

# WOMEN'S EMPOWERMENT: EVIDENCE FROM THE CORN-TORTILLA VALUE CHAIN IN THE CENTRAL VALLEY'S REGION AND THE ISTHMUS OF TEHUANTEPEC, OAXACA, MÉXICO

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**Abstract:** This article explores the level of Women's Empowerment (W'E) from six empowerment domains: decision-making, autonomy, access and control of resources, community participation, and participation in business management, within the context of the corn-tortilla value chain. A semi-structured questionnaire was used to collect data through the survey method and participant observation. The sample consisted of 136 women producers from two municipalities, 67 from Santa María Xadani in the Isthmus of Tehuantepec and 69 from San Antonio de la Cal in the Central Valleys of Oaxaca, Mexico. The results highlight that women exercise five of the six explored domains of empowerment, two with high levels and three with medium levels of empowerment. The women's income from selling their corn tortillas is used to buy food, raw materials, and health services. Much of their time is spent on corn tortilla production and marketing, and household activities. Finally, this study makes implications for public policy to contribute with the generation of strategies that raise the levels of W'E in agrifood systems in rural contexts.

**keywords:** women's empowerment, entrepreneurship, sustainable development, gender, corn-tortilla value chain.



# EMPODERAMIENTO DE LA MUJER: EVIDENCIA EN LA CADENA DE VALOR DE MAÍZ-TORTILLA EN LA REGIÓN DE VALLES CENTRALES Y EL ISTMO DE TEHUANTEPEC, OAXACA, MÉXICO

**Resumen:** Este artículo explora el nivel de empoderamiento de las mujeres (EM) a partir de seis dominios: toma de decisiones, autonomía, acceso y control de los recursos, participación comunitaria y participación en gestión empresarial, dentro del contexto de la cadena de valor de maíz-tortilla. Se utilizó un cuestionario semiestructurado para recolectar datos a través del método de encuesta y la observación participante. La muestra fue integrada por 136 productoras originarias de dos municipios, 67 de Santa María Xadani de la región Istmo de Tehuantepec y 69 de San Antonio de la Cal de la región Valles Centrales en Oaxaca, México. Los resultados destacan que las mujeres ejercen cinco de los seis dominios explorados de empoderamiento. Dos dominios con niveles altos y tres dominios con niveles medios de empoderamiento. Los resultados cualitativos indican que los recursos monetarios que las mujeres obtienen de la venta de sus tortillas son destinados a comprar alimentos, materia prima y servicios médicos. Gran parte de su tiempo es dedicado a la producción y comercialización de tortillas, y a actividades del hogar. Finalmente, este estudio genera implicaciones a las políticas públicas para apoyar la construcción de estrategias que eleven los niveles de EM en los sistemas agroalimentarios de los contextos rurales.

**Palabras clave:** empoderamiento de la mujer, emprendimiento, desarrollo sostenible, género, cadena de valor de maíz-tortilla

## I. INTRODUCTION

Women's empowerment (W'E hereafter) is valued as a fundamental concept for achieving democratic and human rights through developing societies and integrating gender equality. Likewise, the W'E incorporates the social dimension of sustainability, with notable advances in research studies in the last two decades, due to the interest in contributing to poverty reduction, democratic governance, and sustainable development (García-Orozco et al., 2020; UN, 2021). In the frame of the Sustainable Development Goals (SDGs), SDG 5 aims to achieve gender equality and W'E. Because of its multidimensional nature, it can generate a chain reaction toward other goals, such as SDG 8, which promotes eradicating extreme poverty and hunger, and SDG 1, which promotes economic growth (Kazembe, 2020). In addition, empowering women farmers, especially rural subsistence farmers, effectively combat household hunger and poverty (Bikaako et al., 2022).

For example, within the agricultural food system, in the value chains, women participate in different linkages that alternate with non-agricultural activities in the household (Ao et al., 2019; Belete & Ayele, 2020; Bikaako et al., 2022). However, in many countries, their contributions are underestimated or limited by social norms and gender barriers. A body of research studies explores W'E within this context, where there is a wide variety of local agricultural activities and specific linkages in which women's participation is the protagonist, but which does not necessarily empower women nor increases household wealth and asset ownership (Nazneen et al., 2019; Quisumbing et al., 2021; Mosha et al., 2022). For example, in their study, Anderson & Eswaran (2009) found that employment on farms did not give women more autonomy than domestic work gives them. Therefore, studying the W'E in agrifood systems should pay attention to the production process, resources, and lifestyles, which impact sustainability with positive effects on food security, nutrition, fair employ dynamics, resilience, and sustainability (García-Orozco et al., 2020; Njuki et al., 2022).

Indeed, W'E is related to women's decision-making power, easy access to information, control of resources, and recently to women's entrepreneurship (Noor et al., 2021). However, to the extent that women's participation in new spheres is observed, there is a marked need for tools and indicators to measure and monitor W'E. On the other hand, determining empowerment continues to be a challenge. For example, geographically, there are areas with high rates of marginalization and poverty; and, with the eagerness to build generalized indicators, they could bias information and capture disempowerment, especially in agricultural decision-making, besides not adequately capturing the nuances behind the domains or dimensions of W'E (Cornwall, 2016).

In this sense, recognizing the productive and reproductive dynamics of women in rural contexts makes it possible to visualize their needs and socioeconomic, cultural, and household characteristics, to design actions that empower them to improve their opportunities and strengthen their empowerment domain in the ownership of assets (land and home), expand their mobility pattern and their decision-making concerning works, health, and their expenses to influence different areas of their lives and environment (Sultana et al., 2010; Ganle et al., 2015; Swaminathan, 2015).

