



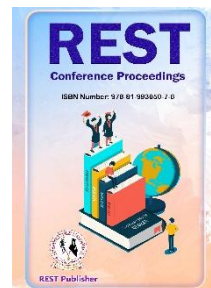
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# Evaluating Women Empowerment Initiatives Using Grey Relational Analysis (GRA): A Data-Driven Approach

\*R. Meenakshi Devi

Mannar Thirumalai Naicker College (Autonomous) Madurai, Tamil Nadu.

\*Corresponding Author Email: [meenakshidevir@mannarcollege.ac.in](mailto:meenakshidevir@mannarcollege.ac.in)

**Abstract:** This necessitates a comprehensive and updated analysis of the current evidence on its impact on global development efforts, particularly on fertility. Drawing insights from fieldwork interviews in Fiji, Sri Lanka, and Timor-Leste, this research highlights diverse cultural perspectives on empowerment, often emphasizing the role of society. While higher education and employment are essential drivers of empowerment, cultural influences cannot be ignored. Social norms continue to shape women's empowerment, directly or indirectly, enabling or constraining their advancement. This study specifically examines women's psychological empowerment in Tehran, focusing on the influence of higher education and employment. In this study, education and occupation were considered as independent variables, while empowerment served as the dependent variable. These groups provide microcredit facilities so that women can engage in entrepreneurial activities and achieve financial independence. Entrepreneurship and income-generating activities serve as practical solutions to foster empowerment. Some researchers highlight the impact of militarization and the perceived threats to male dominance, while others argue that wartime experiences can disrupt traditional gender hierarchies. This study examines the mechanisms by which war preparation and experiences contribute to changes in women's empowerment. Empowerment is equally important for both men and women, as it emphasizes shared power and equal opportunities. Women's empowerment plays a key role in fostering social, economic, and political equality. This study uses the Gray Relational Analysis (GRA) methodology to reexamine traditional empowerment models and identify innovative strategies that enhance women's rights, autonomy, and overall well-being. By examining scalability, sustainability, relevance, and reliability, this research not only identifies effective interventions but also redefines empowerment beyond conventional frameworks. A key finding is the dominance of A5, underscoring the critical role of reliability and relevance in designing impactful empowerment programs. However, this study also challenges existing norms, advocating for dynamic, data-driven improvements to underperforming initiatives. Beyond theoretical analysis, this research serves as a roadmap for policymakers, community builders, and change makers, encouraging bold, disruptive innovations in women's empowerment. Ultimately, it drives the global gender equality movement forward, laying the foundation for holistic, inclusive, and future-focused empowerment ecosystems that redefine the role of women in society. This study uses the Gray Relationship Analysis (GRA) method to evaluate women's empowerment initiatives based on four key criteria: scalability, sustainability, relevance, and credibility. GRA helps in ranking various alternatives (A1–A7), analyzing their performance and identifying the most effective strategies. The approach includes normalization, deviation order calculation, Gray relationship coefficient calculation, and final ranking. This method ensures data-driven and objective evaluation of empowerment programs, guiding policymakers in designing impactful initiatives. Evaluation parameter taken as C1—Measurability: Definition: Women's empowerment efforts should have clear, tractable indicators to assess their impact. C2—Achievability: Definition: Women's empowerment goals should be realistic and achievable within a specific timeframe. C3—Relevance: Definition: To be truly effective, empowerment efforts must be aligned with women's unique cultural, social, and economic realities. C4—Reliability: Definition: The methods used to monitor and evaluate women's empowerment efforts should be consistent and reliable. Based on the results, A5 proved to be the most effective initiative, demonstrating high relevance and credibility, making it the best approach for sustainable empowerment. A4 and A6 followed

*closely, showing strong reachability and alignment with empowerment objectives. However, A3 ranked the lowest, indicating limited effectiveness, which may be due to challenges in practical implementation or alignment with real-world needs. The results indicate that A5 is the most effective initiative, demonstrating high relevance and credibility for sustainable women's empowerment. Meanwhile, A3 was ranked the lowest, highlighting the need for improvements in practical with empowerment objectives implementation and real-world impact. However, A3 ranked the lowest, indicating limited effectiveness, which may be due to challenges in practical implementation or alignment with real-world needs.*

