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Article

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Determinants of multi-dimensional women empowerment in Mali

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ABSTRACT

This study assesses the dimensions and determinants of multidimensional women empowerment in Mali. It uses the Alkire Foster methodology and factor analysis to create different measures of multidimensional empowerment for 1691 consistent responses. Five indicators of empowerment are employed to create the multidimensional empowerment index. We found that women are multidimensionally disempowered for all the indicators used. At a deprivation cutoff of 2/5, 41.8% are multidimensionally disempowered, and 79.6% using the multidimensional disempowerment headcount. Also, we find that agency domain contributes significantly to the empowerment index. For the factor analysis method, two factors played a very important role in the creation of the empowerment index. Age of the respondent, wealth index, sex of the household head, educational status, and region of residence play an important role in determining empowerment in both approaches used in the study. The study concludes that the level of women empowerment in Mali is relatively low and that more policy efforts are needed to improve women empowerment. In view of these empirical insights, a number of policy recommendations are proposed to promote the empowerment of women in Mali. First, interventions should concentrate on the identified determinants, including the improvement of educational opportunities, particularly in areas where empowerment scores are lower. Second, it is essential to implement strategies aimed at wealth redistribution and economic inclusion to offset disempowerment resulting from economic disparities. Furthermore, the promotion of gender-balanced household dynamics through awareness campaigns and policy incentives could make a substantial contribution to women's empowerment.

IMPACT STATEMENT

This study evaluates multidimensional women empowerment in Mali, using data from 1,691 respondents. Employing the Alkire Foster methodology and factor analysis, it reveals that 41.8% of women are multidimensionally disempowered, with significant influences from factors such as age, wealth, household head gender, education, and region. The findings emphasize the need for policies enhancing educational opportunities, wealth redistribution, and gender-balanced household dynamics to improve women's empowerment in Mali. These insights are crucial for informing effective policy interventions and promoting gender equality in the region.

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Introduction

In today's global development plan, women's empowerment has become increasingly important and is closely associated with a number of development outcomes. The fifth Sustainable Development Goal (SDG-5) is the empowerment of women and the attainment of gender equality, and it must be fulfilled by 2030. Though a significant body of literature (Cornwall, 2016; Kabeer, 2005; Malhotra et al., 2002; Mandal, 2013; Njoh & Ananga, 2016) has been produced on theorising, operationalizing, and conceptualising the idea of

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women's empowerment, there isn't a universal definition or metric to represent empowerment in the form of agency or achievement (Soharwardi & Ahmad, 2020). For issues of equality and ensuring that there is a balance in the distribution of resources across the divides of gender, women empowerment tends to gain much-needed attention. Thus, the literature, which is undergoing significant development, highlights the need to include the empowerment of women in the socioeconomic development process. For Golla et al. (2011), achieving the rights and well-being of women, the reduction of poverty, and the acceleration of economic development, efficiency, and productivity have necessitated the recent spike in the literature and discussion involving women empowerment and gender inclusion. Eyben et al. (2008) argue that the economic and social empowerment of women implies that there is somewhat unrestricted access to economic resources and also to social resources, including their social choice and the free will to choose.

According to the United Nations (2015), women constitute half of the population of the developing world. However, in the developed world, the percentage is a bit higher than in the developing world. In households within developing nations, about two-thirds of female are excluded from decision-making processes. They do not have the luxury of taking unilateral decisions and also own property, and they are continuously disadvantaged in recognition of agricultural decision-making and policies. Bushra and Wajiha (2015), therefore, conclude that in third-world economies, the confidence and self-esteem of rural women are generally lower for females than for males due to the fact that women tend to be more isolated and less empowered.

Literature has delved into the concept in a bit to unearth a broader and clearer understanding of the concept of empowerment by decomposing it into various definitions. Kabeer (1999), for instance, indicates that empowerment results from an interlink between related indicators, which are identified as agency, achievements, and resources. For him, agency presents the liberty and free will of the agent to make deliberate preferences, as well as their ability to manage resources or assets. Achievements for him become the end results of the choices an agent makes using his or her available resources. Resources constitute the framework that guides the conditions under which an economic agent could make a choice.

Mandal (2020) proposed the notion of women's empowerment through the delineation of five specific classifications: political, social, psychological, economic, and educational. Moreover, Mandal emphasised the indispensable nature of each of these classifications in enabling the acquisition and management of resources, entitlements, and autonomy in pivotal spheres of a woman's existence. Narayan (2005) also finds that the empowerment process builds critical indicators such as opportunity structure and agency. According to Akyüz and Sayang-Cengiz (2016), women should not be considered a homogenous group but rather a group with inherent differences. For them, women have different access to social and economic resources. While some women have access to economic resources, others do so by virtue of their political and societal settings. In some settings, women are seen as agents who can compete with their male counterparts, while in others, women are seen only as housewives and oftentimes become victims of domestic violence and are restricted to doing only house-related activities and not being able to actively engage themselves in other socio-economic activities (Landig, 2011).

According to the United Nations Women (UN Women), Mali ranks as one of the countries with a very low human development index and a very high incidence of gender inequality. In Mali, women and girls experience a range of kinds of violence and discrimination, including forced and early marriage, female genital mutilation, and limited access to economic, health, and educational possibilities. Data from the 2018 reports of the Demographic Health Survey indicate that Mali is characterised by a chronic unemployment rate and a low rate of female employment. Among the age ranges of 15 to 59, females (28.8%) are more afflicted than men (25.8%). The reason behind women's low labour market involvement is because they work from home, accounting for 16.7% of the population's inactivity (DHS, 2018). Approximately, 26% of Mali's agricultural GDP is contributed by women, while men's participation is estimated to be only 14% (Mohammed, 2013). Furthermore, if women have equal access to resources like land, seed, fertiliser, and money as men do, agricultural productivity might rise by 20%. Because of this, women's economic empowerment through agribusinesses is acknowledged globally as a major factor in reducing poverty, promoting economic growth, and guaranteeing food security for households (African Development Bank, 2015).

Campaigns to encourage girls to enrol are helping to reduce gender imbalances in primary school, but they haven't spread to secondary education. Mali has the highest rate of female genital mutilation in the world, affecting 89% of women aged 15 to 49. Violence against women is rampant (DHS, 2018). Within the customary and traditional courts, women are not granted the same legal position as men.

