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Composite Appraisal of Women Development in Selected Thirty-six Countries with Special Focus on Pakistan: Applying Grey Incidence Analysis Model

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ABSTRACT

Aim of the study is to appraise women development in selected thirty-six countries with special reference to Pakistan. The design of the study comprises of survey of literature, data elicitation and analysis. The study uses grey incidence analysis model (usually known as Grey Relational Analysis or simply GRA). The model has been applied on the secondary data extracted from the website of World Development Indicators (WDI). The countries included in the analysis have been selected on the basis of availability of data. From the result of GRA it can be learnt that *thirty-six* countries of the world are classified into seven different categories. There are *five* countries (namely Estonia, Hungary, Slovak Republic, Thailand and Ecuador) categorized as countries having *exceptionally high* women development, whereas, *five* countries under each next ensign (*very high, high, moderate, low and very low*). There are *six* countries (namely Tanzania, Madagascar, Cote d'Ivoire, Pakistan, Nigeria and Afghanistan) categorized under the ensign of *exceptionally low*. Pakistan fall under the ensign of *exceptionally low*. This study is designed on an original country level data extracted from very reliable source and the results of the study are useful for regulators, researchers, NGOs and other stakeholders of the phenomenon by way of providing deeper and new information.

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1. Introduction

Women play key role in economic and social development of any country. They play vital role in nutrition security, generating income and improving standard of living. They also play significant role in agriculture. Women are primary caretakers of children and elders in almost every society. Women development is a hot topic of research in domain. There is influx of research studies on the topic viz Iqbal et al. (2016) carried a comprehensive study to assess gender disparities across 167 economies of the world by taking the component (i.e. providing incentive to work, using property, going to court, building credit, access to institutions, getting job and violence protection) of WBL legal gender disparity measure and proclaimed a high degree of legal gender disparity. Islam et al. (2018) gathered data from 59,000 firms of 94 economies and concluded that prevailing unequal laws discourage women participation and empowerment in top managerial positions of private sectors firms. Morgan and Pritchard (2019) discussed in detail gender matters in hospitality and emphasized on highlighting the issues of neglecting female ability despite of rise of feminism. Oladokun et al. (2018) analyzed data of 1502 from south-east and 5024 women from north-east of Nigeria to assess the levels of women assets ownership and bolstered that education plays a pertinent role in owning women assets ownership. A lot of work has also been done in Pakistan concerning women development like a study of women entrepreneurship by Qazi, Niazi, Basit and Hameed (2020). But the authors could not find any study that has compared women development at country level using a composite mathematical approach like grey incidence analysis model. Since it is a hot topic therefore a country level multi criteria analysis is call of the day in order to provide comprehensive and deeper new information to stakeholders. To be more specific there is a severe need of comparing the women development among different countries on objective basis. The objectives of the study are: i) to develop a theoretical framework for country level analysis of women development, ii) to rank the countries on the basis of grey relational grade, iii) evaluate the position of Pakistan qua other countries and iv) discuss the results qua reality. Major research questions are: i) how the countries rank against each other on the basis of women development? ii) where do Pakistan stand among its counterparts? In order to address the issue and attain the objectives of the study there are many alternate methodologies viz TOPSIS, VIKOR, SWARA, AHP, GRA, ISM, SEM etc. This study uses GRA since it seems to be the most appropriate method for analyzing the secondary data of multi alternative cum multi attribute phenomenon. Remaining part of the article is arranged as literature review, theoretical framework, methodology, results & discussions and concluding remarks.