*Keywords: Women in the media, women's empowerment, economic independence, women's socialization, gender-based violence, women's health, emergency support, female leadership, gender equality.*

## 1. INTRODUCTION

A woman's life often oscillates between freedom and the threat of violence, highlighting complex social challenges that require urgent attention in empowerment debates. The middle-class contradiction that social norms support and hinder women's advancement further complicates the issue. Historically, women have faced persistent oppression, and despite numerous movements advocating for their liberation, discrimination and human rights violations remain widespread. While progress has been made, lasting change requires profound social transformation. Responses that were not explicitly labeled "empowerment" revealed two more key insights. First, empowered women actively exercise their agency in their communities, assume leadership roles, and participate in decision-making. Second, women's participation in decision-making at various levels, especially in areas related to peace and security, serves as both a result of empowerment and a means to further empowerment. It can be seen as a process that helps individuals gain control over key factors that affect their lives. Women's empowerment involves developing awareness, political engagement, economic independence, and informed decision-making in all aspects of life. However, women often face significant resistance, and it takes strength and resilience to overcome social barriers. This strength is manifested through education, health, and proper nutrition, which are essential tools in ensuring that women can lead autonomous and empowered lives. Within a democratic framework, various laws, policies and schemes have been introduced to promote the advancement of women in various fields. Although the foundation for empowerment is in place, significant efforts are still needed to achieve true gender equality. Women are a vital pillar of society, playing a vital role in shaping the future of a country. The media serves as a powerful tool in accelerating the empowerment of women, especially in enhancing their economic independence. Like other forms of social communication, the mass media plays a vital role in promoting positive representations of women, highlighting their contributions and achievements in various fields. By presenting inspiring examples, the media can inspire young women and encourage their active participation in economic and social development. However, social norms can directly limit women's empowerment or indirectly limit their access to education and financial resources. In some cases, even though women are allowed to work and earn money, they have no control over their earnings, leaving men as the primary beneficiaries of empowerment efforts. Although Iran's patriarchal culture is often seen as an obstacle to women's empowerment, research conducted in Tehran suggests that employment significantly enhances empowerment. The findings highlight that financial independence is a key factor in strengthening women's autonomy and social status. As part of these efforts, we designed a user-friendly mobile application called Women Empowerment that aims to support both rural and urban women. The application provides legal information on violence against women (VAW), as well as health tips and emergency support features. One of its key functionalities is an emergency call system that women can activate if they are in danger. Unlike existing applications that focus only on emergency response or domestic violence support, our application integrates multiple resources on a single platform. It provides domestic violence prevention laws, essential health guidance and an emergency contact feature for women facing street violence. Women's decision-making power and autonomy are central to empowerment, and the application serves as a comprehensive tool to promote their safety, awareness and independence. In this study, women's contraceptive use serves as the dependent variable, while demographic factors serve as independent variables, with a primary focus on two key aspects of women's empowerment: autonomy and decision-making power. However, most existing research has only examined a limited scope of the relationship between women's empowerment and contraceptive use. Empowerment is a multifaceted concept with a variety of interpretations and outcomes. Supporting women's empowerment as a development goal is driven by two key perspectives: first, as a fundamental aspect of social justice essential to human well-being, and second, as a catalyst for broader social progress. The term 'empowerment' is used in a variety of contexts by different organizations, and its interpretation often depends on the specific framework in which it is used. Women's leadership is built on the belief that lasting change begins with self-transformation, which then impacts external actions. Developing leadership skills requires continuous practice, self-reflection, and meaningful relationships that provide genuine support and constructive feedback. It also aims to challenge and overcome historical biases in decision-making, within organizations, businesses, and society as a whole. In India, women are no longer confined to traditional roles; rather, they are actively shaping domestic and global landscapes. The influence of globalization has enabled them to make significant contributions in many areas, while successfully managing both professional and family responsibilities. The well-known analogy compares humanity to a flock of birds, with one wing representing men and the other wing representing women – only when both wings are equally strong can society truly progress and flourish. Empowerment is a

