Forecasting Follower Trends on Facebook for NGO through ARIMA

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A B S T R A C T

Plan international is one of the world's largest non-governmental development organizations, with more than 75 years experience in development. It is working in 70 countries and has sponsored more than 1.4 million children and women. The main purpose of Plan International is safeguard of children's right and equality of girls. The main campaigns carried out by Plan International are 'Education', 'Mother's Day', 'Women's day', 'Menstrual Hygiene Day', 'Child Marriage', 'Child Mothers', 'Because I am a girl' etc. The present study is based on the secondary data from Facebook profile pages of Plan International. The analytical tool used was ARIMA technique. Study reveals the trend of Facebook followers of Plan International according to the region. It also tell about the campaigns that contributed in increasing the follower's number. This study aims to track a record of their Facebook followers for past 24 months from July 2014 to June 2016 and to predict the number of followers for next 6 months i.e., July 2016 to December 2016 using ARIMA forecasting technique. The study would provide an idea about leading trends on Facebook for different regional offices of Plan International and impact of these Facebook post in getting the attention of more people and thus getting more funds for women welfare and empowerment. This study aims to highlight the importance of social media in upliftment and empowerment of women by attracting high funds and sponsors for various campaigns, which would be utilized by NGOs for various welfare projects. Since the majority of Plan International's income comes from supporters who sponsor children and women welfare project and the remainder is raised through donations and grants.

Introduction

Plan International is an international organization with their presence in 70 countries across Africa, the Americas, and Asia to safeguard the rights of women and children. It is among top NGOs of the world after UNICEF and Care International. Major leading campaigns for Plan International are "Because I Am a Girl campaign" for upliftment of girls and women in developing and developed nations, "Save the girl child", "Sponsor a child", "No child marriages",

"Gender equality", "End to FGM", "Hands on heart against Ebola", "Child brides", "Vocational training for rural women" etc. It is a nonprofit organization and it works in 58,000 communities to address the needs of women and children around the world. The NGO focuses on women and child participation, education, economic security, emergencies, health, protection, sexual health (including HIV), clean water and sanitation. It provides training in disaster preparedness,

response and recovery and has worked on relief efforts in countries including Haiti, Neal, Syria, Colombia and Japan. Plan International also motivates girls throughout the world to fight for their rights and social independence through campaigns like "Being a girl" and "Every day is Malala day". Plan International has 5 regional offices namely ARO (Asian Regional Office), WARO (West Africa Regional Office), RESA (Regions of East and Southern Africa), ROA (Regional office Americas), EU (European Union Regional Office) and has an International Headquarters (IH) in UK.

Plan International uses their social media very effectively to create awareness about their ongoing campaigns and to raise funds for the campaigns. They use different mode of social media posts to attract high audience attention. Modes of posts are picture post, text post, video post and Infographic post.

This study aims to track a record of their Facebook followers for past 24 months starting from July 2014 to June 2016 and to predict the number of followers for next 6 months i.e., July 2016 to December 2016 using ARIMA forecasting technique. The study provides an idea about leading trends on Facebook under different regional offices of Plan International.

It help to quantify the impact of Facebook post in getting the attention of more people and thus getting more funds for women welfare and empowerment. This study aims to highlight the importance of social media in upliftment and empowerment of women by attracting high funds and sponsors for various campaigns and welfare projects. Majority of Plan International's income comes from supporters who sponsor children and women welfare project and the remainder is raised through donations and grants.

Methodology

Source of data: Secondary data was manually collected by researcher from profile of regional offices and International Headquarters of Plan International on 1st day of each month from July 2014 to June 2016 to keep a track of month wise increase of follows, which provided the base for forecasting.

Technique used: ARIMA forecasting technique was used to predict the followers from coming 6 months for regional offices and International Headquarters of Plan International ARIMA models are applied when data show evidence of non-stationarity, where an initial differencing step (corresponding to the "integrated" part of the model) can be applied one or more times to eliminate the non-stationarity. The AR part of ARIMA indicates that the evolving variable of interest is regressed on its own lagged values. The MA part indicates that the regression error is actually a linear combination of error terms whose values occurred contemporaneously and at various times in the past. I (for "integrated") indicate that the data values have been replaced with the difference between their values and the previous values. The purpose of each of these features is to make the model fit the data as well as possible. When two out of the three terms are zeros, the model may be referred to base on the nonzero parameter, dropping "AR", "I" or "MA" from the acronym describing the model. For example, ARIMA (1,0,0) is AR(1), ARIMA(0,1,0) is I(1), and ARIMA(0,0,1) is MA(1). ARIMA models can be estimated following the Box–Jenkins approach. Given a time series of data X_t where t is an integer index and the X_t are real numbers, an ARMA (p,q) model is given by

$$X_t - \alpha_1 X_{t-1} - \cdots - \alpha_{p'} X_{t-p'} = \varepsilon_t + \theta_1 \varepsilon_{t-1} + \cdots + \theta_q \varepsilon_{t-q}$$

Where L is the lag operator, α_i are the parameters of the autoregressive part of the model, θ_i are the parameters of the moving average part and ε_t are error terms. The error terms are generally assumed to be independent, identically distributed variables sampled from a normal distribution with zero mean.