The Family Code encourages polygamy, widespread male control, domestic abuse, and opposition to women working outside the house, despite efforts to change it. Despite being significant players in every facet of everyday life, women frequently lack authority and need increased awareness of their legal rights as well as a bigger voice in society.

Recent studies on the empowerment of women in emerging economies have utilised limited women empowerment dimensions and have failed to consider the role of gender equality in promoting women's empowerment (Akram, 2018; Ayeubomwan et al., 2016; Islam, 2021; Sharma & Sanchita, 2017; Sibide et al., 2023; Soharwardi & Ahmad, 2020). Further, in Mali, there is a knowledge gap on the dimensions of women empowerment and what determines women empowerment.

This study's primary goal is to investigate the factors that contribute to multidimensional women's empowerment in Mali using data from a nationally representative survey. The five dimensions of agency, income, resources, leadership, and time/workload – are used to measure and analyse women's empowerment. By offering empirical insights on the variables influencing women's empowerment in Mali, a nation that struggles mightily to achieve gender equality and women's rights, this study adds to the literature already available on the empowerment of women in developing nations. To achieve the results of the study, we developed the dimensions of women empowerment using the Alkire and Foster (2007) methodology as adopted by Obayelu and Chime (2020). Since the dimensions of women empowerment can be considered latent (unobservable) and the various indicators of domains of empowerment need to interact in a structure to determine empowerment, we also employ factor analysis, which will be used to create an index. Subsequently, a logit model and an OLS are used to estimate the determinants of multi-dimensional women empowerment in Mali. This allows for a detailed analysis of the dimensions of women empowerment using various methods. Our method defers from previous studies that have studied women empowerment using just single indicators, which do not give a comprehensive understanding of the nature of empowerment.

For policy implications, this study provides useful insights for the government and other stakeholders in Mali to design and implement effective interventions that can enhance women's empowerment in various domains. Similarly, the results of this study can inform policies that address women's social and political empowerment, such as increasing women's participation in decision-making, promoting women's rights and legal status, and preventing violence and discrimination against women. For further research, this study contributes to the literature on women empowerment in developing countries by applying a multi-dimensional approach that captures the complexity and diversity of women's experiences and aspirations.

The remainder of this study is structured as follows: the theoretical and empirical reviews, discussions of the methods and materials used, the estimation and discussion of results, and the conclusions and recommendations emanating from the discussion of results.

Literature review

Theoretical framework and the concept of women empowerment

Various studies and organisations have given different perspectives on the concept and dimensions of women empowerment. According to the United Nations Population Network (UNPN, 1995), women empowerment is the situation in which women have unrestricted access to social and economic resources and are consciously aware of their self-value. They should also have the ability to control and manipulate the resources they possess and have significant control over the direction of their wellbeing and societal change. According to Kabeer's (1999) theory, empowerment arises from the mix between achievements, agency, and resources. Agency is the capacity to make deliberate judgements and exert control over resources and choices that have a significant impact on life outcomes. Resources are the enabling components that create the circumstances in which choices are made and carried out. Achievement is the result of decisions.

When discussing women's empowerment, the viewpoints of feminist theory are widely employed. According to the theory, women should have equal access to all types of power since they are molded by political, economic, and social power relations (Turner & Maschi, 2015). According to feminist theory, empowerment gives individuals greater power over their lives (AlMaseb & Julia, 2007). As a result, they

inspire female to express themselves, gain self-assurance, and reclaim as much of their social, political, and interpersonal authority as they can (Lee & Koh, 2001). As an example, the core of liberalist feminist philosophy is the idea of an ideal environment that values every one of its people, giving women and men equal rights and opportunities. It was suggested by postmodern feminists that both males and females could exhibit traits associated with one sex or even switch between sexual characteristics (Butler, 1995).

There are four components to empowerment: political, psychological, cognitive, and economic. The development of women's beliefs that they can succeed in making changes in both their personal and societal lives, as well as their growing desire to improve their situations, are considered the psychological part of women's empowerment (Stromquist, 1995). The understanding of the reasons behind women's subjugation is part of the cognitive component of women's empowerment. The political aspect of empowerment involves the capacity to examine the external world from a social and political perspective, whereas the economic aspect pertains to women's ability to engage in productive activities that afford them a certain degree of financial independence.

Being empowered means having the freedom to exercise those options, in addition to having them available to you (Kabeer, 1999). The human agency concept, which relates to the freedom to make decisions without facing dire consequences, addresses this issue. The three (3) main elements of empowerment including, resources (preconditions), agency (process), and accomplishments (outcomes) – can therefore be integrated.

For Allsopp and Tallontire (2014), they see empowerment as a non-static process that constantly changes scope. But they generally see this process as following a sequence that guarantees that ownership of a particular type of power increases the probability of being able to utilise other types of power, both related and unrelated to the former, thus resulting in a power play. Kabeer (2005) sees the idea of empowerment as circling around the notion of authority to choose and conceptually argues that people deserve the opportunity to make choices. Put differently, empowerment can be understood as a multifaceted process that grants people who have been denied the option to choose previously this capacity. The option to make a different decision should be offered in order for this to occur and the choice to be successful.

Agency and structure of opportunity contribute significantly as the basis for the empowerment process (Samman & Santos, 2009). They see agency as the ability of an individual to make effective choices in relation to economic and social circumstances, while they define opportunity as the framework in which an individual implements their agency or achieves its priorities, including economic, social, and political backgrounds and casual community rules and standards.

The ability to make practical decisions, or to translate decisions into desired outcomes and activities, is what empowers a person (Alsop & Heinsohn, 2005). According to Kishor and Subaiya (2008), empowerment is a process that gives those who lack power the ability to change their own circumstances. The idea behind empowerment is that one should not have the power to subjugate others; rather, one should have the ability to accomplish objectives. This process appears to be impacted by a number of social, cultural, and economic factors (Upadhyay et al., 2014). In many nations, patriarchal customs, laws, and political structures that establish a system of male dominance and female subjugation provide men with greater agency, wealth, and power (Cindoglu Lu & Toktaş 2002).

Empirical review

Various studies have identified various socioeconomic factors that can affect women empowerment. Some of the identified socioeconomic factors include the respondents age, educational status, income, husbands' education and income, microcredit, employment status, and access to media (Abshoko et al. 2016; Banerjee et al., 2020; Islam, 2014; Islam 2021; Sado et al., 2014; Sibide et al., 2023; Soharwardi & Ahmad, 2020; Trommlerová et al., 2015; Zertashia, 2015).