multidimensional process that allows women to realize their full potential in all aspects of life. It is fundamental to achieving equality, development and social justice. When discussing women's empowerment, the focus is on promoting leadership roles and ensuring that women have equal opportunities to contribute. However, women's empowerment movements have struggled to thrive under authoritarian regimes, particularly those that perpetuate gender-based subordination and male-dominated ideologies. When women gain the freedom to plan their families, they also gain the ability to shape their futures in terms of education, career, and personal aspirations. Recognizing that women's health issues are deeply linked to their limited social, economic, and political autonomy, experts advocate a shift in health policy—from a traditional welfare model to one that prioritizes women's empowerment. Despite its widespread application, empowerment remains a complex and challenging concept to define.

## 2. MATERIALS AND METHODS

Using the GRA (General, Reason, and Application) method provides a structured approach to understanding women's empowerment across cultures. General Women's empowerment involves equipping women with the resources, rights, and opportunities they need to make independent decisions and participate equally in society. It encompasses economic, social, and political dimensions, ensuring access to quality education, meaningful employment, and leadership roles. Reason: Throughout history, different cultures have viewed women's roles as unique. In some societies, women were traditionally confined to domestic roles, while in others, they held influential positions. The push for women's rights gained momentum worldwide in the 20th century, leading to movements for voting rights, workplace equality, and protections against discrimination. Today's women's empowerment is reflected in legal reforms, gender-inclusive policies, and leadership efforts aimed at fostering equality. Many countries recognize that empowered women contribute to the overall development of societies, leading to an emphasis on education and entrepreneurship as key drivers of change. While cultural barriers persist, emerging social norms are reshaping gender equality. Globally unlike other decision-making techniques, GRA does not require assumptions and is particularly useful when working with small samples or unknown distributions. Its unique advantage lies in its ability to use a reference sequence, making it highly adaptable to different contexts. To enhance understanding of women's perspectives, a graduate research assistant (GRA), who was a certified yoga instructor, conducted prenatal yoga sessions, providing local women with a platform to engage with stakeholders and influence development efforts. Globally, gender and transport challenges persist, yet there is no standardized, replicable framework for assessing gender-based mobility issues. A comprehensive assessment of gender and mobility data and policies is crucial for identifying gaps that influence decision-making and policy-making. To address this issue, the SuM4All Gender Working Group partnered with the World Bank to develop a methodological approach aimed at helping countries analyze and narrow the gaps in gender and mobility policies, thereby ensuring more inclusive and gender-responsive transport systems.

Alternatives: A1—Total beneficiaries engaged in the project or program, General: Women's empowerment helps women access education, employment, and leadership opportunities, promotes gender equality, and fosters inclusive development. Programs designed to empower women play a key role in this transformation. Rationale: Across cultures, participation in empowerment programs has helped women gain financial independence and break down traditional barriers. The number of beneficiaries involved in these programs reflects the reach and impact of such efforts. Application: Tracking the number of women involved in programs helps measure progress. Higher participation indicates increased awareness and acceptance, which leads to broader social and economic improvements.

A2—Number of beneficiaries employed after the project: The number of individuals employed after the program is completed serves as a key indicator of the success of this initiative in promoting women's economic empowerment and self-sufficiency. Women's empowerment involves ensuring equal opportunities for success in the workplace and meaningful contributions to economic development. Rationale: While many programs emphasize skills and training, their true impact is measured by how many women gain sustainable employment. Gaining employment leads to financial independence and long-term sustainability. Application: The employment rate among women following participation in empowerment programs highlights the effectiveness of these initiatives. Expanding employment opportunities fosters sustainable empowerment and strengthens communities

A3—Beneficiaries who started a career after the project: This measure reflects the effectiveness of the program in promoting entrepreneurship among women, achieving financial independence, and promoting economic growth. Generally, women's empowerment promotes entrepreneurship, helps women establish and manage their own businesses, and fosters self-sufficiency. Rationale: Many cultural and economic barriers have historically limited women's ability to own businesses. Entrepreneurship programs provide training, resources, and financial support to help women start and sustain their ventures. Application: The number of businesses started by women after completing empowerment programs reflects their ability to generate income and contribute to economic growth. Supporting women entrepreneurs strengthens entire communities

