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Evaluating the Agreement Index of the Barriers Faced by Women During the Transition from Higher Education to Empowerment in Brazil: A Sustainable Development Perspective

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Abstract: Efficient and sustainable human resources are crucial for promoting development in emerging nations. Brazil's education policy provides its citizens with widespread educational opportunities, resulting in high literacy rates. However, women with academic qualifications and skills often encounter significant barriers when transitioning from higher education to positions of empowerment, leading to an underutilisation of human capital. This study, conducted in 2024, gathered data from female students and staff at three Brazilian universities (the State University of Maranhão, the Federal University of Rio de Janeiro, and the University of São Paulo) using a survey methodology to ascertain the barriers impeding women's transition from higher education to empowerment. The data were analysed using Fuzzy Synthetic Evaluation (FSE), a soft computing technique, and it was identified that the most significant barriers revolve around women's freedom and mobility. Additional challenges include gender norms, family responsibilities, violence and harassment, socio-cultural constraints, and financial limitations. The study offers practical recommendations such as organising awareness programmes and integrating digital technology to enhance workplace safety, thereby addressing these barriers. The findings contribute both practically and theoretically to the more effective utilisation of human resources in Brazil. These insights are particularly valuable for stakeholders, including government bodies, managers, and academic institutions, in fostering gender equality and empowering women in the workforce.

Keywords: empowerment; gender equality; sustainable development goals; Brazil; higher education



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1. Introduction

The empowerment of women is a central focus in international development programmes (Wang et al., 2024), as it plays a crucial role in driving social, economic, and political progress—all necessary for sustainable development. Empowering women not only improves their well-being but also enhances entire communities by fostering greater gender equality, reducing poverty, and promoting sustainable development. International initiatives often aim to increase women's access to education, healthcare, employment opportunities, and leadership roles while addressing issues such as gender-based violence

and discriminatory practices. By prioritising women's empowerment, these programmes contribute to more inclusive and equitable societies globally. Over the past few decades, the presence and status of women in empowerment have significantly improved (Duflo, 2012). However, research indicates that women's empowerment across various professions still encounters numerous barriers. Multiple studies have identified a range of structural obstacles within organisations that contribute to the underrepresentation of women at senior levels (Yousaf & Schmiede, 2016; Osituyo, 2018); restrictive societal and cultural practices (Choudhry et al., 2019; Maheshwari et al., 2023); inequitable gender-specific influences (Powell et al., 2002; Pathak et al., 2013); the anti-female environment of administrations (Cortis & Cassar, 2005; Eagly & Carli, 2007); and the established perception of opportunities, networking, and mentoring (Cordano et al., 2002). Past studies on women's empowerment have highlighted its crucial impact on procreative condition performances, which may induce family-related barriers to their empowerment (Kishor & Subaiya, 2008; Upadhyay et al., 2014). As women gain the ability to make strategic life decisions, the willingness to plan their future and broaden their roles beyond being a wife and mother is apparent, but they are often faced with a deadlock or dead end in some developing nations (Marphatia et al., 2017). Several studies have highlighted research efforts to investigate the means of improving women's representation across different countries through empowerment (Rana et al., 2024; Sharif et al., 2024; Kabeer et al., 2018).

According to the statistics of the World Bank Group (2024), the literacy rate between both women (94.4%) and males (94.9%) in Brazil aged 15 years and above is high, and whilst it is reported that 53.1% of females participate in the labour force, the majority are engaged in unpaid domestic work. According to a 2024 report, women occupy about 33.5% of senior management roles in mid-market companies globally, with Brazil reflecting similar trends (UN Women, 2020). However, this proportion remains far from gender parity. In recent years, the Ministry of Education in Brazil, in collaboration with the Canadian government, has undertaken significant efforts to empower women by enhancing their technological and professional competencies. This initiative aims to bridge gender gaps in the workforce and equip women with the skills needed to thrive in the evolving digital and professional landscape (Durand et al., 2021). In fact, education policy in Brazil mandates schooling for all until secondary school level to increase the number of women in the labour market (Segatto et al., 2022), which is evident in the aforementioned female literacy level rates (World Bank Group, 2024). Unfortunately, the skills acquired by socially vulnerable women through various empowerment programmes and the academic knowledge of privileged females with higher education in Brazil have not translated to economic advantages for them and society at large because of barriers. Complex challenges such as socio-cultural values, family issues, and gender norms, among others, faced by women during transitioning from higher education to empowerment are apparent in Brazil and need practical solutions. This study employs the agreement index to identify and rank the barriers hindering women's transition from higher education to empowerment, utilising a quantitative research approach to assess their hierarchical importance. By understanding these barriers, this study aims to provide practical recommendations for relevant stakeholders. The findings will not only enhance advocacy for women's rights by the United Nations but also promote gender equality and improve the overall quality of life.

2. Literature Review

2.1. Overview of Transition from Higher Education to Empowerment

Empowerment describes enhancing an individual's authority over their life and increasing their involvement in addressing problems and making decisions that affect their lives and community, leading to development, collective modification, and equality (Adams, 2017; Zimmerman, 2000). Based on this premise, women's empowerment involves ensuring women have equal access to labour markets, decent employment, and creative means. With greater involvement and influence in economic decision-making at all levels, women can exercise more authority over their time, lives, and incomes (United Nations, 2018), in which education is a key factor in the empowerment pursuit (Van Eerdewijk et al., 2017). In some developing nations, women are frequently conditioned to believe that certain professions are not appropriate for them (Johnson, 2023; Rana et al., 2024), which may constitute avoidance of the profession or gender unfairness and discrimination against females in the profession (Elliott & Blithe, 2021; Starr & Zurbriggen, 2017). The effective and sustainable utilisation of human resources is critical for fostering sustainable economic development, as it ensures that the workforce's potential is maximised while maintaining long-term social and economic stability (Manioudis & Meramveliotakis, 2022). By investing in education, skill development, and equitable access to employment opportunities, countries can enhance productivity, reduce inequalities, and promote inclusive growth (UNDP, 2015). Furthermore, sustainable human resource practices prioritise worker well-being, diversity, and adaptability to changing economic conditions, which are essential for building resilient economies (OECD, 2021). These approaches also align with the principles of sustainable development, which emphasise balancing economic growth with social equity and environmental preservation (Brundtland Commission, 1987). Consequently, fostering an environment where human resources are effectively utilised and supported is indispensable for achieving broader development goals.