Women's self-reliance, as evaluated by their level of educational attainment, age at their first marriage, and age difference between spouses, is negatively correlated with their reproductive ability (Abadian, 1996). Income will not only improve access to healthcare and lower child mortality but will also improve access to education and minimise child labour by increasing the ability for children to enrol and retain in schools, as indicated by Abadian (1996). Also, Larsen and Hollos (2003) indicate that, due to the increasingly elite or educated status of women, particularly when they have the choice of

either choosing a partner or not, women's education and family wealth decline, and the probability of transitioning from one child to the next declines. Housing decisions and positive attitudes towards abuse are very closely correlated with a greater ideal number of children; women's attitudes have a negative correlation with an insignificant ideal size of children (Upadhyay & Karasek, 2012).

Islam (2014) studied the impact of microcredit on achieving the empowerment of women through financial inclusivity in Bangladesh. The study used a sample of unprivileged, low-profile rural women and found that financial inclusion is positively influenced by microcredit. They also found that microcredit was a significant determinant of empowering rural women through mobilisation of savings, income generation, and household poverty reduction. Similarly, Islam (2021) also studied the role of Islamic finance in women empowerment. According to the study, IMFS has caused a structural shift in the respondents' families' employment patterns from agricultural to retail. In addition to improving living standards and the development of human capital, IMFS has had a major positive effect on the income of households, their savings, and their expenditure. They have also strengthened all three aspects of empowerment – familial, sociocultural, and economic—and increased the standard of living (FLEM). Of them, FLEM has an adverse but negligible effect on overall empowerment, but ECEM and SCEM have positively impacted the empowerment of women overall.

Sibide et al. (2023), using data from Mali, studied the role of women empowerment in women's health-seeking behaviour. Using principal component analysis, they create a women empowerment index from four dimensions consisting of 13 indicators. They find that the index of women empowerment was associated with health-seeking behaviour, which comprises the use of contraceptives and health services. Their findings indicate that a number of characteristics, including maternal health insurance, female participation in women's activity, household decision-making, residence area, and the head of the household's education level, might considerably lower the behaviour of seeking reproductive healthcare if they were improved.

Soharwardi and Ahmad (2020), using data from 38 developing countries, attempt to study the dimensions and determinants of women empowerment. They create and use five dimensions to measure women empowerment, which include awareness, women's work status, self-esteem, participation in decision-making, and self-confidence. Using a multiple linear regression, they find that women's health, higher education, husbands' education and employment status, and household income status positively affect women empowerment. They also find that the younger the woman, the more she has self-confidence and awareness.

Banerjee et al. (2020) studied the determinants of women empowerment of rural women in rural India. They measure women empowerment in terms of the decision-making of women in the household. The findings of the study indicate that women empowerment is determined by having their own source of income, knowledge of the legal system and legal rights, the educational level of the woman, the educational level of the woman's mother, higher self-esteem, and also belonging to a relatively wealthy family.

Zertashia (2015) identified the socio-economic, socio-demographic, and social components that affected women's empowerment in the district of Punjab. Fear of violence from one's father or husband is a social factor. While the family structure is a socio-demographic component, socio-economic factors include having a bank account, having access to the media, and having an employment position. All the factors were found to have a good impact on women's empowerment; however, women's empowerment in rural areas has particular needs, such as education in the home, community awareness of opportunities, media impressions, and knowledge of Islamic education addressing women's rights. Urban women are able to access all aspects of life, while rural women are not given the same chances and, based on research conducted in these areas, are limited to married women.

In a study titled 'Determinants of Socio-Economic Empowerment of Married Women: Evidence from Ethiopia', Abshoko et al. (2016) found that women's employment status, education level, income relative to husbands, media exposure, place of residence, age at first marriage, family size, and attitude towards wife beating were all significant factors that negatively impacted their participation in social and economic matters within the home. The most significant finding of a study by Shahbaz et al. (2017) titled 'Determinants of Women's Empowerment and Poverty Reduction: A Case Study of Rural Faisalabad, Punjab' was that women were more likely to have higher decision-making authority in their households, indicating that women's empowerment would likely reduce poverty and improve household wellbeing.

Trommlerová et al. (2015) concluded in their study that the factors that determined whether or not a person was empowered were their age, the educational status of the individual, the type of economic activity they were engaged in, their country of residence, and also their marital status, including whether they were polygamous or not. The educational status of the individual played a significant role in determining whether an individual took household decisions alone or jointly with their partners (Kishor & Subaiya, 2008). They also indicated that exposure to the media, the control of economic resources, and other social factors such as the age of the female largely influenced the empowerment status of the individual. The results of their study indicate that older females seem to have more control over economic resources than females who are relatively younger and thus tend to be more empowered.

In their study, Sado et al. (2014) found that there exists a positive relationship between the decision-making of households and some other factors that are related to women empowerment. The wealth stock of the household strongly determines the control of resources, but it also has a negative association and is significant in determining the overall household decision-making of women. It is also found that there is a correlation between various empowerment indicators and the covariates (Mahmud et al., 2012). The factors linked to empowerment sources (education, employment, and wealth) have a higher explanatory influence than those relating to empowerment establishment (family structure and age).

Mahmud et al. (2012) suggest that women's independence and household wealth are not linked. This is not astonishing, as mobility is high for impoverished women who always have to move outside their own houses to work. We also claim that wealthy women in the household have less influence; we prefer to think that their opinion is not worth it but that they have high chances of accessing money for expenses. On the contrary and unexpectedly, a female with greater decision-making ability and self-esteem in an extended family has been found to be more likely to stay in Sado et al. (2014).

From the literature on the dimensions and determinants of women empowerment, three most important themes are noted, and they include (i) in trying to define the issue of multidimensional empowerment and also the domains of empowerment, there are actually issues of measurement that arise and are still topical. Different authors, based on their social setting, define empowerment and its measures in various ways, especially when they employ cross-sectional survey data. (ii) It is also realised from the various studies that in trying to understand the issue of empowerment and its various dimensions, one should go beyond some structural factors and factors considered too simplistic, which include family-related factors and also social-related factors, which could be used to estimate the empowerment of women in a comprehensive way. (iii) Since there are difficulties in measuring the empowerment of women as discussed above, it is imperative that efforts at getting an in-depth understanding of women empowerment result in the researcher spending some time in communities and also doing a lot of control experiments.