A4—Types of jobs obtained, including blue-collar, white-collar, and managerial roles: General: Empowering women ensures equal access to a variety of career opportunities, from entry-level positions to leadership positions. Rationale: Historically, women have faced barriers to higher-paying or leadership positions. By gaining education and skills, they can enter blue-collar, white-collar, and management jobs. Application: Measuring the types of jobs women obtain after empowerment efforts highlights progress in workplace equality. Equality in job positions indicates growing inclusion across different sectors.

A5—Dignity of Work Provided, General: True women's empowerment ensures not only employment, but also fair, safe and decent employment opportunities. Rationale: Many women face workplace discrimination, unfair pay and poor working conditions. Ensuring job quality is as important as job availability. Application: Assessing factors such as fair pay, job security and equal treatment in the workplace determines the effectiveness of empowerment programs in achieving long-term success.

A6—improving professional knowledge: Emphasizes skills development and vocational training to enhance women’s empowerment, job readiness, and career opportunities. Rationale: Many women lack access to formal education and vocational skills. Programs that focus on vocational knowledge help them secure stable jobs or start their own businesses. Application: Measuring the increase in vocational skills among women in empowerment programs reflects their ability to become self-sufficient and successful in various occupations

A7—Enhancement of Social Abilities: empowerment goes beyond economic growth; it also enhances confidence, communication, and leadership skills. Reason: Social skills are essential for career advancement, networking, and personal development. Women who improve in these areas can advocate for themselves and influence societal change. Application: Tracking improvements in social skills helps assess empowerment programs’ effectiveness in fostering independence, leadership, and active participation in society.

C1—Measurability: Definition: Women’s empowerment efforts should have clear, tractable indicators to assess their impact. Example: Progress can be assessed by measuring the number of women who complete skills development programs, get jobs, or start businesses.

C2—Achievability: Definition: Women’s empowerment goals should be realistic and achievable within a specific timeframe. Example: Setting a target to increase women’s employment in a specific sector by 20% within five years ensures practical implementation.

C3—Relevance: Definition: Empowerment efforts should be designed to meet the specific needs of women in diverse cultural, social, and economic contexts. Example: In rural areas, providing vocational training may be more relevant than institutional leadership programs, ensuring real impact.

C4—Reliability: Definition: The methods used to monitor and evaluate women’s empowerment efforts should be consistent and reliable. Example: Using validated surveys, employment records, and case studies ensures accurate reporting of progress over time.

### 3. ANALYSIS AND DISCUSION

TABLE 1. Data Set

	Measurability	Attainability	Relevance	Reliability
A1	1.82	1.65	0.26	1.1
A2	1.25	2.62	0.48	1
A3	1.2	1.24	1.21	0.3
A4	0.58	2.65	0.23	0.5
A5	1.74	0.25	0.25	0.2
A6	1.92	1.98	0.34	1.3
A7	1.75	2.47	0.65	1.3

A1—Total beneficiaries engaged in the project or program, A2—Beneficiaries employed after the project, A3—Beneficiaries who started a career after the project, A4—Types of jobs obtained, including blue-collar, white-collar, and managerial roles, A5—Quality and relevance of jobs provided, A6—Improvement of beneficiaries’ vocational knowledge, A7—Improvement in beneficiaries’ social skills. Women’s empowerment is assessed using a variety of criteria to ensure its effectiveness. Measurableness reflects how well empowerment programs can be measured, ensuring that progress is trackable. Among the indicators, A6 (1.92) and A1 (1.82) show strong measurability, indicating well-structured and trackable outcomes. Achievability ensures that targets are realistic. A4 (2.65) and

A2 (2.62) rank highest, highlighting programs that can be achieved within practical limits. Relevance determines how well initiatives align with the real needs of women. However, relevance scores are relatively low, with A7 (0.65) leading the way, suggesting room for improvement in addressing practical concerns. Reliability assesses the consistency of results, where A6 and A7 (both 1.3) score high, ensuring reliable outcomes. Overall, while some efforts are measurable and achievable, improving relevance and credibility will further strengthen women's empowerment efforts globally.