2. Literature Review

Women development is highly researched area, there exists a plethora of research on the phenomenon. The authors have reviewed many studies relevant to the topic. While during the survey of research it was envisaged on authentic websites of research like ScienceDirect, JStor, Wiley-Blackwell, Taylor & Francis, etc. Relevant studies that are necessary to set out the outset of the study are reported in this article. Avalanche of published literature can be witnessed on women development across the globe including: identifying the capabilities of women's leadership and sustainable development in Colombia (Barrios et al., 2020), exploring the relationship between female directorship and firm performance in France (Bennouri et al., 2018) gender inequality in assets ownership in Latin America (Deere et al., 2010), wage gaps of female-male among salaried workers in India (Deshpande et al., 2018; Lee & Wie, 2017; Menon & Rodgers, 2009), uncovered opportunities and barriers of female employment in sports in UK (Forsyth et al., 2019), women segregation in tourism employment in APEC region (Hutchings et al., 2020), women empowerment in East Africa (Miedema et al., 2018), women empowerment in Nepal (O'Hara & Clement, 2018), women asset ownership in rural south-east and north-east Nigeria (Oladokun et al., 2018), participation of Saudi women in development index (Omair et al., 2020), gender wage gap in Mexico (Popli, 2013), gender wage discrimination in Pakistan (Sabir & Aftab, 2007; Yasmin, 2009), gender wage inequality between 1992-2014 in Sri Lanka (Seneviratne, 2020), role of female directors and stock price in China (Shahab et al., 2020), women's social and financial empowerment in Pakistan (Tahir et al., 2018) and gender wage gap in Philippines (Zveglic Jr. et al., 2019). Bennouri et al. (2018) examined the data of 394 French firms and affirmed that there is a positive relationship between female board directorship and firm performance; similar finding have been found by Nekhili & Gatfaoui (2013) and Peni (2014).

Likewise, Chen et al. (2018); Chen et al. (2019) and Ullah et al. (2020) asserted that female board representation has positive impact on firm performance particularly for those firms who intend to be creative and innovative. del Carmen Triana et al. (2019) argued that educational background of top management team and inter-organizational strategic alliance support for moderation between strategic change and senior management gender diversity. Deshpande et al. (2018) found male-female wage discrimination among salaried workers in India wherein female are likely to be paid less. Forsyth et al. (2019) identified barriers and opportunities of female employment in sports and bolstered that gender inequality is still need to be addressed in educational sports related settings. Hutchings et al. (2020) gathered data from tourism sector of 21 Asia-Pacific Economic Cooperation (APEC) member economies and concluded that there is clear segregation of women in tourism employment across the economies due to intersectionality and cultural barriers. Salahodjaev and Jarilkapova (2020) collected data from 176 countries between 1990-2015 and buttressed that female parliamentarism has significant socio-economic results as increased political empowerment of female is vital to the reduction of deforestation levels for different income ranks in both developed and developing nations. Seneviratne (2020) examined gender wage inequality in Sri Lanka between 1994-2014 and revealed following results: i) shrink in gender wage inequality due to women's human capital improvement, ii) overestimate gain in equality and iii) underestimate gender wage gap. Diederer et al. (2002) and Shinbrot et al. (2019) uncovered potential challenges and contributions for women leadership in sustainable development including: lack of self-confidence and patriarchal structure to refrain women to become leader. Tahir et al. (2018) stated that despite of taking initiative of Benazir Income Support Program (BISP) to alleviate the poverty and empower the women, there is no significant improvement is found in women's empowerment socially and financially. Zeb and Ihsan (2020) found significant relationship between innovation, entrepreneurship and entrepreneurial performance. They argued that there is direct relationship between innovation and performance; innovation mediates the relationship; moreover, entrepreneurial qualities (i.e. need for achievement and risk-taking propensity) have significant effect on both entrepreneurial performance and innovation. Zveglic Jr. et al. (2019) affirmed that conservative proxies in Philippines undervalue the efforts of gender differences in work experience while discussing gender wage gap. From the aforementioned review following theoretical framework has been derived.

3. Theoretical Framework

Theoretical framework of a study fixes the limits of variables, data set, alternates and criteria (Abend, 2008). Here alternates are the selected countries whereas the criteria are the variables concerning the women development in each country. The nomenclature, operational definition, unit of measurement and acceptable characteristics of every criterion is expounded in Table 1.