Methods and materials

This study explores the dimensions of women multidimensional empowerment and the factors that determine whether a woman could be considered multidimensionally empowered or disempowered. The study therefore extends our understanding of the dimension of empowerment and how to approach the concept. The study will focus on women empowerment, using Mali as a case study.

Secondary data will be used for the purpose of the study. Thus, the study will employ the 2018 version of the Demographic Health Survey data for Mali. The dataset for Mali contains a total of 10,519 females between the ages of 15 and 49 years. However, for the purpose of this study and in order to use the Alkire Foster (2007) method (multidimensional threshold and each domain's proportionate contribution for identifying areas that need intervention from governments), analysis of data is done using respondents who had consistent responses in the indicators to be used for the creation of the multidimensional women empowerment index as suggested by Obayelu and Chime (2020). Thus, a sample size of 1,691 consistent responses is employed in this study. The sample contains both rural and urban residents who spans nine (9) geographical regions of the Mali Republic. The nine regions included Kayes, Kuolikoro, Sikasso, Seguo, Mopti, Tombouctou, Gao, Kidal, and Bamako.

Model specification

To examine the factors that influence multidimensional women empowerment in Mali, the index of multidimensional women empowerment is created from five (5) domains using 15 variables with their assigned weights. For the purpose of this study, two indices are created based on the Alkire Foster Methodology and factor analysis. Thus, for the first model, a logit model is estimated due to the binary nature of the response variable and for the second model, an OLS is estimated as follows.

Given that women empowerment is a function of respondent's household characteristics then,

$$WEI = f(\text{age, education, location, spouse characteristics, wealth, sex of hh head, marital status}) \quad (1)$$

The logit model for the determinants of women empowerment could then be specified as

$$P(y_i = 1|x_{ij}) = \beta_0 + \beta_1 \text{age} + \beta_1 \text{maritalstatus} + \beta_2 \text{education} + \beta_4 \text{wealth} + \beta_5 \text{sexhh} + \beta_6 \text{h_age} \\ + \beta_7 \text{h_education} + \beta_8 \text{Region} + \varepsilon_i \quad (2)$$

The OLS model from the factor scores could also be specified as follows.

$$WEI = \beta_0 + \beta_1 \text{age} + \beta_1 \text{maritalstatus} + \beta_2 \text{education} + \beta_4 \text{wealth} + \beta_5 \text{sexhh} + \beta_6 \text{h_age} + \beta_7 \text{h_education} \\ + \beta_8 \text{Region} + \varepsilon_i \quad (3)$$

The variables are described in Table 1.

Description of variables

Construction of the multidimensional women empowerment index

Dimensions and indicators of empowerment

To construct the Women empowerment index, we consider two approaches as used in the literature. The empowerment index will constitute five domains which are comprised of agency, resources, time, leadership and income. We track female indicators which we use to construct the domains.

Estimation procedure one (1)

Kishor (2000) notes that empowerment is a multidimensional concept implying that a person might be empowered in one or some of the indicators or domains of empowerment and be disempowered in other domains. Empowerment should therefore not be considered as a whole process. The 5 domains of empowerment (5DE's) used in the estimation procedure includes 15 indicators, collapsed into 11 indicators as stated in Table 2.

We define the women empowerment index (WEI) using the dual cut-off method proposed by Alkire and Foster (2007). For the AF methodology, they assign equal weights to the domains used in the construction of the index and the indicators. An individual, based on his weighted deprivations, gets a weighted deprivation score. The total weights assigned to all the domains range from 0 to 1, and so an individual is considered poor if their weighted deprivation score is greater than 0.33. The headcount ratio of disempowered (H) and intensity of disempowered based on the number of disempowered and

Table 1. Description and measurement of variables.

Variable	Description	Expected sign
WEI	Women Empowerment Index created using the Alkire foster methodology and factor analysis	
Age	Age of the woman in years	+
Marital status	Marital status of the respondent	+
Education	Level of the Education of the woman	+
Wealth	Wealth ranking of the household	+
Sex hh	Sex of the household head	+/-
H__age	Age of the husband of the woman	+
H_education	Level of the Education of the husband	+
Region	Region in which the respondent is based	+/-

Table 2. Domains and indicators used for empowerment index.

Domain	Indicators	Weights
Agency	Decision to visit community facility	7
	Decision on large household purchases	7
	Perception on violence ¹	6
Income	Works for self or for someone	10
	Decision on spending earnings	10
Leadership	Ownership of house	10
	Discuss family planning with FP worker	10
Resources	Rate of Literacy	10
	Number of visits for prenatal care	10
Workload/Time	Time used to get water for home	10
	Cooking fuel type used	10

Note 1. Perception on violence include 5 indicators with equal weights of 1.2 each. They include: (1) Beating acceptable if wife leaves home without informing husband, (2) Beating acceptable if wife abandon the children, (3) Beating acceptable if wife disputes with husband, (4) Beating acceptable if wife declines to have sex with husband (5) Beating acceptable if wife burns the food.

Source: Authors Construct.

cutoffs (A) are needed to compute the multidimensional empowerment index. The head count ratio is computed as a ratio of the total number of disempowered using the dual cutoff to the number of observations included.

$$H = \frac{q}{n} \quad (4)$$

We can also compute the intensity of disempowered, which indicates the shared likely dimensions a respondent has experienced. It captures the mean weighted count of deprivations experienced by the multidimensional disempowered. This is then given as.

$$A = \frac{\sum_1^q c}{q} \quad (5)$$

c is the total weighted deprivations experienced by the disempowered.

The WEI can now be computed as the product of ratio of headcount (that meets the decomposability properties) and the intensity of disempowerment also known as the adjusted headcount ratio.

$$M = HA \quad (6)$$

The adjusted ratio thus clearly meets the property of dimensional monotonicity due to the fact that as a respondent a woman become disempowered in any additional dimension, the level of A rises. Using Alkire et al. (2012), we can then compute women empowerment index as

$$5DE = H_e + H_d A_e \quad (7)$$

Where H_e is the percentage of empowered women.

H_d is the percentage of disempowered women.

A_e is the mean absolute score of empowerment among those disempowered.