Therefore, the objective research explores the level of W'E from six empowerment domains, production decision-making, access to resources, control over income and time, community participation, and business management within the context of the corn-tortilla value chain. The paper used data from two municipalities in Oaxaca, Mexico, where women are the primary corn tortilla producers, as part of their traditional knowledge within the localized corn-tortilla agrifood system. Likewise, the research is oriented to answer the following exploratory research questions.

What are the empowerment domains that contribute most to W'E in the context of the corn-tortilla value chain?

What is the general level and that of each of the domains of W'E?

How do the women producers invest the income obtained from corn tortilla sales?

How do women producers spend most of their time on within the study areas?

This study also contributes to the W'E conceptual definition understanding, identification, and evaluation of its dimensions and indicators in rural contexts, such as the localized agrifood systems value chains, which have been little explored. In addition, the information generated eases the interpretation and understanding of the behavior of W'E at the individual, family, and community levels to contribute to the literature on W'E and generate implications for public policymakers from a gender perspective.

Finally, the document is organized into four sections. First, a literature review of W'E is described. The second presents a depiction of the context of the study. The third section exposes the research study's results divided into two sections. The first section exhibits the sociodemographic profiles of the corn tortilla producers in the study areas, and the second displays the levels of empowerment domains analyzed. Finally, the conclusions and implications of the study are presented.

## 2. THEORETICAL FRAMEWORK

W'E was articulated between the 1980s and 1990s as a political concept of radical approach and social justice, adopted in the twentieth century by liberation theology, popular education, black power, and feminism (Blair, 1985; Bosch, 1998; Gutiérrez & Lewis, 1994). According to the literature, W'E is based on three elements. The first involves the preconditions or resources, the second, the action or agency, and the third, the result (Kabeer, 1999; Allendorf, 2007). The sources and scenarios of W'E are, first, the assets that women have to improve their bargaining power and control over household decisions. Second, the characteristics of women's past and present environments facilitate their empowerment (Kishor, 2000).

To date, W'E is the subject of study in different countries, in new fields of knowledge sensitive to the reflection of women's change, their perception, and evaluation from multiple theoretical and methodological approaches, research parameters, and disciplines. In addition, the W'E has the support of different international instances by including gender equality and motivating development in contexts of poverty and inequality (CDB, 2021; ECLAC, 2021; IBRD-IDA, 2021; UNICEF, 2021; UNWomen, 2021; UNWTOM, 2021).

From different perspectives, W'E is a multidimensional process that includes dimensions from different perspectives in fields such as psychology (Zimmerman, 1990), society (Malhotra & Schuler, 2005), health (Prattley, 2016), politics (Robinson & Gottlieb, 2021), economics (Ahmed et al., 2010; Duflo, 2012), laws (Schuler & Hashemi, 1994), sociocultural, family, interpersonal relations (Hameed et al., 2014), ecological (Barab et al., 2019), and others.

In order to measure and generalize W'E, several indexes have been developed. For example, in the 1995 Human Development Report, the Gender Empowerment Measure (GEM) was designed. However, it was widely criticized due to the assumptions made for overcoming gender gaps used for its construction (Bardhan & Klasen, 1999; Charmes & Wieringa, 2003). Subsequently, since 2012, the Women's Empowerment in Agriculture Index (WEAI) has been used through five empowerment domains, (1) decision-making over agricultural production, (2) access and decision-making power over productive resources, (3) control over the use of income, (4) leadership in the community, and (5) time management (Alkire et al., 2013). The WEAI also measures the relative differences between the levels of empowerment of men and women through the Gender Parity Index (GPI) (Alkire et al., 2013). Over time, recent adaptations of the GPI have included dimensions adapted for the livestock value chains and livestock research studies (Colverson et al., 2020). However, several authors agree that generalizations are not always appropriate. Firstly, women are not a homogeneous group, and secondly, they have different attributes and roles within a specific population (Mganga et al., 2021).

Moreover, since the Beijing Women's Conference in 1995, the W'E has become a primary political objective in the world (Termine & Percic, 2015); different research studies have identified several domains of W'E. According to Upadhyay et al. (2014), the innovative and frequently used measurement of W'E should be tested. However, suitable measures, such as household decision-making, were the first to operationalize the W'E. Another measure tested is the empowerment domain on resources and assets, which, together with the first, improves control over income, influencing women's decision-making and reflecting their ability to benefit from their efforts (Mosha et al., 2022).

The current quantitative studies on W'E, through cross-sectional studies and surveys, have explored relationships between different variables and indicators of W'E. For example, Vyas (2009) adapted contextual

variables to explore W'E. She analyzed the relationships among the women violence risks with her romantic partner with women's education level, poverty level, access to resources (microfinance), employment, and training. She found that violence towards women affected bargaining power, feelings of valuation, and spousal communication.

W'E has also been studied from the entrepreneurship approach because women's entrepreneurial efforts are underestimated, especially in developing countries, where entrepreneurs predominate more in an informal than a formal economy (Datta & Gailey, 2012). From this approach, entrepreneurship is seen as a process involving activities where women take advantage of available opportunities and create value (Ratten & Tajeddini, 2018). Therefore, an empowered woman entrepreneur uses her skills, experience, and resources to start and develop a business, defying obstacles to meet household needs and increase her financial independence through business activities (Noor et al., 2021), which are W'E indicators.