An ARIMA (p,d,q) process expresses this polynomial factorization property with $p=p'-d$, and is given by:

$$\left(1 - \sum_{i=1}^{p} \phi_i L^i\right)(1 - L)^d X_t = \left(1 + \sum_{i=1}^{q} \theta_i L^i\right)\varepsilon_t$$

Thus can be thought as a particular case of an ARMA($p+d,q$) process having the autoregressive polynomial with d unit roots.

$$\left(1 - \sum_{i=1}^{p} \phi_i L^i\right)(1 - L)^d X_t = \delta + \left(1 + \sum_{i=1}^{q} \theta_i L^i\right)\varepsilon_t$$

The above can be generalized as follows. This defines an ARIMA (p,d,q) process with drift $\delta/(1 - \Sigma\varphi i)$.

Forecasts using ARIMA models

The ARIMA model can be viewed as a "cascade" of two models. The first is non-stationary:

$Y_t = (1\text{-}L)^d X_t$

While the second is wide-sense stationary:

$$\left(1 - \sum_{i=1}^{p} \phi_i L^i\right)Y_t = \left(1 + \sum_{i=1}^{q} \theta_i L^i\right)\varepsilon_t$$

Now forecasts can be made for the process, using a generalization of the method of autoregressive forecasting.

Result and Discussion

Trends of Plan International IH

Plan International Headquarter is in UK. The data regarding number of Facebook followers for 24 months of Plan International IH and its regional pages are shown below.

Fig 1 represents Plan International Facebook follower's trend from Jul'14-Jun'16. Among all the profiles, the highest audience response and growth was observed in case of IH (International Headquarters). IH posted on Fcebook about all the regional as well as global campaigns of Plan International like "Beacause I am a girl", "Sponsor a girl child" and post related to interntional days like Mother's day, International women's day etc. Other profiles posted mainly about their regional campagins, thus they attracted less number of Facebook followers compared to IH.

Table 1 represents number of Plan International Facebook followers from Jul'14-Jun'16. Over a period of 24 months all the profiles have increased their Facebook followers due to global campaigns like "Beacause I am a girl", "Sponsor a girl child", "I am Malala", "Girls not bride" etc. IH had highest growth in followers and thus was able to attract highest number of sponsers and

funds for their campagins. Other progessive profiles were ARO (Asia) and ROA (America) which raised awarenss about women and child projects. Good internet facilities specially in developed countries of Asia and America suppoerted their campaigns. RESA (Eastern and Southern Africa) and WARO (Western Africa) had less followers than IH, ARO and ROA as most of the countries in Africa were underdeveloped countries or developing countries thus facing the issues of limited internet facilites.

Fig 2 represents trend of IH International Headquarters Facebook followers for 24 months. From Jul'14 to Jun'16, IH reported a growth of 114.4% due to campaigns like being a girl, Child rights, End FGM, Because I am a Girl , Eradicating child marriage , child labour,, Disasters management for for girls, Caring for children of sex workers, girl education and voluntary training for girls.

Fig 3 represents International Headquarters Facebook follower's forecast form Jul'16 to Dec'16. Forecast drift reflected the number of followers from 129660 (Jul'16) to 144295.3 (Dec'16). Campaigns which might contribute to increase in followers are girl education, girl safety and end to child marriage. Also project related to women empowerment, safety and hygiene could help to attract more sponsors.

Table 2 represents forecast of facebook followers for 6 months at confidence level of 80% and 95%. Over a period of 6 months an expected growth of 11.2% could be observed.

Trend Analysis of RESA

Fig 4 represents trend of RESA Facebook followers for 24 months. From Jul'14 to Jun'16, RESA reported a growth of 42.79 % due to campaigns EndFGM, ECCD (early childhood care and child development programme), water and hygiene for girls,

upliftment of Syrian Refugees and Becauseiama Girl.

Fig 5 represents RESA Facebook followers forecast form Jul'16 to Dec'16. Forecast drift reflected the number of followers remained constant of 15622 (Jul'16) to (Dec'16). Campaigns which might contribute to little increase in followers are End to voilence against girls, girl education and hygiene.

Table 3 represents forecast of facebook followers for 6 months at confidence level of 80% and 95%. Over a period of 6 months an expected growth remained constant.

Trend of Asian Regional Office(ARO)

Fig 6 represents trend of ARO Facebook followers for 24 months. From Jul'14 to Jun'16, ARO reported a growth of 85.58% due to campaigns like child malnutrition, vocational training for girls, Meri Beti Meri Shakti, sanitation, malnutrition and nutrition awareness.