This implies we will be able to restate Equation (4) as

$$5DE = 1 - M_0 \quad (8)$$

We can compute the contributions of the indicators to the WEI as

$$\text{Contribution of indicator to WEI} = \frac{w_i CH_i}{WEI} \times 100 \quad (9)$$

Where w_i is the weight of the indicator and CH_i is the censored headcount ratio of the i th indicator.

We then estimate the determinants of empowerment using a logistic regression. This is computed as follows;

$$p_i = E(y_i = 1 | x_{ij}) = \frac{1}{1 + e^{-(\alpha + \sum \beta_j X_{ij} + \varepsilon_i)}} \quad (10)$$

Transformed as

$$Z_i = \ln \left[\frac{p_i}{1 - p_i} \right] = \alpha + \sum \beta_j X_{ij} + \varepsilon_i \quad (11)$$

Where $y = 1$ if woman is empowered and 0 otherwise

X is the vector of explanatory variable which includes the respondent's social characteristics.

Estimation method two (2)

Factor analysis is employed and used in the creation of the index. It is used to estimate the variations in a set of multivariate data in relation to a set of uncorrelated linear combinations of variables (Khudri & Chowdhury, 2013). Variables used are reduced to factors which are extracted for further regression analysis. However, since most the indicators used are binary, a tetrachoric correlation is carried out so as to extract a matrix which is then used in the factor analysis.

Given that $X_1, X_2, X_3, \dots, X_p$ are p variables such that they are computed in n female have a covariance matrix Σ . and eigenvalues given as $\gamma_1 \geq \gamma_2 \geq \gamma_3 \geq \dots \geq \gamma_p \geq 0$ and $Y_1, Y_2, Y_3, \dots, Y_p$ are the components and are uncorrelated linear combinations of $X_1, X_2, X_3, \dots, X_p$. we can, therefore, combine this as;

$$\begin{aligned} Y_1 &= \beta_{11}X_1 + \beta_{12}X_2 + \beta_{13}X_3 + \dots + \beta_{1p}X_p \\ Y_2 &= \beta_{21}X_1 + \beta_{22}X_2 + \beta_{23}X_3 + \dots + \beta_{2p}X_p \\ Y_p &= \beta_{p1}X_1 + \beta_{p2}X_2 + \beta_{p3}X_3 + \dots + \beta_{pp}X_p \end{aligned} \quad (12)$$

We can restate the combinations as $Y' = \beta X'$ where $Y' = (Y_1, Y_2, Y_3 \dots Y_p)$ and $X' = (X_1, X_2, X_3, \dots X_p)$ and β is a coefficient of matrix. The coefficients of the components $\beta_{11} \dots \beta_{1p}$ are chosen such that the $Var(Y_1) = \beta_1 \Sigma \beta_1$ is maximized subject to the constraint $\beta_{11}^2 + \dots + \beta_{1p}^2 = 1$ (Johnson & Wichern, 1982). The variation of this factor should be γ_1 , which is the larger variance of β' . The second element is completely not correlated with the first element and has equal variance to γ_2 . Under the same restriction as the first component, this component explains a smaller variance in the original variable but more than it did. Moreover, components (up to the limit of p) can be specified in the same approach. The sum of squares of each component's coefficients equals one, and none of the components relate to the others. Upon completion of the factor analysis, the women empowerment index will be constructed using the factor scores of each factor with eigenvalues greater than 1.

Results and discussions

This section details the estimations and discussion of results on the dimensions and determinants of multidimensional women empowerment in Mali. The section presents the dimensions of multidimensional women empowerment in Mali, and the determinants of multidimensional empowerment. Two indices are created using the Alkire foster methodology and factor analysis.

Regional distributions of the indicators used in WEI

To construct the women empowerment index, we stratified the data into women who provided consistent information on the indicators used. A total of 1691 women who were consistent in their responses to the indicators are indicated in the Table 3. Fifteen indicators were used to construct five domains of empowerment. The regional distributions of the indicators used in the study are indicated in the table.

From Table 3, Bamako had the highest number of responses for all the indicators. All indicators in the agency domain indicate that usually the husband of the respondent has a major say in taking household decisions. This implies that the woman was less autonomous in those decisions. Also, for all the indicators of perceptions of violence, women seem to be okay with their husbands beating them in various scenarios. On the income domain, for both indicators, women mostly have the luxury of working for themselves and determining the use of their own income. On ownership of a house, most of the women do not have a claim on owing a house, as most of them indicate houses are owned by their spouses.

Table 3 further indicates that most women do not discuss issues of family planning with health care providers. For the resource's domain, most of the respondents indicate they can't read at all, except for respondents based in Bamako, who mostly can read and write. Also, almost all respondents have had prenatal visits. For the time/workload domain, the results show that most respondents do not have to travel long distances in order to reach water sources, and most of the respondents use less than

Table 3. Distribution of empowerment indicators.

	Kayes	Koulikoro	Sikasso	Segou	Mopti	Tou	Gao	Kidal	Bamako
Agency									
Decision on respondents healthcare									
Joint/alone	63	84	40	40	50	31	9	5	106
Partner alone	179	158	162	249	60	73	23	1	286
Decision on household's large purchases									
Joint/alone	38	94	23	82	43	30	8	3	123
Partner alone	204	148	179	207	67	74	24	3	269
Beating acceptable if wife leaves home without informing husband									
No	75	77	83	139	56	60	14	5	227
Yes	167	165	119	150	54	44	18	1	165
Beating acceptable if wife abandon the children									
No	60	97	87	132	48	60	15	4	248
Yes	182	145	115	157	62	44	17	2	144
Beating acceptable if wife disputes with husband									
No	62	50	63	61	62	66	15	3	143
Yes	180	192	139	228	48	38	17	3	249
Beating acceptable if wife declines to have sex with husband									
No	46	71	75	89	57	62	17	3	167
Yes	196	171	127	200	53	42	15	3	225
Beating acceptable if wife burns the food									
No	134	182	161	224	88	95	24	4	372
Yes	108	60	41	65	22	9	8	2	20
Income/Assets									
Respondent works for family, others, self									
Self	220	230	193	245	102	98	27	6	300
Someone else	22	12	9	44	8	6	5		92
Decision to spend respondents earnings									
Joint/alone	225	228	189	248	95	90	27	5	350
Partner alone	17	14	13	41	15	14	5	1	42
Leadership									
Ownership of house									
Joint/alone	101	70	89	65	26	48	11	2	55
Does not own	141	172	113	224	84	56	21	4	337
Told of family planning									
Discussed	68	61	49	100	42	24	16	2	187
Not discussed	174	181	153	189	68	80	16	4	205
Resources									
Literacy									
Can at least read/write	59	66	44	64	24	20	15	2	199
Can't read at all	183	176	158	225	86	84	17	4	193
Prenatal visits									
Visited	242	242	202	289	110	104	32	6	392
None visit	0	0	0	0	0	0	0	0	0
Time/workload									
Time to reach water									
Less than 30 mins	226	234	202	280	106	96	28	4	382
More than 30 mins	16	8		9	4	8	4	2	10
Type of cooking fuel									
Gas/electricity	2	2	2	2	3		1	4	8
Charcoal	240	240	200	287	107	104	31	2	384