A woman whose identity and pursuit of goals have been tarnished may encounter compounded obstacles in higher education and in their professional lives (Carbado & Gulati, 2013). Individuals, especially women who are socialised into gender title roles and prospects from a young age, may be conditioned to prioritise caregiving and development roles, which can lead to struggles with the burdens of being empowered through skills and education (Grusec & Hastings, 2014). Therefore, investigating the barriers faced by women during the transition from higher education to empowerment is worthy of investigation, especially in countries with high literacy rates in women but low participation in the labour market.

2.2. Barriers to Transition from Higher Education to Empowerment

2.2.1. Family-Related Issues

A family is a key unit of a community that has a significant impact on the education and empowerment of young school leavers. Rana et al. (2024) identified marriage arrangements between families as a potential obstacle for young girls in Egypt. Parents often informally betroth their daughters at a very young age of around 15 or 16, and the marriage is made official when the girl turns 18 (Francis-Chizororo, 2010). However, educated parents perform better by allowing their wards access to education and employment (Farahat, 2009). Marphatia et al. (2017) similarly reported in their study that marriage for girls under 18 is permitted in 73 counties; on the other hand, a mother's education plays a crucial role in a child's background and home environment (Chen & Li, 2009). Notably, the belief that women should primarily focus on family responsibilities is frequently expressed, which affects the empowerment of women in rural and urban areas (Rana et al., 2024). The family-

related challenges, such as time constraints and conflict with domestic duties and career tasks, may also contribute to the problem of women empowerment in Pakistan, Sierra Leone, and other developing nations (Sarwar & Imran, 2019). However, educated parents advocate the empowerment of their female children after completing their academic studies (Farahat, 2009; Jasis & Ordoñez-Jasis, 2012).

2.2.2. Socio-Cultural Values

For a long time, certain nations have exhibited cultural preferences favouring male children (Phillips, 2003; Bako & Syed, 2018), but the advent of civilization has significantly diminished this primitive practice, particularly in developed nations (Rana et al., 2024). Similarly, in order to influence women's empowerment in a country, one must first understand cultural and societal norms. Outdated perspectives of femininity, which portray household tasks and caregiving as being associated with women, affect their empowerment choices and prospects (Kabeer et al., 2018). Despite innovations, learning and professional training inequalities continue to impact women's empowerment prospects (Miyata & Yamada, 2016). Cultural barriers not only impede girls from accessing good education but also cause women to avoid using basic health services after childbirth (Chiang et al., 2013). It was stated that, in Egypt, some parents do not send their daughters to school due to the expectation that they will be married off at a very young age (Rana et al., 2024). This situation is similar to what is observed in some developing countries worldwide, particularly in rural communities with poor or illiterate parents and caretakers (Workineh et al., 2015; Kohno et al., 2020). Therefore, a child denied education may not be considered deserving of empowerment either.

2.2.3. Gendered Norms

Gender equality is essential for common goals of improving quality of life and collective coordination (World Economic Forum, 2023), which is established on environmental, economic, and social grounds (Finatto et al., 2021). However, it has been challenged by the dichotomy of gender disparity. For example, quality education, which establishes a platform for better job opportunities, guidance, and decision-making for school leavers (Shahtalebi et al., 2011), is majorly advocated for males in some countries because of some inherently gendered norms relating to leadership or cultural background (Rana et al., 2024). As a result of gendered norms, issues surrounding the transportation system for women have been reported in Bangladesh and India (Balachandran & Desai, 2024; Nasrin & Chowdhury, 2024). One study (Balachandran & Desai, 2024) attempted to encourage the provision of a transport system to help women access new jobs based on their findings, which raised the issue of transportation for women to increase the number of women in the labour force. This implies that gendered norms can be beneficial to the larger society and, on the other hand, could have grave consequences (Tamunomiegbam & Arinze, 2024). Studies have also shown that the perception of employers and recruitment organisations about women and the nature of the job applied for and their cultural beliefs often inform their decision-making and disposition toward women in Africa (Rana et al., 2024), while Latin American countries also have their share of gendered norms that pervade their society (Campaña et al., 2018).

2.2.4. Economic Factor

The neoclassical theory of labour supply serves as the foundation for analysing individuals' participation and how they allocate their time to other activities (Jefferson & King, 2001). Within this framework, human capital theory suggests that productivity is tied to specific human capital. Consequently, workers who have career interruptions may be seen as less valuable to employers because of the perceived human capital depreciation, which

may be untrue and an unfair assertion for women (Gerst & Grund, 2019). Women often experience career disruptions due to maternity leave, childcare, and other family responsibilities. Institutional approaches to the labour market in Brazil emphasise the role of policies, regulations, and organisational practices in promoting gender equality. Initiatives such as the enforcement of anti-discrimination laws, maternity protections, and gender quotas in leadership positions aim to address systemic barriers that limit women's participation and advancement in the workforce (ILO, 2021). However, the effectiveness of these measures often depends on their implementation and the broader socio-cultural context, which continues to reinforce traditional gender roles (Ribas & Rangel, 2020). As a result, employers who adhere to neoclassical theory may be reluctant to hire women or may offer them lower wages, contributing to the gender wage gap (Biasi & Sarsons, 2022). Additionally, researchers have emphasised that women are influenced by economic and demographic factors such as economic development, fertility, women's educational attainment, gender wage disparities, and number of children. Previous studies have identified demographic factors as barriers to women's transition, with fertility and education being significant determinants (Askew et al., 2017; Mehtap et al., 2017). In terms of the structural foundations of the labour market, focusing on power dynamics, economic inequalities, and the commodification of women's labour, it is argued that true gender equality requires dismantling patriarchal and capitalist systems that perpetuate gendered exploitation and segregation. In Brazil, radical approaches advocate for transformative strategies, such as redefining unpaid care work as a central economic activity and restructuring labour market institutions to prioritise social justice over profit (Gonçalves & Hirata, 2020).