Fig 7 represents ARO Facebook follower's forecast for Jul'16 to Dec'16. Forecast drift reflected the number of followers increased from 60946 (Jul'16) to 66936 (Dec'16). Campaigns which might contribute to increase in followers are ourvoicematters against domestic violence, child sexual exploitation, Good Handwashing Practices and Safe Schools for girls.

Table 4 represents forecast of facebook followers for 6 months at confidence level of 80% and 95%. Over a period of 6 months an expected growth of 9.82 % could be observed.

Trend Analysis of WARO

Fig 8 represents trend of WARO Facebook followers for 24 months.

Table.1 Plan International Facebook followers Jul'14-Jun'16

		International Headquarters	RESA	ARO	WARO	ROA	EU
2014	Jul'14 Followers	59,345	10,940	32,194	9,702	15,281	0
	Aug'14 Followers	61,935	12,131	33,257	9,834	17,675	0
	Sep'14 Followers	66,778	15,137	34,948	9,847	20,960	0
	Oct'14 Followers	73,403	15,182	36,627	9,865	22,642	0
	Nov'14 Followers	75,851	15,257	37,763	9,905	22,955	0
	Dec'14 Followers	78,163	15,285	39,782	10,000	23,364	0
2015	Jan'15 Followers	80,331	15,315	41,216	10,016	23,957	0
	Feb'15 Followers	82,144	15,333	42,021	10,028	24,416	0
	Mar'15 Followers	82,449	15,018	41,821	9,952	23,941	0
	Apr'15 Followers	84,391	15,057	42,411	9,970	24,076	0
	May'15 Followers	87,970	15,097	43,473	11,002	24,181	0
	Jun'15 Followers	89,871	15,138	44,033	11,014	24,207	0
	Jul'15 Followers	92,000	15,199	44,766	11,310	24,324	0
	Aug'15 Followers	93,910	15,230	45,119	11,367	24,412	0
	Sep'15 Followers	97,802	15,274	45,860	11,438	25,379	0
	Oct'15 Followers	1,03,045	15,311	46,869	11,582	25,512	0
	Nov'15 Followers	1,05,943	15,345	47,490	11,675	25,608	1,054
	Dec'15 Followers	1,08,319	15,371	48,047	11,744	25,743	1,069
2016	Jan'16 Followers	1,11,308	15,414	48,989	11,845	26,105	1,099
	Feb'16 Followers	1,14,964	15,448	50,191	11,973	26,640	1,126
	Mar'16 Followers	1,19,004	15,493	56,969	12,342	27,102	1,135
	Apr'16 Followers	1,23,283	15,558	58,571	12,468	27,744	1,148
	May'16 Followers	1,25,743	15,607	59,367	12,516	28,239	1,182
	Jun'16 Followers	1,27,230	15,622	59,748	12,568	28,507	1,204

Table.2 Forecast of facebook followers for 6 months

Month	Predicted value	At 80		At 95	
		Lower	Higher	Lower	Higher
1 (Jul'16)	129660	128054.0	131267.9	127203.4	132118.5
2 (Aug'16)	132587.8	129575.7	135599.9	127981.2	137194.4
3 (Sep'16)	135514.7	131569.6	139459.7	129481.2	141548.1
4 (Oct'16)	138441.5	133745.4	143137.1	131259.4	145623.7
5 (Nov'16)	141368.4	136025.7	146711.1	133197.4	149539.4
6 (Dec'16)	144295.3	138376.2	150214.3	135242.9	153347.7

Table.3 Forecast of facebook followers for 6 months

Month	Predicted value	At 80		At 95	
		Lower	Higher	Lower	Higher
1 (Jul'16)	15622	14752.40	16491.60	14292.06	16951.94
2 (Aug'16)	15622	14392.20	16851.80	13741.18	17502.82
3 (Sep'16)	15622	14115.80	17128.20	13318.47	17925.53
4 (Oct'16)	15622	13882.80	17361.20	12962.12	18281.88
5 (Nov'16)	15622	13677.51	17566.49	12648.16	18595.84
6 (Dec'16)	15622	13491.92	17752.08	12364.32	18879.68

Table.4 Forecast of facebook followers for 6 months

Month	Predicted value	At 80		At 95	
		Lower	Higher	Lower	Higher
1 (Jul'16)	60946	59256.31	62635.69	58361.84	63530.16
2 (Aug'16)	62144	59754.42	64533.58	58489.45	65798.55
3 (Sep'16)	63342	60415.37	66268.63	58866.11	67817.89
4 (Oct'16)	64540	61160.62	67919.38	59371.68	69708.32
5 (Nov'16)	65738	61959.74	69516.26	59959.65	71516.35
6 (Dec'16)	66936	62797.12	71074.88	60606.13	73265.87

Table.5 Forecast of facebook followers for 6 months

Month	Predicted value	At 80		At 95	
		Lower	Higher	Lower	Higher
1 (Jul'16)	12692.61	12411.72	12973.50	12263.03	13122.19
2 (Aug'16)	12817.22	12419.98	13214.45	12209.70	13424.74
3 (Sep'16)	12941.83	12455.31	13428.34	12197.77	13685.88
4 (Oct'16)	13066.43	12504.66	13628.21	12207.27	13925.60
5 (Nov'16)	13191.04	12562.96	13819.13	12230.47	14151.61
6 (Dec'16)	13315.65	12627.62	14003.68	12263.40	14367.91