30 minutes to reach water sources. Finally, most respondents use charcoal as their source of cooking fuel, with only a few using gas or electricity.

Dimensions of multidimensional empowerment

To calculate the women empowerment index, we aggregated across the various indicators in the domains. We used five cutoffs, which will aid in determining how the individual was multidimensionally disempowered across the various domains. The first cutoff (20%) indicated the achievement of a woman across the domains, while the second (40%) indicated whether an individual was multidimensionally empowered. From Table 4, 99.4% of women were disempowered at the first cutoff. However, as the cut-off increased, the percentage of disempowered women decreased using the headcount method. The intensity of disempowerment increased with the level of the cutoff.

For the empowerment index calculated as $5DE = 1 - M_0$, as the level of K increased, the multidimensional empowered increased. At K (5), the 5DE almost summed to 1. This result is consistent with Obayelu and Chime (2020).

Table 4. Estimates of women multidimensional empowerment indices.

Disempowerment cutoff (k)	Multidimensional disempowerment index (M_0)	Multidimensional disempowerment headcount (H)	Intensity of disempowerment (A)	Empowerment index
1	0.481	0.994	0.484	0.519
2	0.418	0.796	0.525	0.582
3	0.169	0.271	0.623	0.831
4	0.005	0.006	0.810	0.995
5	0.001	0.001	0.900	0.999

Source: Authors' construct.

Table 5. Contributions of empowerment domains.

Dimensions	Agency	Income	Leadership	Resources	Time/Workload
K = 1	31.3	4.6	28.5	14.5	21.1
K = 2	31.9	4.9	28.7	14.8	19.7
K = 3	31.3	6.9	29.5	15	17.3
K = 4	24.7	19.8	24.7	12.3	18.5
K = 5	22.2	22.2	22.2	11.1	22.2

Contribution of indicators to disempowerment

Table 5 indicates the contributions of the various empowerment domains and dimensions to the disempowerment score. Agency contributed more than the rest of the domains in all the dimensions. Income contributed less in the first three dimensions.

The second-highest contributor to the disempowerment index is the leadership domain, as it contributed an average of about 26.7% across all the dimensions. Time domain also contributed substantially to the disempowerment index.

Distribution of women empowerment

Table 6 indicates the distribution of empowerment across various variables.

Determinants of women empowerment using the index from Akire Foster Methodology

To estimate the determinants of women empowerment, we use the predicted empowerment index for women and estimate a logistic regression. A log likelihood ratio of -717.34 is significant at 1%, indicating the measure of goodness of fit. From Table 7, we compute the margins at means to determine the changes of the independent variables on the dependent variable.

A total of 1,619 observations, which represented women with consistent responses to all the indicators, were used. Age of the respondent, level of education, wealth index, and location are the only significant factors determining women empowerment in Mali, based on the data.

Table 7 indicates that the age of the respondent is a significant determinant of women empowerment in Mali. An increase in the age of the respondent increases the likelihood of an individual being multidimensionally empowered. An additional year for a woman increases their likelihood of being multidimensionally empowered by about 0.003%. This is consistent with the findings of Zertashia (2015), Meraj and Sadaqat (2016), who all found that the empowerment of women increased as they grew older. As women get older, they gain more experience and knowledge, which could aid them in navigating the social and economic challenges affecting women in communities. Also, as women get older, they may have more opportunities to participate in household decision-making, ownership of resources, and other community activities, which could contribute to their sense of empowerment.

Education plays an important role in determining women empowerment in Mali. Education builds the self-confidence of women, their knowledge base, their income levels, and their ability to take charge of decisions that affect their well-being. From the table, it is evident that the likelihood of being empowered increased with the level of education. Women who had primary education had a 0.2166 greater likelihood of being empowered than women without any form of formal education. This increases to 0.2857 and 0.5044 for attaining secondary and tertiary education, respectively. The results corroborate

Table 6. Distribution of empowerment between socioeconomic factors.

Variable	Empowered	Disempowered	Total
Woman's age			
15–19	59	206	265
20–24	84	290	374
25–29	68	267	335
30–34	50	237	287
35–39	32	134	166
40–44	25	75	100
45–49	13	79	92
Woman's education level			
No education	108	905	1013
Primary	77	165	242
Secondary	115	196	311
Higher	31	22	53
Marital status			
Married	329	1278	1607
Unmarried	2	10	12
Wealth Index			
Poorest	19	142	161
Poorer	40	208	248
Middle	62	266	328
Richer	65	317	382
Richest	145	355	500
Type of toilet			
No facility	14	65	79
Flushed/Water syst	33	50	83
Pit latrine	278	1152	1430
Hanging bucket	6	21	27
Occupation			
Professional/technical/managerial	40	49	89
Clerical	4	5	9
Sales	177	710	887
Agricultural - self employed	55	344	399
Services	40	151	191
Skilled manual		1	1
Unskilled manual	3	15	18
Armed forces	1		1
Others	11	13	24
Source of drinking water			
Bottled/Sacket	1	5	6
Tanker/car with tank	2	12	14
river/dam/lake/ponds/stream/canal/irrig	5	20	25
Piped water	193	538	731
Tubewell/borehole/others	130	713	843

Source: Authors' construct.

the findings of Banerjee et al. (2020) and Soharwardi and Ahmad (2020), who both find in different studies that the education of a woman plays an influential role in determining their empowerment. The more educated a woman is, the more empowered she becomes. Banerjee et al. (2020) argue that the education of women does not only affect them but has a trickle-down effect on household income and even health outcomes and therefore cannot be ignored.