Table 1: Descriptions of Variables

Code	Variable of Women Development	Measure	Criteria
1	Female Life Expectancy at Birth	Years	Larger is the best
2	Female Account ownership at a financial institution or with a mobile-money-service provider	% of population ages 15+	Larger is the best
3	Female wage and salaried workers	% of females employment	Larger is the best
4	Firms with female participation in ownership	% of firms	Larger is the best
5	Female share of employment in senior and middle management	%	Larger is the best
6	Women in parliaments	% of total seats	Larger is the best
7	Nondiscrimination clause mentions gender in the constitution	1=yes; 0=no	Larger is the best

The close observation of the variables listed in Table 1 possess the characteristics of larger is the best.

However, the unit of measurement of the variables are different. The criteria taken to account for building the theoretical framework of the study was decided on the basis of availability of data on the variables.

4. Methodology

This study follows positivist research philosophy and deductive approach. It is a country level secondary data based descriptive study. Overall design of the study consists of literature survey, data elicitation and analysis. The data has been obtained from World Development Indicators (WDI), 2020. On the website of WDI, 2020 complete data of thirty-six countries and seven different variables was available which has been used for the purpose of investigation. The analysis of the study is based on grey system theory advanced by Julong Deng (1989). Out of this theory grey incidence analysis model has been used as a method of investigation. This model proceeds step wise as given in following section (Hamzaçebi & Pekkaya, 2011; Kuo et al., 2008; Tayyar et al., 2014; Wu, 2002; Zhang et al., 2011).

5. Grey Incidence Analysis Model (GIAM)

Following steps of GIAM were used to access the best performer among different countries of the world: Step 1: Created a data set and established decision matrix of data set using following formula:

$$x_i(k) = \begin{bmatrix} x_1(1)x_1(2) & \cdots & x_1(m) \\ \vdots & \ddots & \vdots \\ x_n(1)x_n(2) & \cdots & x_n(m) \end{bmatrix} \quad (1)$$

Table 2: Original Set of Women Development Data

Sr.	Country	1	2	3	4	5	6	7
1	Afghanistan	66	7.2	4.3	2.2	4.3	28	0
2	Albania	80	38	44	13	29	30	1
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
26	Pakistan	68	7	25	12	4.2	20	1
27	Poland	82	88	84	40	38	29	0
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
35	Turkey	80	54	64	25	17	17	1
36	Zambia	66	40	12	50	29	18	1

Source of Data: (World Development Indicators (WDI), 2020)

Step 2: Created reference series and comparison matrix using formula:

$$x_0 = [x_0(k) \dots \dots \dots x_0(n)] \quad (2)$$

Reference series is formed with identifying best alternative from normalized matrix which is added to decision matrix to make a comparison among alternatives.

Table 3: Reference Sequence and Comparable Sequences

Sr.	Country	1	2	3	4	5	6	7
0	Reference Sequence	82	98	94	70	54	61	1
1	Afghanistan	66	7.2	4.3	2.2	4.3	28	0
2	Albania	80	38	44	13	29	30	1
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
26	Pakistan	68	7	25	12	4.2	20	1
27	Poland	82	88	84	40	38	29	0
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
35	Turkey	80	54	64	25	17	17	1
36	Zambia	66	40	12	50	29	18	1

Step 3: Created a normalized matrix using the following formulas for larger is the best/acceptable:

$$x_i^*(k) = \frac{x_i^{(0)}(k) - \min x_i^{(0)}(k)}{\max x_i^{(0)}(k) - \min x_i^{(0)}(k)} \quad (3)$$

Table 4: Normalized Comparable Sequences

Sr.	Country	1	2	3	4	5	6	7
0	Reference Sequence	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	Afghanistan	0.4074	0.0022	0.0000	0.0000	0.0020	0.4310	0.0000
2	Albania	0.9259	0.3407	0.4426	0.1593	0.4980	0.4655	1.0000
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
26	Pakistan	0.4815	0.0000	0.2308	0.1445	0.0000	0.2931	1.0000
27	Poland	1.0000	0.8901	0.8885	0.5575	0.6787	0.4483	0.0000
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
35	Turkey	0.9259	0.5165	0.6656	0.3363	0.2570	0.2414	1.0000
36	Zambia	0.4074	0.3626	0.0858	0.7050	0.4980	0.2586	1.0000