2.2.5. Freedom and Mobility

A country's advancement is measured not solely by its economic growth but also by the enhancement of living standards and the overall well-being of its citizens. Among fundamental human rights, free movement rights are vital and can only be realised by ensuring safe mobility without fearing violence (IWWAGE, 2023). According to IWWAGE (2023), the three primary factors that affect women's mobility and accessibility are time constraints, cost, and individual safety, along with social observations and spatial position. Women are more unlikely than men to rely on public transportation worldwide due to a higher vulnerability to assault in public spaces (Kacharo et al., 2022). The protection and safety of transportation are critical factors shaping women's mobility actions and decisions (Hidayati et al., 2020). Furthermore, women's ability to engage in paid work in communities denoted with violence may be linked to the availability of various options for transportation-related infrastructure and services and consciousness of safety in the commuting process. When women have access to affordable and safe transportation, they gain more bargaining power over their mobility (Martinez et al., 2020).

2.2.6. Violence and Harassment

Violence against women is a fundamental challenge that can significantly hinder their learning and employment prospects (Chadha et al., 2022). About 50% of women experience sexual violence annually (CDC, 2023), coupled with child marriage and violence against girls in educational settings, which can decrease school attendance and willingness for empowerment (Lee-Rife et al., 2012; Marphatia et al., 2017). In Nigeria, gender-based violence is notably high, with 31% of women aged 15 and above having experienced intimate partner violence (National Population Commission, 2019). In Brazil, violence from intimate partners occurs at a rate of 27% (World Bank Group, 2024). Global estimations showed that 30% of women experience bodily or sexual violence from their close companions (García-Moreno et al., 2013; WHO, 2021). Studies posit that women who are educated,

working, and earning are at a reduced risk of facing domestic violence, oppression, and domination as their economic independence allows them to achieve a degree of equality with their male counterparts (Obiagu, 2023). In the Philippines, children who have observed violent behaviours between their parents are reported to be affected negatively by the occurrence, and most of them adopt negative coping mechanisms (Sabarre et al., 2021).

3. Methodology

This study examined the barriers women face when transitioning from higher education to empowerment in Brazil. To identify and prioritise these barriers, a survey was conducted among women at three tertiary institutions: the State University of Maranhão, the Federal University of Rio de Janeiro, and the University of São Paulo (USP). The survey methodology was chosen to gather insights into the characteristics of the target respondents (Ponto, 2015). From the total population of female students and staff, a sample size of 384 was calculated using Yemane's formula (see Equation (1)). Additionally, a snowball sampling technique was utilised, where respondents were encouraged to share the survey link with their peers and friends within the same university to increase participation. Ultimately, a total of 306 responses were collected, of which 192 were deemed valid for data analysis, reflecting a response rate of 63%. This high response rate is considered adequate for fulfilling the study's objectives.

$$n = \frac{N}{1 + N(e)^2} \quad (1)$$

where n = sample size, N = total population, e = level of precision (margin error) at 5%.

The survey was meticulously crafted to gather data from respondents. It consisted of two main components: (i) background information, which included demographics such as age group, years of professional experience, academic field, and current position; and (ii) an exploration of the barriers that women face in their transition from higher education to empowerment, derived from existing literature. In the second part of the survey, respondents were asked to express their level of agreement with the identified barriers from the literature using a 5-point Likert scale, where a score of 1 indicated "strongly disagree" and a score of 5 represented "strongly agree" (Vagias, 2006). It is essential to highlight that ethical approval was obtained prior to the survey's administration. All participants were provided with ethical guidelines, and their consent was confirmed before they completed the survey. Furthermore, the participants were assured of the confidentiality of their responses and their right to withdraw from the study at any time without penalty.

The background information of the respondents was analysed using frequency distribution and percentage. The reliability of the construct of barriers against women's transition from higher education to empowerment was tested using Cronbach's alpha. The mean of each variable was computed using the statistical package of social sciences (SPSS version 27), while Fuzzy Synthetic Evaluation (FSE) of the constructs was calculated. FSE is a modelling technique from fuzzy set theory for investigating multicriteria decisions and is opined as an artificial intelligence method for measuring the accuracy of human decisions (Boussabaine, 2013). The restrictions of nominal variables such as True/False or Yes/No are eliminated in FSE logic and this is useful for solving complex problems and vaguely defined fuzzy situations (Owusu et al., 2021). FSE is computed based on establishing an FSE index system, estimating the mean score and weighting (W) of items, and establishing the membership function (MF) and agreement index of factors (Xu et al., 2010).

The evaluation index system for six classes of barriers was defined as $X = (x_1, x_2, x_3, x_4, x_5, x_6)$, and the second level evaluation index within each construct was described as

$x1 = (x11, x12, x13, x14)$. The rating scale for the item evaluation was defined in the order of $P = (1, 2, 3, 4, 5)$, while the second step entails calculating the weighting (W) of items and the component factors using Equation (2) and expressed in the order of the rating scale.

$$W_i = \frac{\mu_i}{\sum_{i=1}^5 \mu_i}, 0 \leq w_i \leq 1, \sum_{i=1}^5 w_i = 1 \quad (2)$$

The third step entails determining the membership function (MF) of each variable in the constructs. The weights assigned by the respondents to each variable were used to derive the MF of each item using Equation (3), where MF_{um} represents the MF of a variable um ; Xb_{um} ($p = 1, 2, \dots, 5$) represents the percentage of a frequency score the respondents assigned to an item um ; and Xb_{um}/Vp explains the relation between Xp_{um} and its alternative grade associated according to the rating scale.

$$MF_{um} = \frac{K_{1um}}{U_1} + \frac{K_{2um}}{U_2} + \frac{K_{3um}}{U_3} + \frac{K_{4um}}{U_4} + \frac{K_{5um}}{U_5} \quad (3)$$

The MF of a set (D_i) is a multiplication of a fuzzy matrix (R_i) of items and the associated weighting indices. Both D_i and R_i can be calculated using Equations (4) and (5).

$$D_i = \begin{bmatrix} MF_{ui1} \\ MF_{ui2} \\ MF_{xi3} \\ MF_{xi4} \end{bmatrix} = \begin{bmatrix} K_{1ui1} & K_{2ui1} & K_{3ui1} & K_{4ui1} & K_{5ui1} \\ K_{1ui2} & K_{2ui2} & K_{3ui2} & K_{4ui2} & K_{5ui2} \\ K_{1ui3} & K_{2ui3} & K_{3ui3} & K_{4ui3} & K_{1ui3} \\ K_{1ui4} & K_{2ui4} & K_{3ui4} & K_{4ui4} & K_{5ui4} \end{bmatrix} \quad (4)$$

$$R_i = W_i \cdot D_i = (w_1, w_2, \dots, w_n) \cdot \begin{bmatrix} K_{1ui1} & K_{2ui1} & K_{3ui1} & K_{4ui1} & K_{5ui1} \\ K_{1ui2} & K_{2ui2} & K_{3ui2} & K_{4ui2} & K_{5ui2} \\ K_{1ui3} & K_{2ui3} & K_{3ui3} & K_{4ui3} & K_{1ui3} \\ K_{1ui4} & K_{2ui4} & K_{3ui4} & K_{4ui4} & K_{5ui4} \end{bmatrix} = (r_{i1}, r_{i2}, \dots, r_n) \quad (5)$$