From a social approach, W'E seeks longer-term sustainable benefits on changes in laws and policies and power relations at the household, community, and market levels (Mosedale, 2005). So, community participation (Aizenberg, 2014), and social capital through social networks based on trust, reciprocity, and cooperation are indicators of W'E, which contribute to reducing poverty, increasing well-being, and improving the economic and social conditions of the population (Coleman, 1990).

From the individual approach, autonomy is the primary indicator of W'E because it reflects people's capacity to act on what they value. It implies understanding the situation balancing different motivations to avoid social violence and disapproval, and acting on their values (Ibrahim & Alkire, 2007).

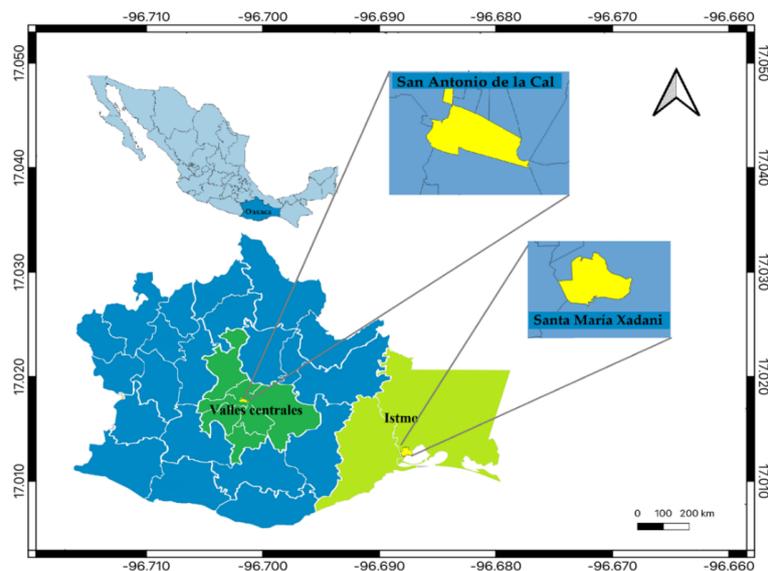
Different approaches to the study of W'E, such as individual (Ibrahim & Alkire, 2007), relational or community (Aizenberg, 2014), entrepreneurial (Noor et al., 2021), social (Mosedale, 2005), and others, have suggested that although the participation of women is latent in different contexts, the need to explore studies on their W'E will continue to be valid because they contribute to understand the domains that most affect empowerment, which contribute to the generation of strategies and public policies that strengthen the participation of women and, at the same time, empower them at their homes, work, and communities.

### **3. CASE STUDY DESCRIPTION**

The state of Oaxaca is located in the southwest of Mexico. To the north, it borders the States of Veracruz and Puebla, the south with the Pacific Ocean, the east with the State of Chiapas, and the west with Guerrero. This land is divided into eight regions: Cañada, Costa, Istmo, Mixteca, Papaloapan, Sierra Sur, Sierra Norte, and Valles Centrales. It comprises 570 municipalities, of which 10,523 are rural localities, and 200 are urban (INEGI, 2022; Segob, 2023).

In Oaxaca, Mexico, the primary sectors of the economy generate the most significant jobs. However, Oaxaca, Mexico, presents problems such as poverty conditions for the population, and the land tenure regime (COPLADE, 2019). The role of rural women producers is developed in high-poverty and marginalization environments. They are generally dedicated to transforming, elaborating, and commercializing basic foodstuffs of ethnic origins, such as corn tortillas, handicrafts, agro-products, agrifoods, and others.

In the primary sector of the economy in Oaxaca, Mexico, six key value chains operate: (i) forestry, (ii) corn, (iii) mezcal, (iv) coffee, (v) honey, and (vi) fishing-aquaculture. They are an essential part of the localized agrifood systems. Oaxaca culturally highlights the participation of women in the production of corn tortillas known as *clayuda* and *totopo*. This study focuses its analysis on the corn-tortilla value chain, adopted as a contextual framework, since currently, among the eight regions that make up the state of Oaxaca, Valles Centrales and Isthmus of Tehuantepec have significant areas of influence and the performance of women is substantial (SIAP, 2019). The first municipality studied is San Antonio de la Cal (Valles Centrales), known as the birthplace of the “*clayuda*”, a large corn tortilla. This municipality covers 11 km<sup>2</sup> and is 5 kilometers from the state capital. It has 26,282 inhabitants, and 8.7% of its population speaks Zapotec and Mixe indigenous languages (INEGI, 2022) (See Figure 1).



**Figure 1.** Map showing the location of the study areas in the Central Valleys and the Isthmus of Tehuantepec

The second municipality is Santa María Xadani (Isthmus of Tehuantepec), with a population of 9,234 inhabitants and an area of 86.1 km<sup>2</sup>. It preserves its traditions since 93.20% speak Zapotec indigenous language (INEGI, 2022). The women are dedicated to produce “*totopos*”, a type of corn-tortilla baked with holes, famous internationally and a staple in the diet of Isthmian communities (DENUE, 2020).

These women contribute significantly to preserving traditional knowledge of localized agrifood systems (Cabrera-Pacheco, 2022). Within the corn-tortilla value chain, two activities of national and international prestige based on corn predominate in Oaxaca and Mexico, where the main protagonists are rural women. According to Sánchez-Soriano et al. (2023), women *clayuda*, and *totopo* producers are the main generators of household income in their communities. These women organize themselves at home from early in the morning to start producing corn tortillas, which are sold in the local and regional markets of the state. In some cases, the income obtained from sales complements family expenses, but in most cases, it is the primary source of income for the family's food.

