% probability of winning the FSA tournament every year there is a 67.23% chance of accomplishing this achievement at least once.

This revenue consists of merchandising revenue, gate receipts and revenue from matchday, media revenues, and franchising and other advertising income. Additionally, the increase in revenue derived from maintaining a competitive team was approximated and as such, a sensitivity analysis was used on the net present value. As mentioned previously, the overall revenue was determined using a 3-year moving average of the growth rates to accommodate for randomness and to represent an overall trend rather than specific details.

NVP (Ideal)		Rev Inc (league attendance)					
	1826231349	0	0.005	0.01	0.015	0.02	
Initial Investment	495000000	-4543147071	-1698192483	1376523120	4698886720	8288033322	
	745000000	-4318292957	-1473338368	1601377235	4923740835	8512887437	
	995000000	-4093438842	-1248484254	1826231349	5148594950	8737741551	
	1245000000	-3868584727	-1023630139	2051085464	5373449064	8962595666	
	1495000000	-3643730613	-798776024.5	2275939578	5598303179	9187449781	

NVP (Ideal)		Rev Inc (Top 10)					
	1826231349	0.01	0.015	0.02	0.025	0.03	
Initial Investment	495000000	-4543147071	-1698192483	1376523120	4698886720	8288033322	
	745000000	-4318292957	-1473338368	1601377235	4923740835	8512887437	
	995000000	-4093438842	-1248484254	1826231349	5148594950	8737741551	
	1245000000	-3868584727	-1023630139	2051085464	5373449064	8962595666	
	1495000000	-3643730613	-798776024.5	2275939578	5598303179	9187449781	

NVP (Ideal)		Rev Inc (FSA Championship)					
	1826231349	0.01	0.015	0.02	0.025	0.03	
Initial Investment	495000000	-4543147071	-1698192483	1376523120	4698886720	8288033322	
	745000000	-4318292957	-1473338368	1601377235	4923740835	8512887437	
	995000000	-4093438842	-1248484254	1826231349	5148594950	8737741551	
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	1495000000	-3643730613	-798776024.5	2275939578	5598303179	9187449781	

4.2 Key Monitoring Metrics

Key metrics to be used to monitor the team's progress over the next 10 years include their win-loss record over the season, performance against upper tier teams (above 0.500 win%) versus lower tier teams (below 0.500 win%), consistency in record, brand value, revenue generated and aggregate market value of the players (Appendix G).

Collation of these metrics should occur twice a season in order for progress overview and feedback for improvement; such as highlighting areas of underperformance, budget allocation, and marketing plan. The team will undergo a full performance review annually and adjustments may be made to the line-up to maximise competitiveness of the team.

5. Assumptions

5.1 Key Assumptions

5.1.1 Correlation between player salary and performance

In sport, it is typical for the best, high performing players to receive corresponding salaries in order to keep them with the teams. Although there are rare cases of overpay and player regression, this is a sound assumption in terms of gauging player skill as a whole.

5.1.2 CAPM

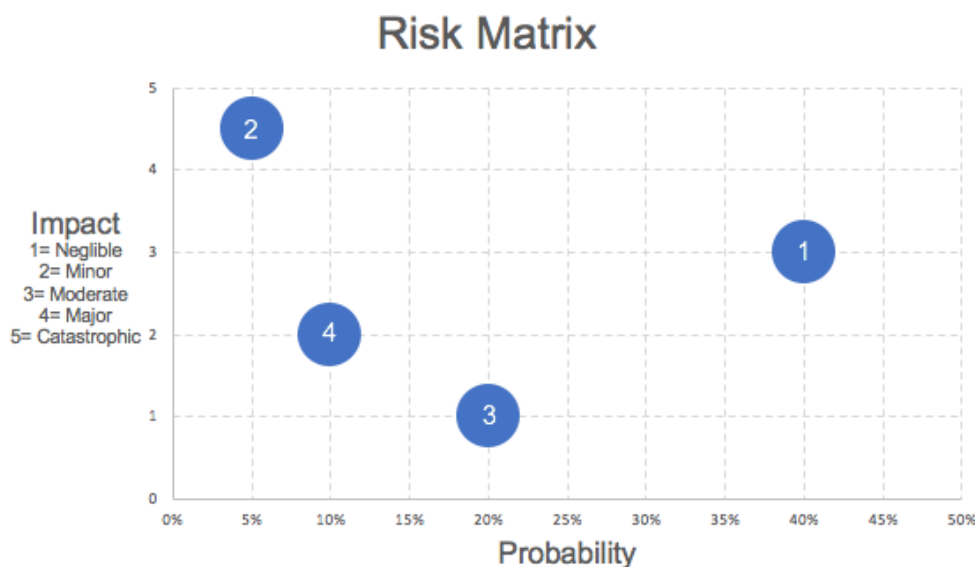
To derive the expected value of the franchise over 10 years, the discount rate was approximated by incorporating the CAPM assumptions and assuming they will not leverage their organisation. Since 0 debt was used over the horizon, the cost of capital was simply the cost of equity which was determined using the CAPM equation. The unlevered beta of 1.12 was extrapolated from the international peers median and the market return of 10% was the average return from the last 10 years.