Finally, the FSE methodology involves quantifying the agreement index (AI) of the barriers against the transition from higher education to empowerment for women in the study. The AI is the product of the grading system ($P = 1, 2, 3, 4, 5$) and fuzzy evaluation matrix (R_i) using Equation (6).

$$LI = \sum_{i=n}^5 (R_i \times P_i) = 1 \leq AI \leq 5 \quad (6)$$

The same formula of AI, i.e., (Equation (6)), was used to compute the overall agreement index (OAI) of the barriers faced by women in the transition from higher education to empowerment using the aggregate of the six constructs.

4. Data Analyses and Results

4.1. Background Information of Respondents

The background information of the respondents is shown in Table 1. The majority of the respondents were aged 30–39 years (33%), 40–49 years (23%), and 20–29 years (21%). Of the total respondents, most of the respondents (i.e., 39%) had 1–5 years of work experience, and 20% had more than 20 years of work experience. In addition, most of the participants reported having a specialisation/residency (31%) or bachelor's degree (21%), and the lowest proportion had only a high school education (7%). Other background information of the respondents comprising their academic field and current position at the time of the study is illustrated in Table 1.

Table 1. Background information of the respondents.

Background Information	Categories	Frequency	Percentage
Age	Less than 20 years	1	0.5
	20–29 years	40	20.8
	30–39 years	64	33.3
	40–49 years	44	22.9
	50–59 years	35	18.2
	60 years and above	8	4.2
Highest educational level	Doctorate	37	19.3
	Master’s degree	31	16.1
	Bachelor’s degree	59	30.7
	Specialisation/residency	41	21.4
	Technical/vocational course	11	5.7
	High school	13	6.8
Years of professional experience	1–5 years	74	38.5
	6–10 years	29	15.1
	11–15 years	32	16.7
	16–20 years	18	9.4
	More than 20 years	39	20.3
Academic field	Agricultural sciences	5	2.6
	Biological sciences	17	8.9
	Health sciences	13	6.8
	Exact and earth science	14	7.3
	Human sciences	93	48.4
	Applied social sciences	28	14.6
	Engineering	4	2.1
	Linguistics, literature, and art	18	9.4
Current position	Undergraduate student	25	13.0
	Graduate student	24	12.5
	Assistant professor	9	4.7
	Associate professor	16	8.3
	Full professor	26	13.5
	Retired	1	0.5
	Technical administrative staff	20	10.4
	Industry	10	5.2
	Technical support fellow	6	3.1
	Others	55	28.6
Currently studying?	Yes	144	75.0
	No	48	25.0

Table 2 shows the mean value of each construct estimated using the mean score and their weighting using Equation (1). The mean values of family-related issues ($M = 1.25$ to 4.36), socio-cultural values ($M = 2.61$ to 4.13), gendered norms ($M = 3.58$ to 4.25), economic factors ($M = 2.91$ to 3.91), freedom and mobility ($M = 3.77$ to 4.46), and violence and harassment ($M = 3.21$ to 3.94) are shown. Table 2 also shows that the alpha value of each construct, which ranges from 0.521 to 0.792 , is higher than the common benchmark of 0.5 and also connotes good internal consistency (Olaniyi, 2019).

The weighting of variables in each construct was estimated from the mean variable received from the respondents’ ratings. For example, the weighting of SV_3 was estimated as

$$W_{SV_3} = \frac{\mu_{SV_3}}{\mu_{SV_1} + \mu_{SV_2} + \mu_{SV_3} + \mu_{SV_4}} = \frac{4.13}{2.61 + 2.89 + 4.13 + 3.97} = \frac{4.13}{13.60} = 0.304$$

It is expected that the estimation of the weightings of the construct in each group must be equal to or approximately equal to 1. Therefore, the estimation of constructs of socio-cultural values (SVs) was computed as an addition of 0.192, 0.213, 0.304, and 0.292 to make a total of 1.000.

Table 2. Barriers faced by women during the transition from higher education to empowerment.

Constructs	Variables	Code	Mean	Weighting	Alpha	Total Mean
Family-related issues	I believe that females should not engage in higher education because their role should focus on the family.	FR1	1.24	0.094	0.521	13.20
	Educated parents advocate higher education and professional careers for their daughters.	FR2	3.55	0.269		
	Time constraints due to domestic responsibilities often lead to a double burden on females to prevent them from higher education/professional careers.	FR3	4.36	0.330		
	Parents often have different professional and life aspirations for their daughters and sons.	FR4	4.05	0.307		
Socio-cultural values	A male-dominated power structure—whereby privilege is held and maintained by men in both society and social relationships—is the norm in my community.	SV1	2.61	0.192	0.605	13.60
	Conservative cultural norms and political factors hinder the academic and professional journey of females.	SV2	2.89	0.213		
	Females often face a lack of access to education, health, and welfare.	SV3	4.13	0.304		
	Early/child/forced marriages lead to a lack of education for females.	SV4	3.97	0.292		
Gendered norms	Women often face gender differences in education, enrollment, and workplace settings.	GN1	4.25	0.272	0.763	15.65
	In my community/social/professional workplace circle, female education is considered a low priority as it does not uplift the family economically.	GN2	3.69	0.236		
	There are fewer or less diverse job options available for women.	GN3	3.58	0.229		
	In my community/social/professional workplace circle, there is a gendered perception of leadership.	GN4	4.13	0.264		
Economic factors	Poverty (financial barriers to affording education) is what restricts the advancement of education for women.	EF1	2.91	0.215	0.757	13.51
	In my community/social/professional workplace circle, there is selective enforcement of policies in the context of women's education and professional career growth.	EF2	3.91	0.289		
	There is unequal pay between men and women.	EF3	3.44	0.255		
	There is a general lack of job security for women.	EF4	3.25	0.241		

Table 2. Cont.