Thus, the production and commercialization of corn tortillas are the main activities of women to support their families and sources of food security in local and regional markets (Sánchez-Soriano et al., 2023).

They drive the local economy of their community and the local consumer market. Even during the COVID pandemic, the women never stopped their activities because corn tortillas are food indispensable for the Mexican diet.

Corn is a cereal of ancestral ethnic origin, rich in vitamins and proteins, a symbol of Mexican food culture, an Intangible Cultural Heritage of Humanity, and a pillar of Mexico's Food Security and Sovereignty policy (Secretaría de Agricultura Rural, 2021; Cárdenas-Marcelo et al., 2022). Thus, different types of corn are used by rural women for the artisanal production of corn tortillas.

In San Antonio de la Cal and Santa María Xadani, the clayuda and totopo manufacturing process is found in the transformation linkages of the corn-tortilla value chain. This process involves nine successive phases that are almost similar to each other. The marketing linkage is the most profitable for the producers because they have stable marketing channels. On the other hand, the corn cultivation linkage is disarticulated in San Antonio de la Cal since women producers neither cultivate nor own the land to produce corn. In Santa María Xadani, the corn cultivation linkage exists but with less presence in the studied sample. The value chain linkages also include support services such as financial services, training, health services, family support, transportation, and technologies.

Considering women's active participation, little is known about women's bargaining power and decision-making capacity in the linkages of value chains in rural contexts, mainly when dominated by women. However, power dynamics occur at the household level as competing demands for labor with the reproductive sphere and unequal access to and control of assets have been shown to affect decision-making capabilities at the most profitable linkages node (Quisumbing et al., 2015; Elias & Arora-Jonsson, 2017). Therefore, it is essential to know women's position in decision-making, autonomy, access to assets, control of resources, community participation, and business management that dictate their level of empowerment domains to define future lines of research studies.

#### **4. METHODOLOGY**

For the study design, qualitative and quantitative methods were used to construct the measurement and observation instruments and analyze the data collected. Qualitative analyses were used to map women's participation in the linkages of the corn-tortilla value chain in the two study municipalities based on a questionnaire with open-ended questions applied to women producers using the face-to-face technique and participant observation. Subsequently, the most consistent indicators were selected according to the explored domains of W'E in these contexts. Next, an individual-level questionnaire was designed with 12 questions to describe the sociodemographic profile and 57 questions to measure W'E with a 5-point Likert-type scale. The instrument was administered to a sample of 136 female heads of household; they were corn tortilla producers between 18 and 65 years old. Sixty-seven questionnaires were applied to women clayuda producers in the Municipality of San Antonio de la Cal, Central Valleys region, and 69 women totopo producers in Santa María Xadani, Tehuantepec Isthmus Region. The study places were selected by their cultural presence and ancestral knowledge in the elaboration of corn tortillas (clayuda and totopo). Both municipalities have the most significant number of corn tortilla women producers in Oaxaca, Mexico.

During the field study, we visited households since these are the production units where women carry out their production activities and sometimes sell corn tortillas. The final questionnaire was constructed based on operationalization of the variables adapted to the study context (as shown in Table 1).

In this study research, based on WEAI (Alkire et al., 2013), the W'E is measured with four dimensions, constructed on the literature reviewed by different authors. First, the decision-making is integrated by three indicators. (i) Decision-making in production, which is defined as the capacity of women to make choices on alternatives and situations of households, corn tortilla production, and commercialization, in order to influence their daily activities; (ii) Decision-making in marketing, it is the woman's capacity to choose alternatives and situations on sales of her products; and (iii) autonomy, the ability of the woman to make her own personal and family decisions

**Table I. Operationalization of women's empowerment**

Variable	Dimension	Indicator
Women's empowerment. The process of women making productive decisions, accessing resources, controlling their income, and participating in social, economic, and political activities in their community, allow them to influence their productive and reproductive performance and well-being, as reflected in the level of positive power in each dimension.	Productive Decision Making (PDM): This is productive and marketing decision making in addition to autonomy in the home that increases their ability to influence their home and work.	Productive decision making (Pdm)
		Decision-making in marketing (Dmm)
		Autonomy (Aut)
	Access to Resources (AR): Women's access to financial resources, information, services and assets that allow them to make use of resources according to their work and household needs.	Access to financial resources (Afr)
		Access to information (Acci)
		Access to Services and Assets (Asa)
	Control over Income (COI): This is the control that women have over income in cash, kind and time derived from their productive activities and from other household members.	Control over household income and assets (Chia)
		Control over labor income and assets (Cla)
		Time control (Tc)
	Socioeconomic Participation (SEP): It is the involvement of women in labor, community and management activities for their personal, household and work well-being.	Community participation (Cp)
Participation in management and business activities (Pmba)		

Second, the W'E dimension was the access to resources and assets, which included three indicators; (i) financial access, defined as the extent to which women have access to and use financial resources, cash, and other economic resources, to carry out their production, marketing, and household activities; (ii) access to information, seen as the extent to which women have access to knowledge and data to put it to different uses for their personal and work benefit; and (iii) access to services and assets, the extent to which women have access to and use goods and services with functional capabilities that meet their needs for their benefit and their work (Schuler & Hashemi, 1994; Ganle et al., 2015; Sethy & Jana, 2020).