Table.6 Forecast of facebook followers for 6 months

Month	Predicted value	At 80		At 95	
		Lower	Higher	Lower	Higher
1 (Jul'16)	28737.36	27954.09	29520.64	27539.44	29935.28
2 (Aug'16)	28935.38	27281.57	30589.19	26406.10	31464.66
3 (Sep'16)	29105.58	26483.09	31728.08	25094.82	33116.35
4 (Oct'16)	29251.89	25606.03	32897.75	23676.03	34827.75
5 (Nov'16)	29377.65	24681.27	34074.02	22195.16	36560.13
6 (Dec'16)	29485.74	23729.81	35241.68	20682.80	38288.69

Table.7

Month	Predicted value	At 80		At 95	
		Lower	Higher	Lower	Higher
1 (Jul'16)	1001.889	715.5507	1288.227	563.9725	1439.805
2 (Aug'16)	1001.889	715.5507	1288.227	563.9725	1439.805
3 (Sep'16)	1001.889	715.5507	1288.227	563.9725	1439.805
4 (Oct'16)	1001.889	715.5507	1288.227	563.9725	1439.805
5 (Nov'16)	1001.889	715.5507	1288.227	563.9725	1439.805
6 (Dec'16)	1001.889	715.5507	1288.227	563.9725	1439.805

Fig.1 Plan International Facebook followers trend Jul'14-Jun'16
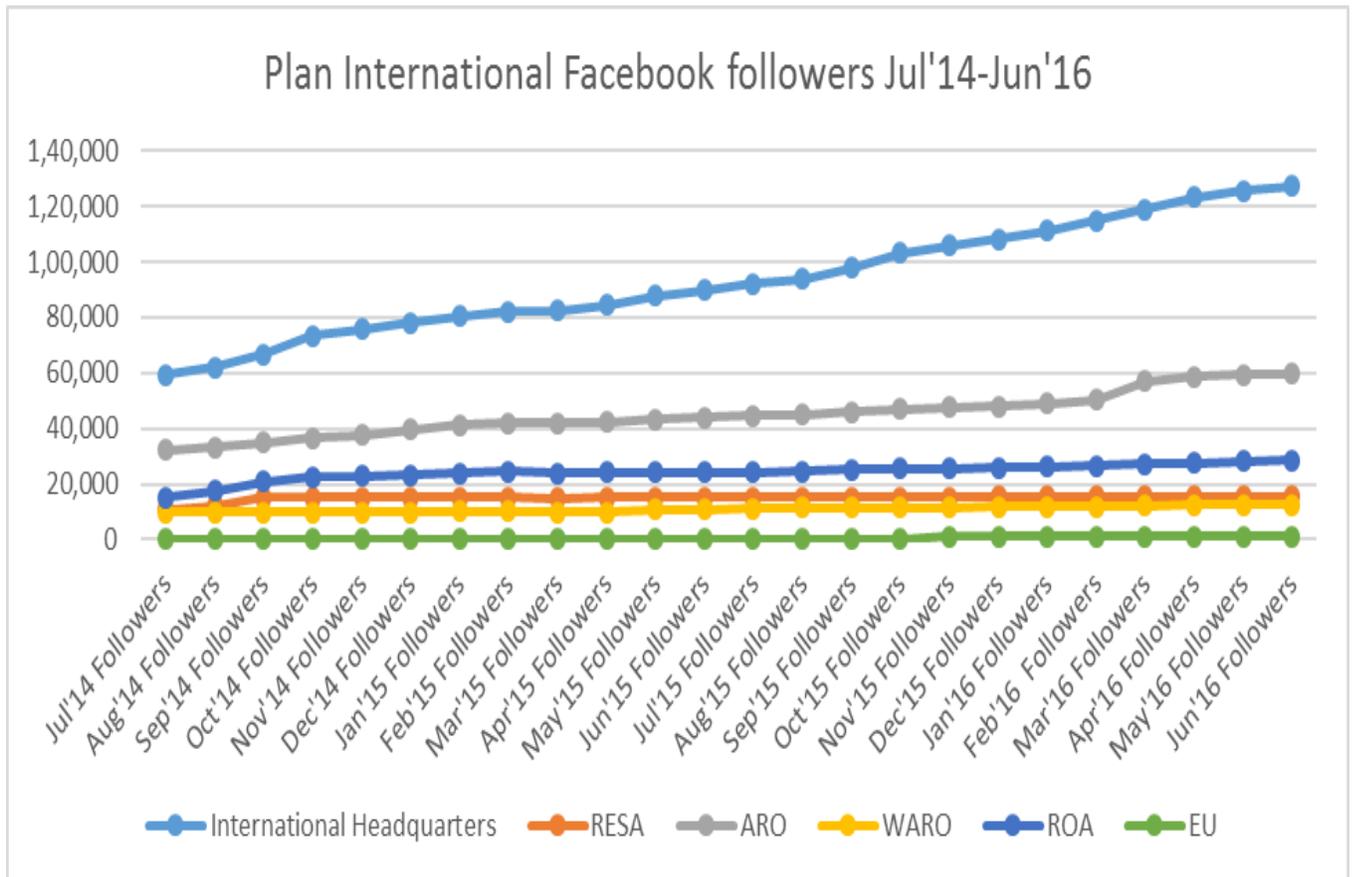
Fig.2 Trend of International Headquarters Facebook followers for 24 months
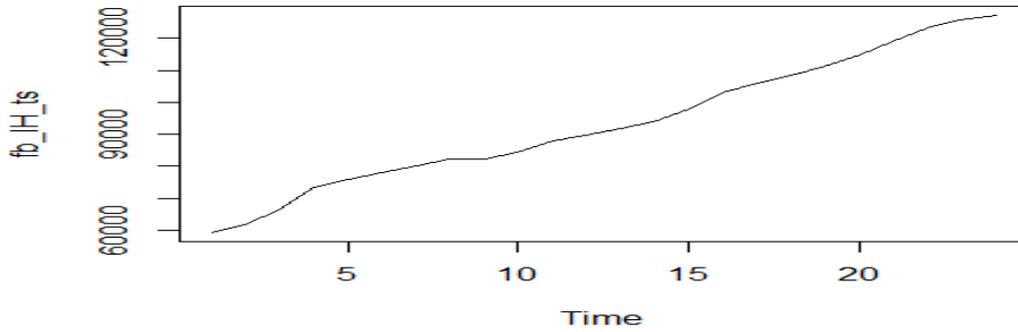
Fig.3 International Headquarters Facebook followers forecast for Jul'16 to Dec'16