Constructs	Variables	Code	Mean	Weighting	Alpha	Total Mean
Freedom and mobility	Regular armed conflicts are what hinder women's mobility.	FM1	3.77	0.230	0.675	16.38
	Cultural and religious restrictions are what hinder women's mobility.	FM2	4.20	0.256		
	There is an insufficient supply of educational institutes within accessible distance for women.	FM3	3.95	0.241		
	Work-life conflict (women are expected to construct a balance between family and profession, which leads to a double burden of household, work, and childbearing/rearing).	FM4	4.46	0.272		
Violence and harassment	In my community/social/professional workplace circle, there is often domestic violence against women.	VH1	3.29	0.232	0.792	14.18
	In my community/social/professional workplace circle, there is often sexual harassment/abuse against women.	VH2	3.21	0.226		
	There is a lack of implementation of sexual harassment policies in education or professional workplace settings.	VH3	3.94	0.278		
	Women often face humiliation in the workplace from intimidating supervisors.	VH4	3.74	0.264		

4.2. Membership Function Calculation for Barriers to Women's Empowerment (Level 3)

The membership functions (MFs) in the FSE range between 0 and 1, and the designation from which the MFs are obtained is important (Ameyaw & Chan, 2016). The intrinsic terms deployed to evaluate the constructs used a five-point Likert scale ranging from 1 representing "strongly disagree" to 5 implying "strongly agree". Thus, the MF of a variable was computed using Equation (3) for socio-cultural value construct (3), i.e., SV_3 based on the rating of respondents in which "strongly disagree = 1.6%", "disagree = 7.3%", "neutral = 9.9%", "agree = 39.6%", and "strongly agree = 41.7%" is illustrated as

$$MF_{SV_3} = \frac{0.02}{\text{Strongly disagree}} + \frac{0.07}{\text{Disagree}} + \frac{0.10}{\text{Neutral}} + \frac{0.40}{\text{Agree}} + \frac{0.42}{\text{Strongly agree}} = (0.02, 0.07, 0.10, 0.40, 0.42)$$

In the same vein, the computation of MFs for all the constructs (i.e., FR_1 to VH_4) was calculated from the respondents' ratings and is illustrated in Table 3.

Membership Function Calculation for Barriers to Women Empowerment (Level 2).

The MFs (Level 2) were computed using Equation (4) by the products of the MFs (Level 3) of constructs in a group of barriers with the associated weighting derived from Equation (1). Using socio-cultural values (Level 2) as an example, the MFs (Level 2) are estimated as follows:

$$R_{SV} = (0.192, 0.213, 0.304, 0.292) \times \begin{bmatrix} 0.41 & 0.13 & 0.10 & 0.19 & 0.18 \\ 0.25 & 0.16 & 0.17 & 0.30 & 0.13 \\ 0.02 & 0.07 & 0.10 & 0.40 & 0.42 \\ 0.05 & 0.09 & 0.06 & 0.46 & 0.34 \end{bmatrix}$$

$$R_{SV} = (0.15, 0.11, 0.10, 0.36, 0.29)$$

By using the same approach, the remaining MFs (Level 2) for the six classes of barriers were calculated and are presented in Table 3.

Table 3. Membership Function calculation of barriers faced by women during the transition from higher education to empowerment.

Constructs	Code	W _v	W	MF for Level 3					MF for Level 2					MF for Level 1				
Family-related issues	FR1	0.094	0.153	0.87	0.08	0.03	0.00	0.03	(0.11	0.07	0.12	0.38	0.33)	(0.07	0.12	0.14	0.35	0.32)
	FR2	0.269		0.06	0.11	0.20	0.48	0.15										
	FR3	0.330		0.02	0.05	0.05	0.32	0.57										
	FR4	0.307		0.02	0.04	0.14	0.46	0.33										
Socio-cultural values	SV1	0.192	0.157	0.41	0.13	0.10	0.19	0.18	(0.15	0.11	0.10	0.36	0.29)					
	SV2	0.213		0.25	0.16	0.17	0.30	0.13										
	SV3	0.304		0.02	0.07	0.10	0.40	0.42										
	SV4	0.292		0.05	0.09	0.06	0.46	0.34										
Gendered norms	GN1	0.272	0.181	0.02	0.06	0.06	0.36	0.49	(0.04	0.10	0.14	0.33	0.39)					
	GN2	0.236		0.06	0.16	0.16	0.29	0.34										
	GN3	0.229		0.05	0.14	0.25	0.31	0.26										
	GN4	0.264		0.02	0.06	0.12	0.36	0.43										
Economic factors	EF1	0.215	0.156	0.18	0.28	0.17	0.20	0.17	(0.08	0.19	0.20	0.32	0.22)					
	EF2	0.289		0.02	0.09	0.16	0.45	0.29										
	EF3	0.255		0.07	0.17	0.23	0.32	0.21										
	EF4	0.241		0.06	0.24	0.26	0.26	0.18										
Freedom and mobility	FM1	0.230	0.189	0.02	0.13	0.21	0.33	0.30	(0.01	0.08	0.13	0.35	0.42)					
	FM2	0.256		0.01	0.05	0.13	0.39	0.43										
	FM3	0.241		0.02	0.11	0.15	0.36	0.36										
	FM4	0.272		0.01	0.03	0.05	0.34	0.58										
Violence and harassment	VH1	0.232	0.164	0.08	0.22	0.21	0.33	0.17	(0.05	0.17	0.18	0.36	0.24)					
	VH2	0.226		0.08	0.27	0.18	0.30	0.17										
	VH3	0.278		0.00	0.10	0.18	0.40	0.32										
	VH4	0.264		0.05	0.11	0.16	0.40	0.28										

Note: W_v = weighting of construct's variables, W = weighting of construct.