For example, Afghanistan: female life expectancy at birth, larger is the best

$$x_1^*(1) = \frac{x_1^0(1) - \min x_1^0(1)}{\max x_1^0(1) - \min x_1^0(1)} = \frac{66 - 55}{82 - 55} = 0.4074$$

Step 4: Deviation sequence is calculated by using this formula:

$$\Delta_{0i}(k) = |x_0^*(k) - x_i^*(k)| \quad (3)$$

For biggest deviation following formula is used:

$$\Delta_{max} = \max_{j \in i} \max_{k} |x_0^*(k) - x_j^*(k)| = 1 \quad (4)$$

For smallest deviation following formula is used:

$$\Delta_{min} = \min_{j \in i} \min_{k} |x_0^*(k) - x_j^*(k)| = 0 \quad (5)$$

Table 5: Deviation Sequences

Sr.	Country	1	2	3	4	5	6	7
0	Reference Sequence	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1	Afghanistan	0.5926	0.9978	1.0000	1.0000	0.9980	0.5690	1.0000
2	Albania	0.0741	0.6593	0.5574	0.8407	0.5020	0.5345	0.0000
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
26	Pakistan	0.5185	1.0000	0.7692	0.8555	1.0000	0.7069	0.0000
27	Poland	0.0000	0.1099	0.1115	0.4425	0.3213	0.5517	1.0000
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
35	Turkey	0.0741	0.4835	0.3344	0.6637	0.7430	0.7586	0.0000
36	Zambia	0.5926	0.6374	0.9142	0.2950	0.5020	0.7414	0.0000

For example, Afghanistan: female life expectancy.

$$\Delta_{01}(1) = |x_0^*(1) - x_1^*(1)| = |1 - 0.4074| = 0.5926$$

Step 5: Grey relational co-efficient is calculated by using this formula based on values of normalized sequence. Term ξ is distinguishing co-efficient between 0 and 1 the usual value of which is 0.5 in literature.

$$\gamma[x_0^*(k), x_i^*(k)] = \frac{\Delta_{min} + \xi \Delta_{max}}{x_{0i}(k) + \xi \Delta_{max}}, \quad 0 < \gamma[x_0^*(k), x_i^*(k)] \leq 1 \quad (6)$$

Table 6: Grey Relational Co-efficient

Sr.	Country	1	2	3	4	5	6	7
-----	---------	---	---	---	---	---	---	---

0	Reference Sequence	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
1	Afghanistan	0.4576	0.3338	0.3333	0.3333	0.3338	0.4677	0.3333
2	Albania	0.8710	0.4313	0.4729	0.3729	0.4990	0.4833	1.0000
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
26	Pakistan	0.4909	0.3333	0.3939	0.3689	0.3333	0.4143	1.0000
27	Poland	1.0000	0.8198	0.8177	0.5305	0.6088	0.4754	0.3333
...		...	...	...	...	...	...	...
...		...	...	...	...	...	...	...
35	Turkey	0.8710	0.5084	0.5992	0.4297	0.4023	0.3973	1.0000
36	Zambia	0.4576	0.4396	0.3536	0.6289	0.4990	0.4028	1.0000

For example, Afghanistan: female life expectancy.

$$\gamma[x_0^*(1), x_1^*(1)] = \frac{\Delta_{min} + \xi \Delta_{max}}{\Delta_1(1) + \xi \Delta_{max}} = \frac{0 + (0.5) \times 1}{0.5926 + (0.5) \times 1} = 0.4576$$

Step 6: Weighted sum of grey relational co-efficient (Grey Relational Grade) is calculated as follows:

$$\gamma(x_0^*, x_i^*) = \sum_{k=1}^n \beta_k \gamma[x_0^*(k), x_i^*(k)] \quad (7)$$

$$\sum_{k=1}^n \beta_k = 1 \quad (8)$$

Table 7: Grey Relational Grades

Sr.	Country	GRG*
0	Reference Sequence	1.0000
1	Afghanistan	0.3704
2	Albania	0.5901
...		...
...		...
26	Pakistan	0.4764
27	Poland	0.6551
...		...
...		...
35	Turkey	0.6011
36	Zambia	0.5402