Forecasts from ARIMA(0,1,1) with drift
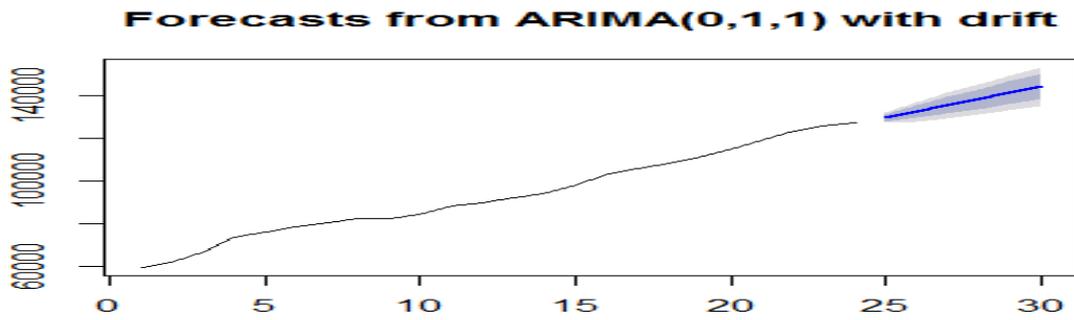
Fig.4 Trend of RESA (Region of East and Southern Africa) Facebook followers for 24 months
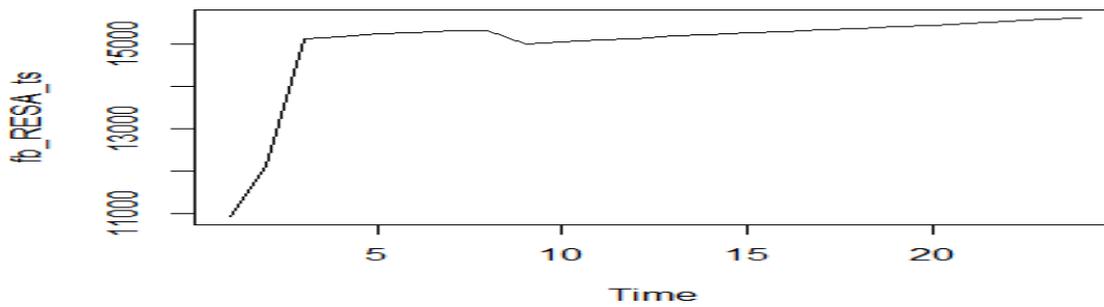
**Fig.5** Region of East and Southern Africa Facebook followers forecast for Jul'16 to Dec'16
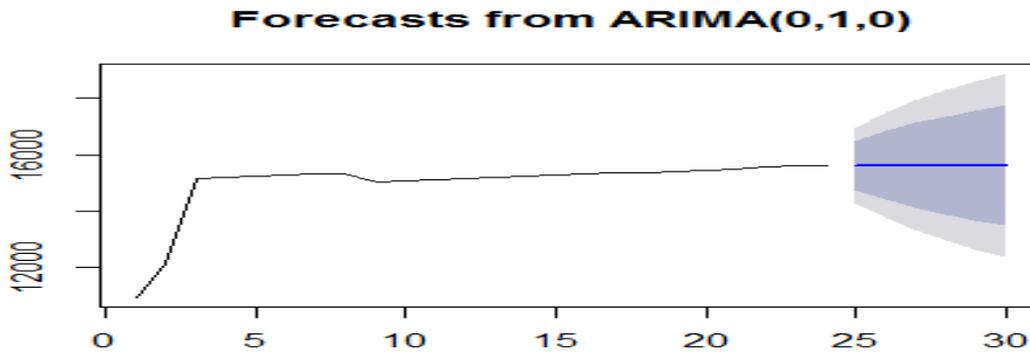