4.3. Agreement Index for Barriers to Transition to Empowerment for Women

The membership function of the barriers faced by women during the transition from higher education to empowerment derived from the constructs was used to estimate the actual agreement indexes.

$$B_{FR} = (0.11 \times 1) + (0.07 \times 2) + (0.12 \times 3) + (0.38 \times 4) + (0.33 \times 5) = 3.78$$

$$B_{SV} = (0.15 \times 1) + (0.11 \times 2) + (0.10 \times 3) + (0.36 \times 4) + (0.29 \times 5) = 3.56$$

$$B_{GN} = (0.04 \times 1) + (0.10 \times 2) + (0.14 \times 3) + (0.33 \times 4) + (0.39 \times 5) = 3.93$$

$$B_{EF} = (0.08 \times 1) + (0.19 \times 2) + (0.20 \times 3) + (0.32 \times 4) + (0.22 \times 5) = 3.44$$

$$B_{FM} = (0.01 \times 1) + (0.08 \times 2) + (0.13 \times 3) + (0.35 \times 4) + (0.42 \times 5) = 4.06$$

$$B_{VH} = (0.05 \times 1) + (0.17 \times 2) + (0.18 \times 3) + (0.36 \times 4) + (0.24 \times 5) = 3.57$$

From the calculation of the agreement levels of all the constructs of the barriers, it can be deduced that women in Brazil are facing challenges during the transition from higher education to empowerment.

4.4. Overall Agreement Index (OAI) of Barriers for Empowerment

The agreement index estimated in the previous section formed the basis for the estimation of the OAI using a formula similar to Equation (5), i.e., $(R_i X Q_i)$, where R_i is the fuzzy matrix for computing the OAI, P_i represents the evaluated matrix for $i = (u_1, u_2, u_3, u_4, u_5)$ normalised by the weighting indicated for the six groups of barriers, that is, $(w_{fr}, w_{sv}, w_{gn}, w_{ef}, w_{fm}, w_{vh})$.

Therefore,

$$D = (w_{fr}, w_{sv}, w_{gn}, w_{ef}, \dots, w_{vh})x \begin{bmatrix} P_{11} & P_{12} & P_{13} & P_{14} & P_{15} \\ P_{21} & P_{22} & P_{23} & P_{24} & P_{25} \\ P_{31} & P_{32} & P_{33} & P_{34} & P_{35} \\ \dots & \dots & \dots & \dots & \dots \\ P_{n1} & P_{n2} & P_{n3} & P_{n4} & P_{n5} \end{bmatrix}$$

$$D = (0.153, 0.157, 0.181, 0.156, 0.189, 0.164)x \begin{bmatrix} 0.11 & 0.07 & 0.12 & 0.38 & 0.33 \\ 0.15 & 0.11 & 0.10 & 0.36 & 0.29 \\ 0.04 & 0.10 & 0.14 & 0.33 & 0.39 \\ 0.08 & 0.19 & 0.20 & 0.32 & 0.22 \\ 0.01 & 0.08 & 0.13 & 0.35 & 0.42 \\ 0.05 & 0.17 & 0.18 & 0.36 & 0.24 \end{bmatrix}$$

$$D = (0.07, 0.12, 0.14, 0.35, 0.32)$$

The D represents the fuzzy evaluated matrix membership function of all the constructs of barriers (MF for Level 1), as shown in Table 3, which was used to compute the OAI by multiplying with the grading scale of 1 to 5. Thus, the calculation is

$$OAI = \sum_{i=1}^5 (DX V_i) = (0.07 \times 1) + (0.12 \times 2) + (0.14 \times 3) + (0.35 \times 4) + (0.32 \times 5) = 3.73$$

The overall agreement index (OAI) was computed to be 3.73 (approximately 4.00), which implied an “agree” index in the rating scale, recollecting the rating scale where 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. Comprehensive discussions of the index system for the barriers facing women during the transition from higher education to empowerment are in the next section.

5. Discussion

This study investigated barriers faced by women during the transition from higher education to empowerment using soft computing techniques. The existing literature has extensively analysed the structural inequalities that perpetuate gender segregation in labour markets, emphasising how such segregation contributes to women’s concentration in low-paid and low-skilled occupations. These dynamics are particularly pronounced in emerging economies, where entrenched socio-cultural norms and economic structures further exacerbate disparities, pushing many women into cycles of poverty and social discrimination.

Notably, gender segregation in the labour market is a persistent feature, often characterised by horizontal segregation (women concentrated in specific industries, such as care-giving, teaching, and administrative work) and vertical segregation (women underrepresented in leadership and high-paying positions). Scholars argue that this segregation is not solely the result of individual choices but is deeply rooted in systemic discrimination, cultural norms, and institutional biases that devalue women’s work (Charles & Grusky, 2004; Blau & Kahn, 2017). Feminist economists have highlighted how occupational segregation reinforces unequal power dynamics and limits women’s access to economic resources and upward mobility (Folbre, 1994).

In emerging economies, the gendered division of labour often relegates women to informal sectors or low-skilled jobs that offer minimal wages, lack job security, and provide little to no social protection. The undervaluation of work traditionally performed by women—such as domestic work, garment production, and agriculture—further entrenches economic disparities (Kabeer, 2015). Even within formal sectors, women are disproportion-

ately represented in entry-level and poorly remunerated roles, with limited opportunities for skill development or promotion (UN Women, 2020).

These economic disadvantages have profound implications for women in emerging countries. Limited access to well-paying jobs perpetuates income inequality, pushing women and their families into poverty. The intersection of economic marginalisation with societal discrimination based on gender compounds these challenges, as women face restricted access to education, credit, and property ownership, further hindering their economic empowerment (Elson, 1999; Chant, 2010). Women in poverty are also more vulnerable to exploitation, workplace harassment, and gender-based violence, reinforcing cycles of marginalisation and exclusion.

Thus, addressing gender segregation and its consequences requires comprehensive policy interventions. Investments in education and vocational training, coupled with anti-discrimination laws and enforcement, can help break the cycle of low-paid and low-skilled employment. Policies promoting women's participation in non-traditional sectors and leadership roles, as well as social protections for informal workers, are crucial in emerging economies. Additionally, feminist economic frameworks emphasise the importance of valuing unpaid care work and integrating it into national accounting systems to challenge traditional metrics of economic productivity (Waring, 1988).

Based on the results of the FSE and the overall agreement index (OAI) computed to be 3.73 (approximately 4.0, which implies "agree" in the used Likert scale), it is indicated that there are barriers faced in women's transition from higher education to empowerment in Brazil. The findings of this study align with the situations faced by women in most developing nations, such as Egypt (Rana et al., 2024), Jordan (Alshdiefat et al., 2024; Sharif et al., 2024), and Pakistan (Fatima & Sultana, 2014), among others. Although women in Brazil are not hindered from acquiring Western education, in contrast to those in some developing countries (Rana et al., 2024), the problems encountered in the transition process using the factors demystified in this study are alarming. The apex of the discourse is the waste of economic, intellectual, and social investment in women in their academics without a successful transition to empowerment.