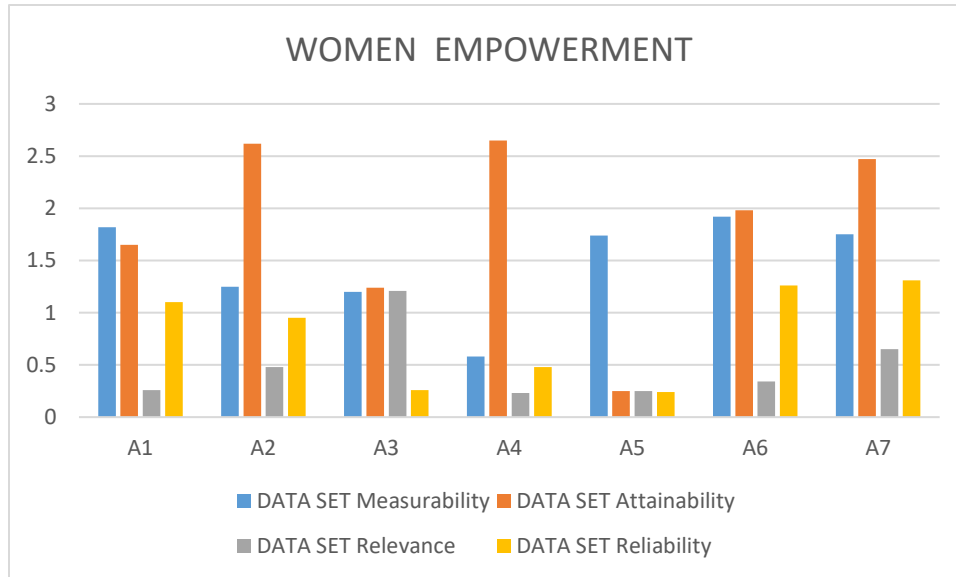


FIGURE 1. Women Empowerment

The bar chart titled “Women’s Empowerment” displays the rating of the various alternatives (A1–A7) based on four key criteria: Measurability, Attainability, Relevance, and Credibility. From the chart, Achievability (orange bars) stands out as being the highest in A4 and A2, indicating that these efforts are highly practical and achievable. Measurability (blue bars) is the highest for A1 and A6, indicating strong data tracking capabilities in these categories. Relevance (gray bars) remains moderate in most alternatives, with A4 having the highest score, indicating alignment with real needs. Credibility (yellow bars) is more balanced, with A6 and A7 showing high values, although some alternatives, such as A5, have low scores, indicating potential inconsistencies. Overall, the chart highlights that while some alternatives excel in attainability and scalability, others require improvements in credibility and relevance to ensure long-term effectiveness in women's empowerment efforts.

TABLE 2. Normalized data

	Measurability	Attainability	Relevance	Reliability
A1	1.0000	0.5833	0.9694	0.0000
A2	0.5403	0.9875	0.7449	0.1744
A3	0.5000	0.4125	0.0000	0.9767
A4	0.0000	1.0000	1.0000	0.7209
A5	0.9355	0.0000	0.9796	1.0000
A6	1.0806	0.7208	0.8878	-0.1860
A7	0.9435	0.9250	0.5714	-0.2442

Women’s empowerment can be assessed using key criteria: Measurability, Sustainability, Relevance and Credibility, each of which reflects different aspects of effectiveness. The measure ensures that empowerment efforts can be monitored, with A6 (1.0806) and A1 (1.0000) scoring high, indicating strong data availability. Sustainability assesses whether the goals are realistic. A4 (1.0000) leads, followed by A2 (0.9875), suggesting practical outcomes for these efforts. Relevance determines how well the programs align with the real needs of women. A4 (1.0000) and A5 (0.9796) score high, showing that these efforts address meaningful issues. Credibility checks the consistency of the results. A5 (1.0000) and A3 (0.9767) rank well, indicating reliable results, while A6 (-0.1860) and A7 (-0.2442) show instability, highlighting areas for improvement. Overall, while some efforts excel in scalability and relevance, reliability remains a challenge. Addressing the discrepancies will further strengthen women’s empowerment programs, making them more impactful and sustainable.