5.2 Minor Assumptions

- Exchange rate
 - Constant foreign exchange rates.
- Inflation
 - Zero inflation.
- Team Composition
 - 22 players with two forwards, four midfielders, four defenders and one goalkeeper.

6. Risk and Risk Mitigation Considerations

The mitigation of intrinsic and extrinsic risk factors arising from the launch of this new team is central to risk control. This can be achieved through reductions in the incidence with which adverse events occur (preventive interventions) or through reductions in the severity of the outcomes from the adverse events (therapeutic interventions).



6.1 Player Injury

This is the most devastating risk, in terms of both probability and impact. The most common injuries sustained while playing soccer are bruising, sprains, strains, fractures and dislocations and are caused mainly by contact and falls.

MITIGATION: Both preventative and therapeutic interventions can be applied to reduce the risk of player injury. Measures taken against excessive game time and bad player habits can mitigate this. Reductions in severity can be achieved through improvements in specialist medical expertise and facilities or rehabilitation functional recovery procedures (Fuller CW 2004).

6.2 Natural Disasters

Rarita may be subjected to catastrophic events such as earthquakes, floods, bush fires, tsunamis, volcanic eruptions, etc. As Rarita can be a hotspot or a neighbouring country of a hotspot, this may result in the destruction of sports facilities.

MITIGATION: As these external risks are hard to predict and control, the only way to offset losses is to cede the risk to an insurer. Although paying premiums to a catastrophe insurance provider might be costly, it is worth the costs as catastrophic events can incur huge losses.

6.3 Exchange Rate Risk

Sports franchises incur a huge amount of foreign market exposure as they are dealing with competitors worldwide. Every transaction is affected by the exchange rate between competitors such as a new loan provision - a player gets lent to another team where the lending country charges a fee of 10% of the player's salary.

MITIGATION: To minimise losses during adverse exchange rate movements the Rarita sports franchise could hedge against the risk using currency forwards. Rarita can enter into a forwards contract to sell 'target' currency (an amount equal to 10% of players' salary) and buy Doubloons at a 1-year forward rate to hedge against FX market exposure.

6.4 Performance Risk

If a player underperforms, demand and salary for that player will decrease, resulting in reduced cash inflows from subsequent player transactions. As players are in a highly exposed environment, this will result in a tainted reputation which may decrease the team's revenue and contribute to their market risk.

MITIGATION: Ensure extensive preliminary scouting has been done before finalising player contracts. Hold mandatory educational courses for all new players regarding media and relations, ensure healthy play-agent relationship to promote good PR and brand recognition.

7. Data and Data Limitations

With the information provided, our team opted to utilise the tournament data over the league data for our team selection criteria as it was deemed more appropriate for RNT after careful consideration of the benefits and disadvantages.

Such benefits included that RNT would be facing a tournament structure rather than a league structure and thus their approaches to the game would be quite different as League games require teams to have more depth in their squad to reduce fatigue as there are more games whereas tournament games are “win or go home” situations which would require line-ups to be the stronger than usual.