The results also indicate that multidimensional women empowerment increases with the wealth status of the women in Mali. The likelihood of empowerment increases with the wealth status of a woman. Women in the middle-class group of wealth index increases the likelihood of multidimensional women empowerment by about 0.0725%, and the richest group increases the likelihood of multidimensional women empowerment by about 0.0846% compared to persons who fall in the poorest category. Higher incomes provide women with access to resources, including health care, education, and financial products, which could help them gain greater autonomy and control over their decisions. Women are also able to easily participate in political and economic activities when their income level is relatively higher in society. This study corroborates the findings of Banerjee et al. (2020), who find that income is an important determinant of the empowerment of women in Pakistan.

The region of residence also played an important part in determining women empowerment. Women living in Mopti were 0.1318% more likely to be empowered than those living in Kayes. Also, women in Kidal had a 0.4674 higher likelihood of being empowered than women who reside in Kayes. This implies

Table 7. Estimates of Logit regression of determinants of women empowerment.

	Coefficients	Marginal effects
Age	0.0253* (0.0120)	.003** (.002)
Marital status	0.291 (0.821)	.0411 (.1159)
Education level		
Primary	1.442*** (0.185)	.2166*** (.0328)
Secondary	1.746*** (0.203)	.2857*** (.0380)
Tertiary	2.636*** (0.363)	.5044*** (.0808)
Wealth		
Poorer	0.414 (0.317)	.0514 (.0379)
Middle	0.555* (0.309)	.0725* (.0373)
Richer	0.121 (0.313)	.0134 (.0340)
Richest	0.631* (0.343)	.0846** (.0429)
Sex of household head	0.128 (0.219)	.0180 (.0309)
Husband's age	−0.00845 (0.00901)	−.0011 (.0012)
Husband's education	−0.0105 (0.0167)	−.0014 (.0023)
Region		
Koulikoro	0.268 (0.242)	.0426 (.0384)
Sikasso	−0.0959 (0.271)	−.0135 (.0382)
Segou	−0.324 (0.256)	−.0425 (.03393)
Mopti	0.730* (0.303)	.1318** (.0581)
Toumbouctou	0.364 (0.312)	.0595 (.0532)
Gao	0.143 (0.486)	.0217 (.0768)
Kidal	2.130* (0.986)	.4674** (.2234)
Bamako	−0.436 (0.269)	−.0551 (.0345)
_cons	−3.265*** (0.922)	
N	1619	1619
LR Chi2 (20)	205.38	
Log Likelihood	−717.3429	
pseudo R ²	0.125	

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Robust standard errors in parathesis.

that being from Mopti increases one's empowerment likelihood by 0.13, while being from Kidal increases one's likelihood by 0.47, respectively.

Factor analysis

Another estimation procedure we used to compute the empowerment index was factor analysis. Since the indicator variables are binary variables, we employ a tetrachoric correlation to compute a matrix of correlations between the variables and then run a factor analysis on the matrix.

The eigenvalues estimated are then used to estimate a score matrix used to convert the data to a one-dimensional orthogonal vector. Using the Kaiser criteria of component selection, we select components with an eigenvalue equal to or greater than 1, which is then used for analysis.

Factor tests of variable relevance

From Table 8, it is realized that given a Kaiser–Meyer–Oklin value of 51.6% it implies that factor analysis can be employed in the estimation. There is also enough evidence to support our use of the indicators, as they are showing a considerably bigger correlation rate.

Eigenvector of factor analysis

From Table 9, factor 1 and factor 2 are responsible for 57.99% of the variation in the in the factors. Kaiser criteria suggest that we retain factors with eigenvalues >1 . We, therefore, use factor 1 and 2 for further analysis.

Factor loadings after promax rotation

From the Table 10, the rotated and unrotated factor loadings are presented.

For the rotated loading, variable 1 load heavily on factor 1. It has a higher correlation and therefore contributes about 93% of the variation in the factor. This trend is also seen in the coefficients of the

Table 8. Tests of factor adequacy and bartlett test of sphericity.

Test	Value
Determinant of correlation matrix	0.627
Bartlett test of sphericity	
Chi-square	752.714
Degrees of freedom	45
<i>p</i> -value	0.000
Kaiser–Meyer–Olkin Measure of Sampling Adequacy	0.516

Source: Authors' construct.

Table 9. Results of factor analysis.

Factor	Eigenvalue	Difference	Proportion	Cumulative
Factor1	1.86863	0.57772	0.3430	0.3430
Factor2	1.29091	0.56989	0.2369	0.5799
Factor3	0.72103	0.13343	0.1323	0.7122
Factor4	0.58760	0.07922	0.1078	0.8201
Factor5	0.50838	0.21913	0.0933	0.9134
Factor6	0.28926	0.16066	0.0531	0.9665
Factor7	0.12859	0.08375	0.0236	0.9901
Factor8	0.04484	0.03548	0.0082	0.9983
Factor9	0.00936	0.00960	0.0017	1.0000
Factor10	−0.00024	.	−0.0000	1.0000

Source: Authors' construct.

Table 10. Factor loadings for retained factors.

Variable	Rotated		Unrotated	
	Factor 1	Factor 2	Factor 1	Factor 2
ag_ind1	0.9339	0.0466	0.9335	0.0035
ag_ind2	0.8235	0.0299	0.8230	−0.0081
ag_ind3	−0.0874	0.3495	−0.0829	0.3535
inc_ind1	−0.0668	−0.3205	−0.0708	−0.3174
inc_ind2	0.3372	−0.1839	0.3345	−0.1995
lead_ind1	0.0645	−0.1467	0.0626	−0.1497
lead_ind2	0.1156	0.0908	0.1167	0.0855
res_ind1	0.0748	0.5624	0.0819	0.5589
time_ind1	−0.0201	−0.1233	−0.0217	−0.1224
time_ind2	0.0371	0.6229	0.0450	0.6212

Source: Authors' construct.

unrotated factor loadings. Variable 2 also loads heavily on first factor for the rotated coefficients. Decision on usage of personal earnings also contributes substantially to the to the first factor. Type of cooking fuels loads largely on the second factor but relatively little on the first factor. Perception on violence loads heavily of factor 2 and positively correlated than for factor 2 which has a negative relationship.