**TABLE 3.** Deviation sequence

	Measurability	Attainability	Relevance	Reliability
A1	0.0000	0.4167	0.0306	1.0000
A2	0.4597	0.0125	0.2551	0.8256
A3	0.5000	0.5875	1.0000	0.0233
A4	1.0000	0.0000	0.0000	0.2791
A5	0.0645	1.0000	0.0204	0.0000
A6	-0.0806	0.2792	0.1122	1.1860
A7	0.0565	0.0750	0.4286	1.2442

The deviation sequence data for women's empowerment illustrate the differences in measurability, consistency, relevance, and reliability between the various alternatives (A1–A7). Measurability for A1 (0.0000) and A6 (-0.0806) shows minimal deviation, indicating strong alignment with the expected outcomes, while A4 (1.0000) deviates the most. Consistency is fairly consistent for A4 (0.0000) and A2 (0.0125), while A5 (1.0000) shows the highest deviation, indicating potential implementation challenges. Relevance varies significantly, with A3 (1.0000) showing the highest deviation, meaning it does not align well with the empowerment goals. In contrast, A4 (0.0000) and A5 (0.0204) show minimal deviation, indicating high relevance. Reliability is most unstable in A7 (1.2442) and A6 (1.1860), indicating inconsistency in results, while A5 (0.0000) and A3 (0.0233) are most stable. Overall, while some initiatives show alignment with empowerment goals, others require adjustment to improve reliability and practical implementation.

**TABLE 4.** Gray correlation coefficient (GRC)

	Measurability	Attainability	Relevance	Reliability
A1	1.0000	0.5455	0.9423	0.3333
A2	0.5210	0.9756	0.6622	0.3772
A3	0.5000	0.4598	0.3333	0.9556
A4	0.3333	1.0000	1.0000	0.6418
A5	0.8857	0.3333	0.9608	1.0000
A6	1.1923	0.6417	0.8167	0.2966
A7	0.8986	0.8696	0.5385	0.2867

The gray correlation coefficient data provides insight into the strength of the relationships between the various alternatives (A1–A7) and the key women's empowerment criteria of measurability, attainability, relevance, and credibility. Measurability is very high for A6 (1.1923) and A1 (1.0000), indicating strong monitoring capacity, while A4 (0.3333) shows weak measurability. Achievability is good for A4 (1.0000) and A2 (0.9756), indicating that these initiatives are highly feasible, while A5 (0.3333) scores very low. Relevance is strong for A4 (1.0000) and A5 (0.9608), highlighting their alignment with women's empowerment needs, while A3 (0.3333) is very low. Reliability is fairly consistent in A5 (1.0000) and A3 (0.9556), ensuring reliable results, while A7 (0.2867) and A6 (0.2966) show low reliability. Overall, A4 stands out for its accessibility and relevance, while A5 excels in reliability. However, improvements in reliability for A7 and accessibility for A5 could further enhance empowerment efforts.