However, there are several data limitations regarding intangible metrics (Appendix H). Further limitations include the tournament data documented in a biased manner, whereby, the number of games played by each team was not constant. To counter the effect of this limitation, statistics were analysed on a per game basis. Additionally, the sample sizes were significantly lower than reality; with each team averaging approximately five games compared to the thirty-eight games in regular league seasons. An analysis was conducted on the top three teams in 2020 and 2021 instead of the top team to increase the reliability and validity and it enabled us to conduct an in-depth and a higher weighting when analysing the data on nations Nganion and Sobianitedrucy as both teams were top three in both 2020 and 2021.

Some key notes that were discovered when conducting our analysis is that DQL did not have a goalkeeper in both tournaments (Appendix I). Missing data in the form of player accolades such as past captaincy, championships and individual player awards would have proved to be useful, especially to gauge characteristics which are difficult to do so with more traditional data, i.e., leadership traits and ‘star power’.

Appendix

- a. More specifically, one concept that must be factored in is player salaries because the general concept behind higher paid athletes encompasses their ability to perform at a higher level relative to other athletes whether it be their intelligence or their physical or mental attributes.
- b. Of the 22 players, 11 were the highest paid players and the rest were players with salary at the median value from Rarita. The overall trend of the expenses were forecasted using a 3-year moving average to account for randomness. To accommodate for the sport's high player injury rate, we have proposed to invest in competitive health officers to maintain risk control in the team. Player contracts were also expected to increase expenses by 1% annually as young players were expected to perform better over the years as they obtained more experience.
- c. It also garners interest in terms of the international stage, enabling the exporting of the product and its broadcasting capabilities and is further backed by strong growth in global demand for sport on the horizon as household incomes rise around the globe and discretionary spending increases. The World Bank estimated that total household expenditure by emerging economies on sport in 2010 was USD \$25 billion (KPMG International, 2020), suggesting further potential for Rarita's growth.
- d. Curiosity, increases in comfort, improved views, and a better atmosphere in new or renovated stadiums regularly lead to significantly higher spectator figures for the clubs, at least for a period after the improvements. In Germany, multivariate studies on all stadium projects since 1963 regarding construction and reconstruction isolated a rise in spectator numbers of about 2,700, or nearly 10 percent, per match (Allmers et al. 2009)
- e. Using a combination of the contingent valuation and travel cost techniques, it was found that the residents of Alberta, Canada, derive both significant use and non-use benefits from the Calgary Flames of the National Hockey League: up to C\$82m dollars a year (Groothuis et al. 2016), adding further support to the immeasurable aspects of having a competitive sports team in Rarita and its provinces.
- f. As to be discussed in assumptions, salary was used as the key driving factor behind player choice along with positions and the need for backups as contingency measures. The following team was assembled as the starting squad: M. Bwire, H. Mubaiwa, H. Tourgeman, G. Namuganza, M. Muhindo, O. Tshuma, Y. Thungu, A. Núñez, W. Nasiru, F. Hang, J. Dahiru, A. Omar. The reserve squad comprises of D. Naula, R. Monti, R. Tsao, A. Mtambo, B. Nakandi, J. Nurhayati, L. Tarigan, R. Namutebi, H. Mirembe, K. Al-Zahrani.

- g. These statistics are commonly regarded as the most effective measures of long term success in a football team and are used to create composite indices which aggregates aspects of sport, economic and social variables. Total score obtained for clubs by applying the composite index is an integrating representation of a team's sporting performance in all major competitions, its local and global reputation and its level of revenue generated by the business (Teodor et al. 2015).
- h. Team chemistry is considered an intangible within the world of football and a major component factor associated with a National Team's team performance. Organizational and team culture plays a massive factor in the "locker room" as it determines the degree to which the players and coaching staff are engaged and committed to each other, thereby extending onto their play on the field. These aspects of football have no quantifiable metric by which we can perform analysis and draw conclusions from, thus proving difficult to incorporate.
- i. There is a high probability that this is a data integrity issue, but there is a slight chance that this is not the case as DQL has demonstrated strong offensive statistics which would have compensated for the lack of goalkeeper.

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