Third, the socioeconomic participation dimension was constructed by two indicators: (i) community participation, which is the involvement of women in community activities that contribute to their leadership and the creation of community ties, and (ii) participation in business management, the involvement of women in building businesses and achieving economic growth, assessing their business opportunities through networking and business skills training (Schuler & Hashemi, 1994; Ganle et al., 2015; Sethy & Jana, 2020).

Fourth, the dimension of control over income is constructed by three indicators of W'E: (i) control over income and labor assets is the total control that women have over the income, monetary and non-monetary income, derived from their productive work; (ii) control over household income and assets, it is the woman's total control over her household's monetary and non-monetary income; (iii) time management is the woman's total control over how she spends her time (Schuler & Hashemi, 1994; Alinovi et al., 2010; Ogolla et al., 2022).

To measure the W'E, the corn tortilla women producers were questioned on the frequency with which they make decisions in the production process, forms of commercialization, and household government. As well as the frequency on which they have the cash to attend to their daily activities and household emergencies, and the frequency in which they access information to know what and how to sell. They actively participate in support, training, and management programs to improve their work and the frequency with which they participate in political, social, cultural, and business activities. Finally, they were asked about what percentage of income obtained from the sale is assigned to satisfy the family and business needs, likewise about managing their time. For the first three dimensions, the scales were evaluated in ascending order on the frequency of each question according to the dimension and indicator (1 = never, 2 = rarely, 3 = occasionally, 4 = frequently, and 5 = always). For the fourth dimension, percentages are from 0 to 100%. It was then coded and transformed to a range variable of 1 = 0%, 2 = 10 to 30%, 3 = 40 to 60%, 4 = 70 to 90%, and 5 = 100%.

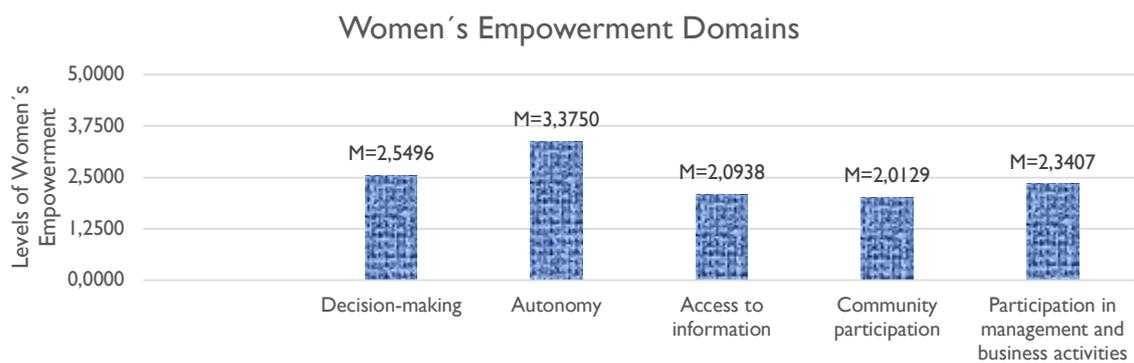
In order to validate and internal consistency of the scale of W'E, a factor analysis was used. Factor analysis allows for generating a multi-item index through data reduction techniques when several indicators are correlated, and offers a better approach to capture the intercorrelation between items, with a better generalization of results than single-item indices (Alinovi et al., 2010). We used principal components and Varimax rotation with Kaiser Normalization to define the structure of the variables and determined KMO and Bartlett sphericity. Items integrated W'E with loadings greater than 0.5. The reliability of the items was obtained by Cronbach's alpha analysis and McDonald's omega coefficient, which were acceptable values for the five domains obtained. Statistically, W'E was validated and constructed by five components (empowerment domains) called: community participation (factor 1), access to information (factor 2), decision-making in marketing (factor 3), autonomy (factor 4), and participation in business management (factor 5), see Table 2.

In order to determine the level of W'E, based on constructs of the factor analysis, a new index was constructed with the statistical means (M) in order to define the levels of empowerment domains, where (i) 0 is equal to none or no empowerment, (ii) 0.01 to 1.25 low level, (iii) 1.26 to 2.5 medium level, (iv) 2.51 to 3.75 high level and (v) 3.76 to 5 very high level (Figure 2).

**Table 2.** Factor analysis of women's empowerment

Women's empowerment	1	2	3	4	5	Communalities
	Community participation	Access to information	Decision-making in marketing	Autonomy	Participation in business management	
<b>Cp1. Assemblies or meetings</b>	.851	.005	.047	-.084	.024	.735
<b>Cp2. Tequios (collective work)</b>	.821	.024	.094	.126	-.015	.535
<b>Cp3. Municipal committees</b>	.779	-.045	-.104	.144	.064	.572
<b>Cp4. Political activities and municipal and state voting</b>	.598	.190	-.074	-.046	.088	.443
<b>ACCi2. Events or forums to promote your totopo/class assistance</b>	.002	.811	.002	.212	-.069	.646
<b>ACCi3. Municipal, state or federal support programs for your business or family</b>	-.115	.773	-.079	-.284	.085	.611
<b>ACCi1. Training</b>	.079	.726	-.102	-.231	.142	.568