**TABLE 5.** GRG

	GRG
A1	0.7053
A2	0.6340
A3	0.5622
A4	0.7438
A5	0.7950
A6	0.7368
A7	0.6483

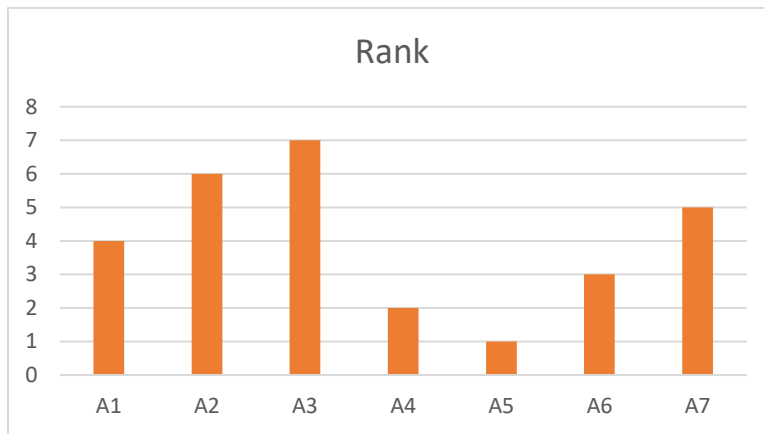
Gray Relational Grade (GRG) values provide an overall ranking of how well each alternative (A1–A7) aligns with key women's empowerment criteria such as measurability, attainability, relevance, and credibility. A5 (0.7950) achieves the highest GRG, indicating that it is highly effective across all dimensions, particularly excelling in relevance and credibility. A4 (0.7438) and A6 (0.7368) follow closely, showing strong overall performance, particularly in attainability and measurability. A1 (0.7053) also scores well, demonstrating a balanced approach. A7 (0.6483) and A2 (0.6340) have moderate GRG scores, indicating that they meet the empowerment objectives but may need improvements in specific areas such as credibility. A3 (0.5622) ranks lowest, indicating that

while it contributes to empowerment efforts, it may need better alignment with relevance and reachability for greater impact. Overall, A5 stands out as the most effective alternative, while A3 needs much improvement to increase its contribution to women’s empowerment.

**TABLE 6.** Rank

	Rank
A1	4
A2	6
A3	7
A4	2
A5	1
A6	3
A7	5

The ranking results for women’s empowerment efforts are based on the Gray Relational Grade (GRG), indicating the performance of each alternative (A1–A7) on key criteria: scalability, attainability, relevance, and credibility .A5 is in first place (1st place), meaning it is the most effective effort, likely to excel in relevance, and credibility. A4 follows in second place (2nd place), highlighting its strength in attainability and relevance. A6 takes third place (3rd place), demonstrating a well-balanced approach across different empowerment dimensions. A1, A7, and A2 rank 4th, 5th, and 6th, respectively, indicating moderate performance but room for improvement, particularly in credibility and attainability. A3 ranks last (7th place), indicating that it is least aligned with empowerment goals and may require significant improvements, particularly in relevance and practical implementation. Overall, A5 is a strong effort, while A3 needs more development to better contribute to women's empowerment efforts.



**FIGURE 2.** Rank

The ranking chart displays the performance of various women’s empowerment initiatives (A1–A7) based on the key evaluation criteria of measurability, sustainability, relevance and credibility. From the chart, A5 ranks highest (1st place), indicating that it is a very effective initiative, excelling in relevance and credibility. A4 ranks 2nd, indicating strong performance in terms of overall alignment with the goals of achievement and empowerment. A6 ranks 3rd, showing a well-balanced contribution across various factors. At the lower end, A3 ranks last (7th place), meaning that it is the least effective, perhaps due to weaknesses in relevance or achievement. A2 (6th place) and A7 (5th place) also show low performance compared to the top-ranked initiatives. A1 (4th place) is in the middle range, indicating moderate performance but with room for improvement. Overall, A5 emerges as an excellent effort, while A3 needs significant improvements to increase its impact on women's empowerment.

#### 4. CONCLUSION

We have developed and proposed a framework for a humanitarian mobile application that aims to support women in their daily lives. The application provides access to various laws related to women's empowerment, violence against women (VAW), which benefits both rural and urban women across our country. Based on the results, A5 proved to be the most effective initiative, demonstrating high relevance and credibility, making it the best approach for sustainable empowerment. A4 and A6 followed closely, showing strong reachability and alignment with empowerment objectives. However, A3 ranked the lowest, indicating limited effectiveness, which

may be due to challenges in practical implementation or alignment with real-world needs. In conclusion, while some initiatives performed well in reachability and relevance, others require improvements in scalability and credibility to increase their overall impact. Future efforts should focus on strengthening weak initiatives and adopting data-driven strategies to ensure long-term empowerment of women.

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