*GRG = Grey Relational Grades

For example, grey relational grade for Afghanistan:

$$\begin{aligned} \gamma(x_0^*, x_1^*) &= \sum_{k=1}^n \beta_k \gamma[x_0^*(1), x_1^*(k)] \\ &= 0.1429 \times \left(\frac{0.4576 + 0.3338 + 0.3333 + 0.3333}{+0.3338 + 0.4677 + 0.3333} \right) = 0.3704 \end{aligned}$$

6. Method of Interpretation of Results

The study follows method of ensigns for interpreting the results of GRA. The scheme of ensigns uses the ranking scale of seven items namely *exceptionally high*, *very high*, *high*, *moderate*, *low*, *very low* and *exceptionally low* (Table 8). Further the brackets of the grey relational grade of the countries are also mentioned in order to make understanding of results more objective.

Table 8: Scheme of Grouping the Countries under Different Ensigns

Sr.	Ensign	Description
1	Exceptionally High	Countries having grey relational grade ranging from 0.7910 to 0.6941 are considered as countries having exceptionally high women development.
2	Very High	Countries having grey relational grade ranging from 0.6891 to 0.6734 are considered as countries having very high women development.

3	High	Countries having grey relational grade ranging from 0.6697 to 0.6446 are considered as countries having high women development.
4	Moderate	Countries having grey relational grade ranging from 0.6296 to 0.5901 are considered as countries having moderate women development.
5	Low	Countries having grey relational grade ranging from 0.5622 to 0.5359 are considered as countries having low women development.
6	Very Low	Countries having grey relational grade ranging from 0.5335 to 0.5195 are considered as countries having very low women development.
7	Exceptionally Low	Countries having grey relational grade ranging from 0.5190 to 0.3704 are considered as countries having exceptionally low women development.

The method of ensigns augments GRA to represent its results in more objective and effective manner. The readers can build more organized and informed opinion about the phenomenon under study by witnessing this classification.

7. Results & Discussion

Results: Gauging the women development of a society is a vital issue for countries since they are complementary wheel to the cart of economy. The issue of time to time country-wide comparative assessment of women development is a research worthy and ever current issue. Therefore, the study aimed to compare women development in selected thirty-six countries and evaluation of position of that of Pakistan as against these countries. Selection of countries and variables representative to women development have been decided on the basis of availability of the data. Technique of data analysis is grey incidence analysis model. The study provides the deeper understanding of phenomenon. The results of the study are represented in Table 9.

Table 9: Results of Grey Relational Analysis

Country	GRG*	Rank	Country	GRG*	Rank
Reference Sequence	1	0	Sri Lanka	0.6150	18
Exceptionally High			Turkey	0.6011	19
Estonia	0.7910	1	Albania	0.5901	20
Hungary	0.7208	2	Low		
Slovak Republic	0.7119	3	Cambodia	0.5622	21
Thailand	0.7020	4	Montenegro	0.5596	22
Ecuador	0.6941	5	Romania	0.5570	23
Very High			Zambia	0.5402	24
Namibia	0.6891	6	Myanmar	0.5359	25
Nicaragua	0.6871	7	Very Low		
Bolivia	0.6856	8	Ethiopia	0.5335	26
Latvia	0.6811	9	India	0.5303	27
Dominican Republic	0.6734	10	Nepal	0.5251	28
High			Ghana	0.5210	29
Serbia	0.6697	11	Bangladesh	0.5195	30
North Macedonia	0.6647	12	Exceptionally Low		
Mongolia	0.6616	13	Tanzania	0.5190	31
Poland	0.6551	14	Madagascar	0.5133	32
Rwanda	0.6446	15	Cote d'Ivoire	0.4816	33
Moderate			Pakistan	0.4764	34
Honduras	0.6296	16	Nigeria	0.4712	35
Bosnia and Herzegovina	0.6204	17	Afghanistan	0.3704	36