<b>ACCI4. Forms of packaging, flavor or design of your totopo/ clayuda</b>	.319	.662	.114	-.138	.034	.616
<b>Dmm2. Find customers in other states</b>	-.104	-.213	.803	-.046	.178	.707
<b>Dmm C4. Negotiate price or discounts</b>	-.044	.088	.743	.054	.083	.704
<b>Dmm3. Barter/trade</b>	.044	-.034	.656	-.032	-.317	.573
<b>Pdm5. Diversify your products to complement your sale</b>	.060	.035	.613	.083	-.237	.735
<b>Aut2. Your children's education</b>	-.080	.093	-.027	.791	.070	.699
<b>Aut4. The activities that your family members should perform in your home.</b>	.025	-.255	.132	.671	.187	.645
<b>Aut3. How many children to have</b>	.271	-.310	-.020	.664	-.003	.409
<b>Pmba4. Finding new customers</b>	.041	.057	-.186	.083	.806	.477
<b>Pmba5. Find new ways to sell</b>	-.087	.181	.028	.099	.658	.696
<b>Pmba3. Promotional programs for your business</b>	.269	-.105	-.034	.032	.626	.484
<b>Explained variance</b>	14.805	14.055	11.752	9.947	9.751	
<b>Explained variance</b>						60.309
<b>Cronbach's alpha</b>						.546
<b>KMO</b>						.636
<b>Bartlett's sphericity</b>						699.949
<b>Cronbach's alpha by dimension</b>	0.792	0.770	0.682	0.634	0.658	
<b>Omega coefficient</b>	0.765	0.774	0.684	0.618	0.578	



**Figure 2.** Levels of women's empowerment

## 5. RESULTS AND DISCUSSION

### 4.1 Sociodemographic profile of women producers

The survey revealed that 28% of the women producers in the two corn tortilla-producing communities are between 41 and 50 years old, 27% are between 31 and 40 years old, 24% are between 18 and 30 years old, 12% are between 51 and 60 years old, and 9% are 60 years old and over. As to their schooling, 32% have primary education, 23% have secondary education, 18% have high school, 21% did not finish primary school, and 6% are illiterate. Regarding their marital status, 66% of the producers are married, 17% are single, 11% live in a common-law relationship, and 6% are widows. It indicates that the economically active woman's different life stages strongly influence the corn-tortilla value chain. Most women have basic education levels and combine production and household activities.

As for the experience of workers in the production and sale of corn tortillas, 40% have 16 to 30 years of experience, 24% have 31 to 45 years, 18% have 6 to 15 years, 11% have 40 to 60 years, and 7% have less than five years. It indicates that women start this activity at a young age. The women were asked who had taught them this activity, and 75% answered that it was their mother, 10% their mother-in-law, 8% their grandmother, and 7% their sister/s. It confirms that it is the productive activity par excellence inherited by generations and distinctive of both municipalities. Traditional knowledge is preserved over time and inherited through the female line. Currently, 39% teach this activity to their daughters, but 38% do not teach anyone; the rest of the women teach their daughters-in-law, sisters, granddaughters, cousins, nieces, and sisters-in-law. It is worth mentioning that a family may have more than one producer. However, each can produce and sell separately to contribute individually to household expenses and keep track of their income.

When women producers were asked about their dependence on income from sales to cover their basic needs (food, clothing, and housing), 29% said they depended a little on the activity, 26% depended a lot, 19% depended at a medium level, 18% depended too much and only 6% said they did not depend on the activity at all. The most significant benefit they receive from the activity is daily consumption, as corn tortillas are part of the basic diet for families. Of the women's supplementary income, it was found that 11% of the women supplement their income by selling food, snacks, and beverages typical of the communities, 7% sell fruits and vegetables and provide domestic cleaning services, embroidery of traditional clothes, washing other people's clothes, among others, 6% sell other products, 6% offer other services, 2% sell inputs such as firewood and corn for making corn tortillas, but 68% have no supplementary income.

Regarding the women's sense of belonging to their activity as local producers, they were asked how proud they are of what they do. 55% of the women producers feel very proud of their work since the production, and especially the sale of corn tortillas, is a challenge that demands effort and time, which means that they are proud of the time they spend between their household chores and their work as producers. 40% feel proud, but they feel the need to do more to be satisfied with their activity, 4% feel more or less proud, and only 1% said they are not proud of their activity. It indicates that women feel more empowered in multitasking, which, although physically exhausting, generates emotional pleasure in feeling they can fulfill the gender roles culturally assigned to them.

When women producers were asked about their perception of the value that customers place on their agrifood activity, 98% stated that they are faced with customers who haggle over prices, reflecting the low value that consumers place on the work they do. Consequently, producers consider that corn tortillas are

very cheap products in the market. However, inputs have increased in price over the last three years, resulting in lower profits and, therefore, less income for household expenses. This inflation situation has forced some women to leave the tortilla production activity to dedicate themselves to another source of income or to complement it with commercial activities. It results in a loss of knowledge for future generations and the abandonment of regional activities.