Fig.6 Trend of ARO (Asian Regional Office) Facebook followers for 24 months
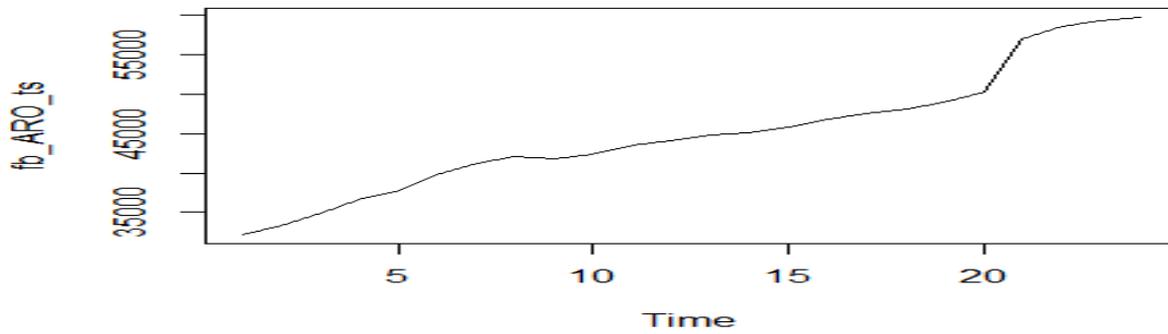
Fig.7 Asian Regional Office Facebook followers forecast for Jul'16 to Dec'16
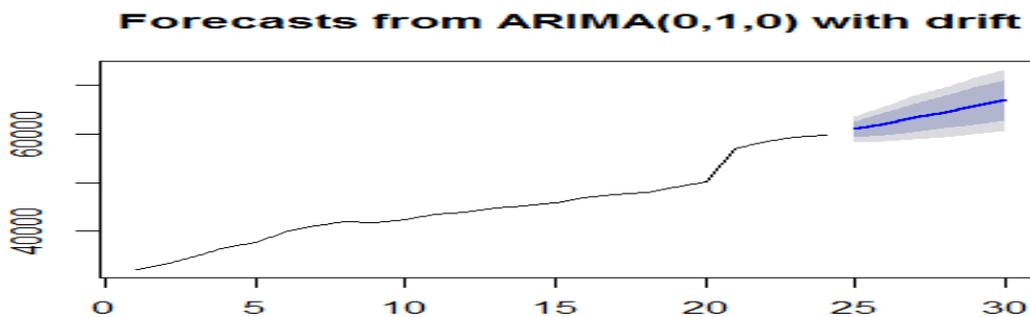
Fig.8 Trend of WARO (West Africa Regional Office) Facebook followers for 24 months
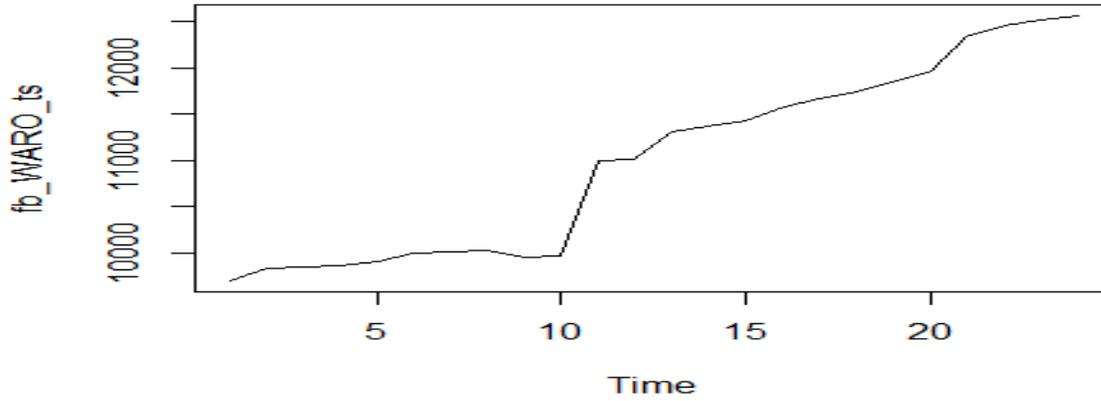