5.1. Freedom and Mobility

Of the barriers faced by women during the transition from higher education to empowerment, freedom and mobility had the highest agreement index of 4.06. The constructs of freedom and mobility hover around armed conflicts that hinder free mobility for women and restrictions (see Table 2). This finding aligns with past studies in Pakistan in which the safety concerns of female health workers have been reported (Mumtaz et al., 2013). The restriction of women's mobility because of other factors, such as norms and socio-cultural suppositions, is a great concern, especially in developing nations. Women in low-income groups in Bangladesh are also reported to face mobility problems and untoward behaviour from other travellers (Nasrin & Chowdhury, 2024). Restriction based on cultural and religious grounds (FM2) is also shown to have a significant mean value in this study. Considering the religious groups in Brazil, which are predominantly Roman Catholic and are not against the free mobility of women (Gomes & Carm, 2015), it suggests that cultural restrictions may be the bane of the issue in the study area. The norms of violence and conflict in Brazil can be a key factor in hindering the free movement of women in their place of work and society at large (Biazoto, 2011; The Economic Times, 2024). The construct of freedom and mobility also encompasses work–family conflict that affects women's transition from higher education to empowerment. Generally, domestic and family responsibilities are constantly indicated as impediments in both developing and developed

nations (Rana et al., 2024; Cavagnis et al., 2023). However, career-driven women employ domestic helpers to ease some expected domestic tasks (Groves & Lui, 2012).

It is important to acknowledge that the advancements in technology and workplace digitisation are opening new pathways for women to transition from higher education to empowerment by addressing longstanding structural and societal barriers. Notably, the integration of flexible working arrangements through digital technologies offers women greater opportunities to balance family responsibilities with active workforce participation. These arrangements, supported by tools such as remote work platforms and virtual collaboration systems, enhance accessibility and inclusivity. In addition, the growing availability of online platforms for skill development, professional networking, and remote job opportunities provides women with alternatives to traditional employment pathways. By circumventing barriers such as mobility constraints and geographical limitations, these platforms empower women to engage in the workforce on their own terms, fostering greater economic and social independence. Thus, technological advancements demonstrate significant potential to drive women's empowerment by bridging gaps between higher education and meaningful workforce participation.

5.2. Gendered Norms

Gendered norms are the second most agreed-upon barrier facing women's transition from higher education to empowerment in Brazil, with an estimated agreement index of 3.93. Although the literacy level for women in Brazil is considerably high (Statista, 2024), they often experience gender differences in the workplace environment. The gendered norm has given rise to new perspectives for women in daily tasks, confirmed in other Latin American countries such as Ecuador, Peru, and Mexico (Campaña et al., 2018). A community with relatively gendered norms may not explicitly embrace leadership for women in an organisation, perhaps because of patriarchal stances or religious beliefs, as reported in Egypt, Pakistan, and other developing nations (Barsoum, 2018; Kelbert & Hossain, 2014; Yousaf & Schmiede, 2017). However, developed countries have pushed against the frontiers of ignorance and boundaries set for women, which possibly add to their level of development.

Interestingly, studies in countries that frown on gendered norms and encourage women in leadership positions revealed that females are better managers and disregard unethical practices (Swamy et al., 2001). One of the variables in gendered norms shows disdain for female education regarding its contribution to family economic resources (GN3). It is worth noting that this finding aligns with the work of Rana et al., 2024, in which recruitment organisations and employers were found to prefer to give men jobs because of their breadwinning role. In fact, a female respondent in the study (Sika, 2017) also stated that she would prefer for her husband to be offered a job even if she was better qualified for the same position.

5.3. Violence and Harassment

In Brazil, the issue of violence and harassment poses substantial barriers for women and is well documented in the literature (Khan, 2017). Women frequently face violence and harassment within educational institutions and workplaces, discouraging their pursuit of higher education and professional careers. This underscores the urgent need for robust policies and protective measures to ensure women's safety and promote their active participation in these domains. Strengthening the enforcement of existing workplace harassment laws in Brazil is crucial to creating environments where women can thrive without fear. Additionally, implementing secure and anonymous reporting mechanisms, alongside dedicated helplines, can empower victims to come forward and seek justice.

These measures align with global best practices for addressing workplace harassment (Khan, 2017; Cheema, 2023, as identified for Pakistan) and are critical for fostering a culture of safety and equality.

5.4. Socio-Cultural Values

The findings highlight that the entrenched societal norms and cultural expectations in Brazil hinder women's educational and professional advancement. Conservative cultural norms and a male-dominated power structure remain pervasive and substantial barriers to women's progress. For instance, societal expectations often prioritise family roles over education and careers for women. These findings align with prior research by Bishu and Headley (2020). Addressing these deeply rooted socio-cultural barriers necessitates a multifaceted approach involving community-level interventions and systemic policy reforms to promote gender equality and challenge traditional norms. We recommend launching nationwide awareness campaigns to challenge traditional gender roles, advocate for women's rights, and promote gender equality across all sectors. Furthermore, integrating gender sensitization programmes in schools and community centres can instil progressive values from an early age. Such initiatives have proven effective in reshaping societal attitudes and fostering more equitable environments in comparable contexts (Sharif et al., 2024; Rana et al., 2024). These interventions are essential for breaking the cycle of patriarchy and empowering women to achieve their full potential in education and the workforce.

5.5. Economic Factors

The *economic factor* is the smallest barrier faced in women's transition from higher education to empowerment in Brazil, with an agreement index of 3.44. The value of the estimated agreement index implies a "neither agree nor disagree" situation for this construct. Interestingly, a cue to unlock this could be a result of the effectiveness of the education policy in Brazil. Poverty or financial constraints are not convincing issues that hinder female education and skill acquisition in Brazil (see Table 2) compared to other developing nations. Although the respondents revealed that there is selective enforcement of policy for women's education and professional career growth, the situation may be more career-related than education-related. The unequal pay among men and women recorded for the construct of economic factors in this study aligns with the findings of past studies (Rana et al., 2024). Generally, the yardstick for payment should be based on experience and academic and professional qualifications; however, recruitment organisations and firm owners also allow gender disparity to contribute to their decision-making (Rana et al., 2024). Perhaps the notion that men are breadwinners for families clouds their judgement (Barsoum, 2018; Kabeer et al., 2018).