#### 4.2 Levels of empowerment domains

Figure 2 shows that women have a high level of empowerment in decision-making ( $M= 2.5496$ ); they are frequently autonomous in decision-making, in producing and selling corn tortillas. They decide without consulting anyone, for example, the diversification of products to complement their sales, seeking customers in other states of the Mexican Republic, carrying out bartering, exchanges with other producers or suppliers (a common practice in local markets in Oaxaca), negotiating the price or applying discounts on their products, and so on. According to Mahato & Vardhan (2021), women have to make decisions relative to the opportunities available to empower themselves. However, at the household level, the degrees of power change in many geographic areas. For example, in southeastern Kenya, decision-making rights in all aspects of production are shared between men and women, while men make financial decisions because they assume ownership (Ogolla et al., 2022). Contrary to what was expected, in the context of the research study, the activity of making corn tortillas is exclusive to women. The qualitative data found that men access the benefits of making corn tortillas because women contribute significantly to family income. In this study, women are proud to supply to family well-being because they donate their income to buy daily food. They generate material goods and provide nutritious food for their families, which increases food security at home. This satisfaction is the product of their work as corn tortilla women producers, so they experience greater participation in household decisions. According to Dupuis et al. (2022), women's sustained empowerment lies on the success of their work and productive activities that enable them to earn surpluses, improve their bargaining power, and become more confident and motivated.

At the same time, women producers' decision-making is related to women's autonomy, evaluated by a high level of empowerment ( $M= 3.3750$ ) (Figure 2), which indicates that they frequently decide on the education of their children, the number of children they want to have and the activities to be performed by their family members in the household. According to Forty et al. (2022), women's autonomy and fertility may vary by sociocultural context. Social norms influenced by patriarchy in developing countries inhibit the realization of women's autonomy at home and beyond. Within the results of this study, it was found that 37% of the women surveyed have 1 to 2 children, 36% have 3 to 4 children, 10% have 5 to 6 children, 1% have 7 children and more, and 16% have no children; therefore, the percentage decrease in the number of children considering the rural context in which women reside could indicate that the autonomy of women affects family planning, as women now decide to expand their activities and not limit themselves to child rearing and home. Likewise, geographically, the isthmus of Tehuantepec has been identified as a region that practices the culture of matrilineality, which could increase women's autonomy (Robinson & Gottlieb, 2021).

In the domain of access to information, their level of empowerment is medium ( $M = 2.0938$ ) (Figure 2), which indicates that women occasionally have information about training for making and selling their corn tortillas, events or forums to promote their products, municipal, state, and federal support programs for their business or family, as well as information about the market, such as types of packaging, new flavors of corn tor-

tillas (totopo/clayuda) in the market. However, regarding the use of information technologies, it was found that 68% of women use a cell phone, and 32% do not. While 61% do not have internet access, 39% have access to the service. Both the cell phone and the internet are work tools for their children education, which also contributes to their individual, family, and community empowerment. The literature reports that women with limited access to resources and information and less access to information and communication technologies have limited capacity to participate and expand in higher-value agricultural businesses (Forsythe et al., 2016; Quisumbing et al., 2015; Witinok-Huber & Radil, 2021). Women's access to information generates benefits for them from different aspects, for example, in the location of loans and the offer of particular products such as savings, insurance, and pensions (Mayoux, 2000). Previous studies indicate that low-cost communication tools such as radio and television contribute to women's empowerment through interactive advice on agricultural and nutrition issues (Noor et al., 2021; Ragasa et al., 2022). Also, social networks are a powerful source of information linked to women's entrepreneurship (Waheed et al., 2022).

The socioeconomic participation domain divided this into two components: community participation and participation in business management. Regarding community participation, women obtained a medium level of empowerment ( $M = 2.0129$ ) (Figure 2). As part of the community, these women occasionally participate in assemblies, meetings, *tequios* (collective work in the community), municipal committees, political activities, and municipal and state voting to elect their representatives. It enables them to generate social capital through the organization, reciprocity, mutual aid, and local trust, which contributes to reducing poverty, increasing social well-being, and the possibilities of contributing economically and socially to the community (Coleman, 1990). At the same time, in rural Bolivian contexts, community participation has been promoted through local governance, which helps to recognize the leadership, networks, and leading role of women that improves the well-being of the community through commitment, training, and active participation in local institutions and, consequently, greater community empowerment (Aizenberg, 2014; Qadir et al., 2021).

Contrary to expectations, this study found that collective work in productive activity is absent, despite the social capital that is evident in the community. 99% of the women do not work collectively or belong to any association or cooperative of producers or women, and 1% said they belong to a cooperative organization outside the community. It indicates that in the business environment, they are individualistic, which limits more vital empowerment, under the assumption that organizations educate women about the leadership role they can play in their own lives, in the organization, and in society, in addition to a strong correlation with production decision-making (Malapit et al., 2015; Malapit et al., 2019). The need for more organization among the women producers in the study areas was identified since they expressed having limited time to organize among themselves and the absence of leading women producers to organize them. Even the woman producers demand opportunities for access to social, commercial, and economic programs to the local, state, and federal governments to improve the conditions of production and commercialization of corn tortillas.

For the domain of participation in business management, women qualified at a medium level of empowerment ( $M = 2.3407$ ) (see Figure 2). Occasionally, they participate in programs promoting their business and local consumption; they participate in multiple interviews, social networks such as Facebook, radio, live streams, or podcasts. The women state that this participation has helped them search for new customers and ways to sell. They mention that knowing the tastes of the clients is essential for the sale. With this, they have prepared tortillas with additional ingredients to the traditional corn, for example, new or colored corn, flavors such as coconut, butter, epazote, grasshoppers that become an attraction for the client and a substantial increase in their sales. This argument coincides with the assumption that entrepreneurship is an opportunity to create value and is essential for the economic expansion of women (Ratten & Tajeddini, 2018).