Fig.9 West Africa Regional Office Facebook followers forecast for Jul'16 to Dec'16
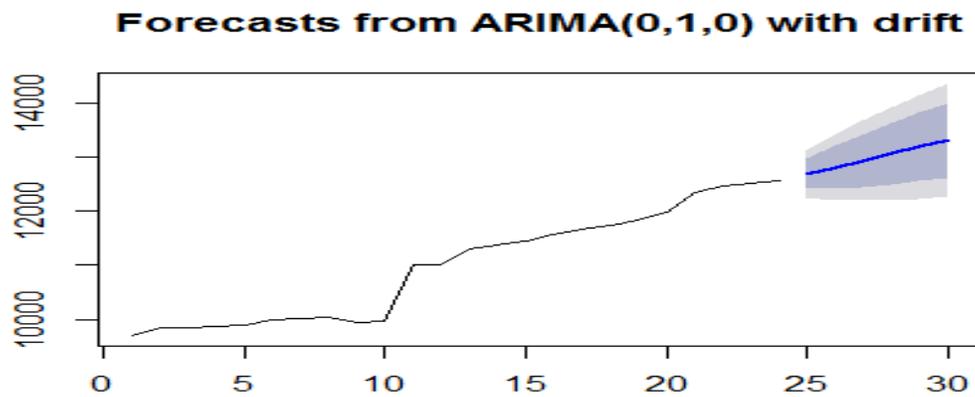
Fig.10 Trend of ROA (Regional Office Americas) Facebook followers for 24 months
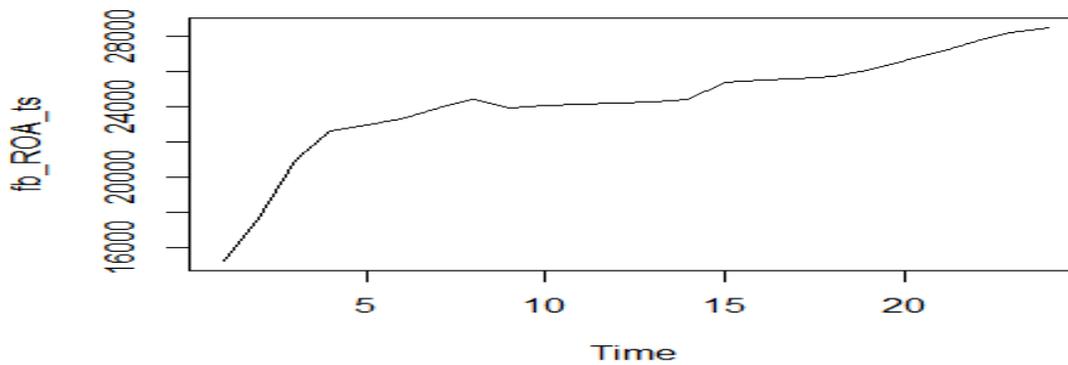
**Fig.11** Regional Office Americas Facebook followers forecast for Jul'16 to Dec'16
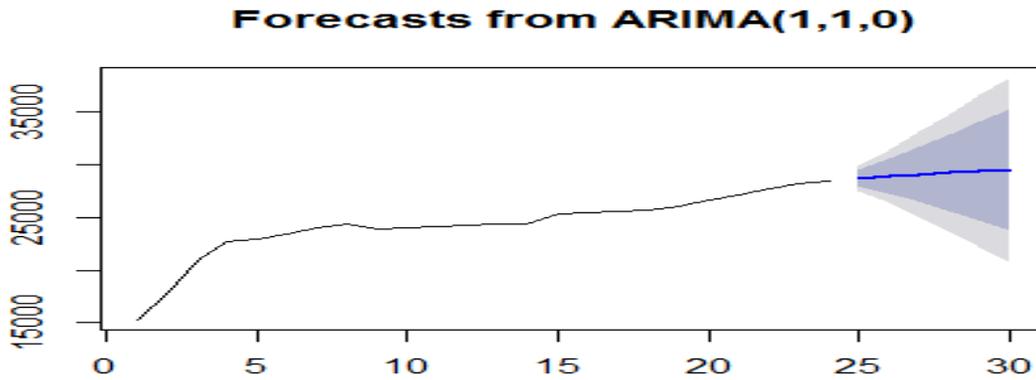
Fig.12 Trend of EU (European Union Regional Office) Facebook followers for 24 months
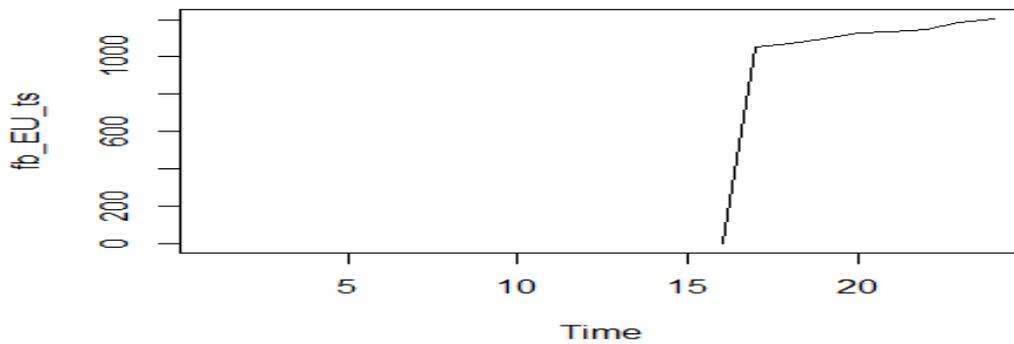