OLS analysis of determinants of disempowerment using factor scores

Using a predicted disempowerment index from the factor analysis, we estimate the determinants of disempowerment using an ordinary least square estimation procedure. At an overall level, the model is significant indicating that the combined effect of the variables is statistically different from zero. Only 67% of the variations in the dependent variable is accounted for by the independent variables (Table 11).

The age of the respondent plays an important role in determining whether they are disempowered or not. As one ages, their level of disempowerment reduces, thereby increasing their level of empowerment. A year-long increase in age results in a 0.4% rise in the level of empowerment. This result corroborates the result of Meraj and Sadaqat (2016), who argue that empowerment increases with age. Older people tend to have a larger say in family decision-making and ownership of resources than relatively younger women. This result is also consistent with the initial result of the logit computation. The implication therefore is that when women increase in age, they have more control over resources and participate in decision-making regarding the household.

Table 11. OLS regression using factor scores.

	Coefficients
Age	−0.00456** (0.00177)
Marital status	−0.0466 (0.0915)
Education level	
Primary	−0.0891** (0.0304)
Secondary	−0.0691* (0.0323)
Tertiary	−0.258*** (0.0722)
Wealth	
Poorer	0.0217 (0.0399)
Middle	0.0150 (0.0386)
Richer	0.0634 (0.0385)
Richest	0.0316 (0.0476)
Sex of household head	−0.0770* (0.0349)
Husband's age	0.000827 (0.00125)
Husband's education	0.000764 (0.00274)
Region	
Koulikoro	−0.131*** (0.0379)
Sikasso	0.0609 (0.0349)
Segou	0.0562 (0.0321)
Mopti	−0.198*** (0.0519)
Toumbouctou	−0.0330 (0.0519)
Gao	−0.024 (0.0742)
Kidal	−0.385** (0.126)
Bamako	−0.0421 (0.0417)
_cons	−0.797*** (0.106)
N	1619
F(20, 1598)	6.09
Prob > F	0.0000
R ²	0.671

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Robust standard errors in parathensis.

Levels of education also play an important role in determining women empowerment in Mali. Additional years of education tend to increase the level of empowerment. Having at least a basic education increases empowerment levels by 0.09 compared to women who do not have any form of basic education. Having secondary education increases empowerment by 0.07 for women, while having tertiary education increases empowerment by 0.25. It is, therefore, evident that increasing one's level of education improves their empowerment status. Education increases the opportunities for women and gives them a voice to have a major say in decision-making and ownership of economic resources. The results are consistent with the findings of Banerjee et al. (2020) and Soharwardi and Ahmad (2020), who both find in different studies that the education of a woman plays an influential role in determining their empowerment. The result also confirms the logit results found earlier in Table 7.

In this model, it is determined that the sex of the head of a household has a significant effect on women empowerment in Mali. Women tend to be more empowered if they are headed by women. Being headed by a female increases a woman's empowerment status by 0.08. Usually, when women are the head of a household, most decisions and ownership of resources are supervised by the woman, resulting in an increase in their level of empowerment.

The location of women also plays an important role in determining empowerment. The results indicate that women who reside in Kuolikoro (0.131), Mopti (0.198), and Kidal (0.385) are more empowered than women who reside in Kayes.

Conclusion and recommendation

To understand the dimensions of women empowerment in Mali, the study examined the five dimensions of empowerment and also how social and economic factors of the respondents affect women empowerment using two different approaches. Women empowerment has become a topical issue on the agenda of most governments. The concept has developed into a multidimensional one. A person is, therefore, considered multidimensionally empowered if they are not deprived of some of the dimensions of empowerment.

Using the Alkire Foster method, a multidimensional women empowerment index is created for Mali. We find that women were deprived of almost all domains except time and workload domains in all regions. At a deprivation cutoff of 2/5, 41.8% are multidimensionally disempowered at a deprivation, and 79.6% using

the multidimensional disempowerment headcount. Also, we find that the agency domain contributes significantly to the empowerment index. For the factor analysis method, two factors played a very important role in the creation of the empowerment index across all five domains of empowerment. For the regression analysis, age of the respondent, wealth index, sex of the household head, educational status, and their region of residence play an important role in determining empowerment in both approaches used in the paper. The study concludes that the level of empowerment of women in Mali is relatively lower and that more policy efforts are needed to improve women empowerment.

Women's agency, or their capacity to choose and take action, must be strengthened. In order for women to assert their rights, express their ideas, and take part in the decision-making process, agency is essential. According to the study, the empowerment measure is greatly influenced by the agency domain, suggesting that women in Mali suffer severe barriers in this area. Therefore, policies that promote women's agency should include

1. Legal changes that uphold the rights of women and guarantee their equal access to resources such as inheritance, property, and the courts.
2. Political reforms that increase women's representation and participation in governance structures, such as parliament, local councils, and civil society organizations.
3. Economic reforms that empower women to engage in income-generating activities, access financial services, and benefit from social protection schemes.
4. Education is essential for women to acquire knowledge, skills, and confidence that enable them to pursue their aspirations and contribute to social and economic development.

In view of these empirical insights, a number of actionable policy recommendations are proposed to promote women's empowerment in Mali. Firstly, interventions should be directed towards the identified determinants, such as improving educational opportunities, especially in regions with lower empowerment scores. Secondly, strategies aimed at wealth redistribution and economic inclusion are vital to combat disempowerment caused by economic disparities. In addition, the promotion of gender-balanced household dynamics through awareness campaigns and policy incentives could make a significant contribution to women's empowerment.

Moreover, the study highlights the necessity for a multifaceted policy approach that recognises the interplay of various dimensions of empowerment. Collaborative efforts involving governmental agencies, non-governmental organisations, and community leaders are indispensable for the effective implementation of these recommendations. By embracing a holistic strategy that addresses both structural inequalities and socio-cultural factors, Mali can pave the way towards substantial and sustainable advancements in women's empowerment.

The study offers an insight into women's empowerment during a specific time frame. In order to evaluate the effects of policy measures and comprehend how empowerment dynamics change over time, future research should take longitudinal studies into account. Future research could also evaluate the effectiveness of existing policies on education and gender campaigns in improving empowerment. Further, using new data, future research could also study the rural and urban comparative analysis of the determinants of multidimensional women empowerment.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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