*GRG = Grey Relational Grades

The study has classified *thirty-six* countries of the world into seven different categories (Table 8). From the result of GRA it can be learnt that there are *five* countries (namely Estonia, Hungary, Slovak Republic, Thailand and Ecuador) categorized as countries having *exceptionally high* women development. Accordingly, there are *five* countries under each next ensign (*very high*, *high*, *moderate*, *low* and *very low*). There are *six* countries (namely Tanzania, Madagascar, Cote d'Ivoire, Pakistan, Nigeria and Afghanistan) categorized under the ensign of *exceptionally low*. Pakistan fall under the category of *exceptionally low*.

Discussion: With the objective of gauging the country level women development, the study investigated the issue as afresh. Using the GRA, thirty-six countries have been compared on the basis of seven variables in a composite mathematical modeling. In the multitude of variables evaluating simultaneously in one mathematical equation is different approach form that of the contemporary studies. The variables used in this study are different on many counts from the contemporary literature. The study has been conducted in different context and it is tilted towards ascertainment of women development in Pakistan qua other countries. However, the results of the study are consistent with contemporary literature in general Table 10.

Table 10: Comparison of results of the present study with prior studies in the literature

Studies	Focus of Study	Variables	Methodology
Current study	Country level comparison of women development	Female Life Expectancy, female account ownership, female wage, firms with female participation, female share of employment, women in parliaments, nondiscrimination clause in law	Grey incidence analysis model
Sakellariou (2004)	Gender earnings differentials	Returns to education by gender, gender earnings differentials	Quantile regression
Jayasuriya and Burke (2013)	Does women political representation affects economic growth	Gross domestic product, per capital, women in parliament, economic growth.	System generalized method
Kitching et al. (2017)	Barriers and opportunities of female employment in golf sport	Barriers include administration & play in “a man’s world”, difficult to get top position/job	Semi-structured interview, interpretivist approach
Islam et al. (2018)	Nondiscrimination in law and disempowerment of women	Ownership, labor market barriers, access to finance, registration of business, ownership of property	Enterprise survey

8. Concluding Remarks

Gauging the women development of a society is a vital issue. The issue of time to time country-wide comparative assessment of women development is a research worthy and ever current issue. This study has compared thirty-six selected countries on the basis of indicators of women development using grey incidence analysis model. As a result GRA has classified *thirty-six* countries of the world into seven different categories. It can be learnt that there are *five* countries (namely Estonia, Hungary, Slovak Republic, Thailand and Ecuador) categorized as countries having *exceptionally high* women development. Accordingly, *five* countries under each next ensign (*very high, high, moderate, low* and *very low*), whereas, *six* countries (namely Tanzania, Madagascar, Cote d'Ivoire, Pakistan, Nigeria and Afghanistan) are categorized *exceptionally low*. Pakistan fall under the category of countries having *exceptionally low* women development. The study contributes a country wise grey relational grade that ranks the countries as against their rivals. This study also contributed a lot of new information by way of aforementioned classification of countries under different ensigns. It is designed on an original country level data extracted from very reliable source and the results of the study are useful for regulators, researchers, NGOs and other stakeholders of the phenomenon by way of providing deeper and new information. This study also has some limitations. Firstly, it is a secondary data based on cross sectional study, therefore, future researches may use primary data and/or longitudinal design. Secondly, the study uses the data set of WDI, therefore, generalizability of the study is accordingly limited. The future researches should use different data set on similar framework of study. Thirdly, the study used grey incidence analysis model. The results of which must be verified with other mathematical/statistical methodologies. Fourthly, it is an analysis of selected thirty-six countries because of the availability of data, therefore, it is suggested to extend future studies to more countries. Lastly, we have used equal weights for the variable, future researchers may use different weights calculating by the way of expert opinion, AHP, or Entropy method.

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