Fig.13 European Union Regional Office Facebook followers forecast for Jul'16 to Dec'16
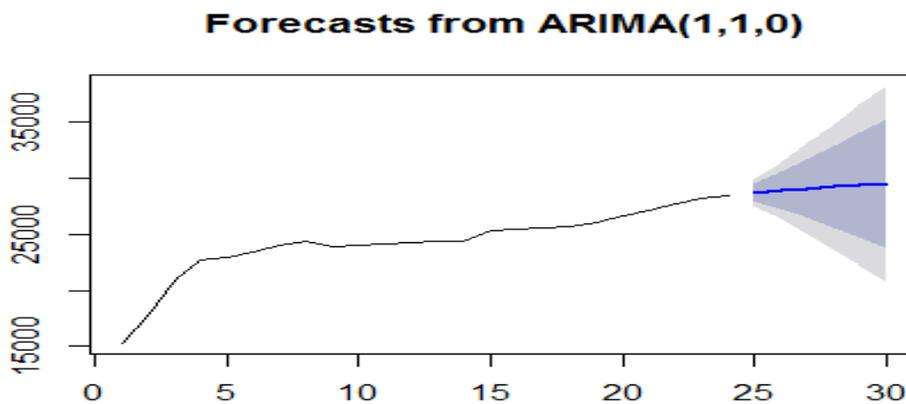
From Jul'14 to Jun'16, WARO reported a growth of 29.54% due to campaigns like managing conflict and crisis for rural women, school construction for girls, hygiene and sanitation for women, vocational training for girls, BringBackOurGirls, end violence etc.

Fig 9 represents West Africa Regional Office Facebook followers forecast for Jul'16 to Dec'16. Forecast drift reflected the number of followers from 12692.61 (Jul'16) to 13315.65 (Dec'16). Campaigns which might contribute to increase in followers are ChildMarriage, ChildLabour, Gender Equality, DayofTheAfricanChild and pay equity.

Table 5 represents forecast of facebook followers for 6 months at confidence level of 80% and 95%. Over a period of 6 months an expected growth of 4.90 % could be observed.

Trend Analysis of ROA

Fig 10 represents trend of ROA Facebook followers for 24 months. From Jul'14 to Jun'16, ROA reported a growth of 86.55% due to campaigns like Being a girl, girl education, gender equality, right of girls in property, right of girls in decision making.

Fig 11 represents Regional Office Americas Facebook followers forecast for Jul'16 to Dec'16. Forecast drift reflected the number of followers from 28737.36 (Jul'16) to 29485.74 (Dec'16). Campaigns which might contribute to increase in followers are child education, raising voice against cyber bullying and girl protection.

Table 6 represents forecast of facebook followers for 6 months at confidence level of 80% and 95%. Over a period of 6 months an expected growth of 2.60 % could be observed.

Trend Analysis of EU

Fig 12 represents trend of EU Facebook followers for 24 months. From Jul'14 to Jun'16, EU reported a growth of % due to Girls Voice against sexual harassment, health and nutrition of mothers, gender equality, clean water and hygiene.

Fig 13 represents European Union Regional Office Facebook followers forecast for Jul'16 to Dec'16. Forecast drift reflected the number of followers remained constant of 1001.889 from (Jul'16 to Dec'16). Campaigns which might contribute to increase in followers ware child education, raising voice against cyber bullying and girl protection.

Table 7 represents forecast of facebook followers for 6 months at confidence level of 80% and 95%. Over a period of 6 months number of followers are estimeated to remain same. However little increase in number of followers might occur due to campaigns like women empowerment and child rights

In conclusion, social media plays an important role in popularity of any organization. It is an effective and low cost medium for advertisement. Facebook user base can be used efficiently to gain popularity and to attract sponsors and funds for various campaigns by NGOs. Various campaigns which contributed to success on social media for Plan International are 'Education', 'Mother's Day', 'Women's day', 'Menstrual Hygiene Day', 'Child Marriage', 'Child Mothers', 'Because I am a girl'. IH is most progressive profile of Plan International since they organize campaigns on regional and global level. IH prepare attractive posts on Facebook to get high audience attention. Other profiles mostly post about their local campaigns, thus their follower base is limited to few countries. ARIMA can be used by NGOs to forecast the follower base of their profiles and to design the campaigns accordingly. Higher Facebook follower base helps to attract higher funds, grants and sponsors for various welfare projects.

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