5.6. Family-Related Issues

Family-related issues are the third key barrier faced in women's transition from higher education to empowerment in this study. In most situations, the domestic burden on women is often a significant setback for their careers, especially the married ones. The situation is not better for single women in countries where females are given away through marriage as teenagers. Surprisingly, over seventy countries have been reported to support marriage for women at the tender age when their counterparts in other nations are acquiring skills and knowledge (Marphatia et al., 2017). Although marriage is a common belief as a result of community or religion, the education of parents plays a key role in their support of career paths for their children. This was confirmed in a study (Farahat, 2009), where most of the female medical practitioners surveyed had parents who were medical experts, even in a country where females face challenges in obtaining an education. Vi-

olence and harassment and *socio-cultural values* have an agreement index of 3.57 and 3.56, respectively. Brazil is one of the most unsafe countries because of the constant violence, attacks, and social unrest, which can lead to casualties (Cadena et al., 2015). The case for women may be severe, especially in the workplace when they are away from their homes, where they can find safety with their immediate families (The Economic Times, 2024), as violence with intimate partners in Brazil is reported to be less than the world average (World Bank Group, 2024). The findings of studies on the assault and sexual harassment of workers in Brazil (Ribeiro Corossacz, 2019; Brito et al., 2022) are in tandem with the findings of this paper. The socio-cultural values evident in the male-dominant power structure and conservative cultural norms in Brazil further reinforce the barriers faced in women's transition from higher education to empowerment. This finding is in consonance with past studies conducted in countries with male dominance, such as the Maldives, Kuwait, Saudi Arabia, Pakistan, and Jordan, among others (di Friedberg & Abdulla, 2021; Fatima & Sultana, 2014; Sharif et al., 2024).

6. Recommendations

This study investigated the barriers facing women during the transition from higher education to empowerment in Brazil, employing a soft computing technique to analyse survey data. The findings revealed that these barriers significantly hinder a seamless transition to empowerment, as indicated by the overall agreement index (OAI) derived from the respondents' ratings. Based on the results of the agreement index of each construct of the barriers, some practical recommendations are provided.

The freedom and mobility of women in Brazil are indicated as the highest barrier to transitioning from higher education to empowerment; therefore, it is suggested that law enforcement agencies in Brazil guarantee safety and security for the free mobility of its citizens. Employers could also install digital technologies to record in real time for security reasons in workplaces (Hodge, 2020), thereby creating safer environments for women.

Deeply entrenched gender norms were also highlighted as a critical obstacle. A nationwide public awareness campaign should be launched to challenge these stereotypes and educate both employers and the general public about the harmful impacts of gendered norms on societal development and organisational performance. Promoting equality and diversity in workplaces and communities is essential for fostering an inclusive culture that supports women's empowerment.

Family responsibilities were identified as a significant challenge for women striving to balance their professional and personal lives. Encouraging the use of domestic helpers and promoting access to affordable childcare services can alleviate the burden on women, enabling them to pursue their careers while fulfilling family obligations (Groves & Lui, 2012). Policies that incentivize shared family responsibilities, such as paternity leave and flexible working arrangements, can also help mitigate these challenges.

Workplace violence and harassment were recognised as pressing issues that undermine women's safety and confidence. Employers must adopt and enforce zero-tolerance policies toward harassment and violence. The clear communication of safety requirements and employee protection protocols should be mandatory across organisations. Additionally, implementing secure and anonymous reporting mechanisms, combined with swift and transparent investigations, can foster safer and more supportive workplace environments (Ribeiro Corossacz, 2019).

By addressing these barriers through coordinated efforts involving government agencies, employers, and civil society, Brazil can create a more enabling environment for women to transition from higher education to empowerment. These measures not only support gender equality but also contribute to the nation's broader social and economic development.

7. Conclusions and Future Studies

This study investigated the barriers faced in women's transition from higher education to empowerment in Brazil. Considering the literacy level and unemployment rate in Brazil, it is evident that there is an inherent impediment to empowerment, which is common for females. Through a questionnaire survey administered at the State University of Maranhao, Federal University of Rio de Janeiro, and the University of São Paulo, the opinions of female students and staff were received. The 192 pieces of valid data received on the constructs of barriers mitigating the transition from higher education to empowerment from the target respondents were analysed using Fuzzy Synthetic Evaluation (FSE). The results of the analysis revealed that the barriers relating to freedom and mobility are the most significant affecting women's transition from higher education to empowerment. Other barriers in descending order include gendered norms, family-related issues, violence and harassment, socio-cultural values, and economic factors, respectively.

This study has several limitations that should be acknowledged. First, the sample composition focused exclusively on female students and staff from three universities, which may not fully capture the experiences of the broader population of women in Brazil. Second, the geographical scope of the study was limited to specific regions, potentially restricting the generalizability of the findings to other parts of Brazil or to similar economies. Additionally, the study employed a cross-sectional design, offering a snapshot of barriers at a particular point in time without accounting for changes or trends over time. Finally, while the Fuzzy Synthetic Evaluation (FSE) method is a robust analytical tool, its reliance on subjective weightings may introduce potential bias into the analysis. In summary, these limitations highlight the need for the cautious interpretation of the findings and suggest directions for future research. Based on the findings of the study, several recommendations were provided, including ensuring the upholding of law and order for the safety of females and citizens generally at workplaces. It is also advised that digital technology be installed at workplaces for record-keeping and data to provide more practical recommendations for safety management. In addition, it is suggested that a public enlightenment campaign be used to educate the public on the importance of female empowerment in Brazil. Although this study achieved the intended objectives, there is a need to explore solutions to the mobility and freedom of women in Brazil for the judicious use of human resources in Brazil. Solutions to other barriers can be explored to further drive the economy of Brazil. Future studies can also investigate the effect of barriers to social and economic outcomes in Brazil. Other barriers that may not be considered in this study, peculiar to other nations, can be explored through focus groups and interviews. The insights gained from this study are not only relevant to Brazil but also to other densely populated and rapidly developing economies, such as India, South Africa, and Indonesia. Future research could explore the cultural and structural barriers identified here in a cross-national context, contributing to a global understanding of women's transition to empowerment.

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