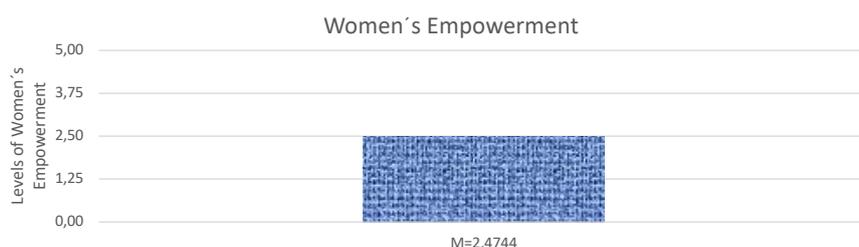
Also, using social media can expand the business, strengthen community relationships and promote business to all corners of the world in a way that empowers women (Waheed et al., 2022). In different parts of the world, women enter entrepreneurial businesses to support, raise children and care for the family. According to Noor et al. (2021), entrepreneurial women have greater control over resources, fewer mobility problems, strong decision-making capacity, autonomy and high ownership of household assets, in-depth knowledge of legal and political issues, greater participation in development activities, and contribution to household expenditure.

The domain of control of income and time was not grouped to form this dimension due to the variation in the results. However, some aspects that should be mentioned are highlighted since they are derived from mapping women's participation in the corn-tortilla value chain. In the case of clayuda women producers, it was identified that they are located in the production and marketing links. Only 17% of women participate in the cultivation link, but are not land owners. It is borrowed or belongs to another family member. The participation of women in this link is in the harvest; generally, the man is in charge of planting. In the case of Santa María Xadani, 7% of the women producers participate in the corn cultivation link, from planting to harvesting, since the women producers and their families own the land. The above proves that asset ownership and land tenure remain challenging and undermine ongoing initiatives toward economic development and W'E. Mosha et al. (2022) note that female heads of household have lower yields due to smaller land size and less access to other production resources, resulting in fewer female heads of household engaging in the marketing link, which limits their levels of empowerment.

Regarding the income women obtain from selling their corn tortillas, it was found that 99% of the women said that, on average, they spend 48.5% to buy food for the household. 71% of the women said that they spend 22.4% of their income to buy raw materials to increase their production volume, 38% of the women spend an average of 5.5% to buy medicines/medical services/health emergencies, and only 7% of the women spend an average of 0.8% to buy a higher value good (land).

In terms of time control, we considered the time of a typical day (24 hours). On average, women spend 8.5 hours a day producing corn tortillas. Generally, 2 hours for marketing (time between leaving and returning home) and 2.5 hours for household chores; the remaining time is spent on household shopping, raising farm animals or livestock, caring for the elderly, sick or grandchildren, and caring for themselves. Thus, their activity is fundamental for the economic sustenance of their households; reducing time devoted to this activity affects their well-being and that of their relatives.

Finally, a general measure of empowerment was generated; according to Figure 3, we can affirm that the empowerment of women corn tortilla producers in the study communities was of medium level ( $M = 2.4744$ ). Therefore, women producers who participated in the totopo and clayuda value chain occasionally make decisions in marketing, have autonomy, access to information, participate in their community and the management of their business.



**Figure 3.** General level of women empowerment

Recent studies have found that W'E within value chains can create essential development opportunities for women and benefit their families. However, women heads of household tend to benefit less from the marketing link, as low levels of access to and control over productive resources result in low agricultural productivity, which affects levels of empowerment (Moshia et al., 2022). Finally, Sethy & Jana (2020) give evidence that participation in entrepreneurial activities has a positive impact on the achievement of decision-making levels. García-Orozco et al. (2021) even mentions that environmental awareness, sustainable knowledge, and culture are conditions determinants in consumer behavior toward sustainable food products; thus, it is recognized that sustainable entrepreneurship linked to the government in rural areas helps women to understand business market opportunities, production cost reduction techniques and the use of the latest technology in their business.

## 6. CONCLUSIONS

This research study aims to explore the level of W'E from decision-making in production, access to resources, control over income and time, community participation, and business management within the context of the tortilla value chain. The paper used data from two municipalities in Oaxaca, Mexico, where women are the main producers of corn tortillas within the localized corn tortilla agrifood system. The empirical evidence in this paper allowed us to fulfill the research objective and answer the proposed exploratory questions.

First, the domains that contribute most to W'E in the context of the corn-tortilla value chain are decision-making, autonomy, access to information, community participation, and participation in business management. In general, a medium level of W'E was found in the context of the corn-tortilla value chain.

Concerning domain W'E, such as access to information, community participation, and participation in business management were at a medium level. However, excessive workload and lack of group membership were found to be important sources of disempowerment for women.

It was also found that women producers allocate most of their income from selling their tortillas to satisfy their family and business needs. Regarding the administration of their time, the women assign it to the production and commercialization of corn tortillas, and to domestic chores. In this sense, future lines of research could be aimed at understanding how the participation of women in value chains intervenes in W'E based on the socioeconomic attributes of households and women.

Finally, the findings of this research could generate information for public policies on the W'E indicators in rural contexts and localized agrifood systems. It also has implications for the literature on the similarities and differences that define the W'E of developing countries.

### **AUTHORS' CONTRIBUTIONS**

In this research, all authors contributed equally in conceptualization, methodology, validation, statistical analysis, writing, revising, and editing. We declare that we agree and accept the version published in this study.

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### **DATA AVAILABILITY STATEMENT**

The sources of information supporting the study are listed in the references. The data obtained from the survey can be requested at [d19161685@itoaxaca.edu.mx](mailto:d19161685@itoaxaca.edu.mx)

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## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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