





Gender and global production network: De-feminization of the Indonesian apparel industry

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ABSTRACT

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This paper aims to measure the involvement of women in the global apparel industry. This article also examines the declining role of women in the apparel industry in Indonesia, even though exports have increased. This article also aims to analyze the phenomenon of the decline of women in the Indonesian apparel industry in the last fifteen years by using survey data for medium and large enterprises conducted by Statistics Indonesia. This study uses the Fixed Effect Model's regression analysis method for panel data. The results show that the apparel industry in Indonesia in the past fifteen years has shown a downward trend, which has led to the phenomenon of de-feminization. The phenomenon of de-feminization is a term used to describe the process of the exclusion of women from specific jobs or roles in society. The results also show that this phenomenon can have a significant impact on women's economic opportunities as well as their ability to participate in the community. According to the rising number of skilled workers and rising fixed capital employed in this industry, the phenomenon of de-feminization is a result of greater mechanization and an increase in skilled workers. Indonesia has a high female workforce, so this research has practical implications; female workers need to be maximally absorbed by industry to avoid high unemployment rates based on the theory of de-feminization in developing countries.

Contribution/Originality: This research contributes to analyzing the phenomenon of de-feminization in the apparel industry, which has a significant influence on employment opportunities and participation in the global production network community.

1. INTRODUCTION

Gender issues have been included in earlier studies that aimed to investigate the consequences of global integration. Previous studies found that the expansion of an industry in an economy has an impact on the intensity of female workers. Most of them also found that export-oriented industries like the apparel industry would undergo the phenomenon of feminization. Feminization is inevitable, due to the nature of the apparel industry itself, which depends on female workers (Baylies & Wright, 1993). The feminization of the apparel industry is inevitable due to the nature of the industry itself. The apparel industry is heavily dependent on female workers, both in terms of the labor force and the consumer base. Women are often the primary purchasers of clothing, and they are also the ones most likely to be employed in the industry. This reliance on female labor and consumers has led to the feminization

of the apparel industry, with more women in leadership roles and a focus on feminine styles and designs. As the industry continues to evolve, it is likely that the feminization of the apparel industry will only become more pronounced.

Without cheap female labor, the apparel industry would not be able to achieve targeted profit (Elson & Pearson, 1981; Tager, 2016), which makes the absorption of female workers to be high. Based on cross-country analysis, the occurring trend shows that female workers are high. Based on the cross-country analysis, the occurring trend shows that an increase in export volume leads to feminization occurring in developing countries (Çağatay & Özler, 1995).

Feminization is interpreted as a consequence of male labor shifts to "cheap" labor, associated with females (Standing, 1999). The labor market has experienced significant changes as a result of the shift in labor, as more and more women are entering the workforce and filling positions that have historically belonged to men. This shift has had a significant impact on the way in which labor is viewed and valued in society and has led to a greater recognition of the value of female labor. However, despite all of the arguments about feminization that have been supported by numerous studies, some middle-income countries have experienced the de-feminization phenomenon that happened after the rapid feminization phenomenon (Kucera & Tejani, 2014).

The global expansion in terms of integration in the manufacturing sector is growing rapidly, especially in production operations. The apparel industry is one of those industries that is expanding in terms of production. As one of the most developing industries in Indonesia, the apparel industry has grown into an export-oriented industry with an impact on Indonesia's economy. In terms of its contribution to exports, in 2017, the apparel industry contributed Rp90 trillion to Indonesia's exports and became the third biggest industry to contribute to exports, after the palm oil industry and the food and beverage industry. In addition, the apparel industry was also the industry with the highest growth in the last quarter of 2017, with a growth of 6.39 percent, making the apparel industry the fourth biggest industry in terms of growth under the food and beverage industry, machinery and equipment industry, and basic metal industry.

The expansion of development in this industry can't be separated from the implementation of networking by the world's leading apparel brands that apply the Global Production Network (GPN) framework in carrying out their operations in Indonesia. The implementation of GPN is increasingly pushing Indonesia's apparel industry into an export-oriented industry. In addition, with the implementation of GPN, these apparel brands make Indonesia an assembly country that requires a lot of workers. The industry has thrived on cheap labor, defined as Indonesia's comparative advantage (Aswicahyono & Mairid, 2003). In terms of employment, the apparel industry has employed 684 thousand workers, of which about 77 percent are women (Statistics Indonesia, 2017).

Gender has been included in the analysis to investigate the consequences of global integration. The previous study found that the industry with export orientation will undergo feminization. It is undeniable that because of the nature of the apparel industry itself, which has a dependence on women workers (Baylies & Wright, 1993), without cheap female labor, the industry would not be generating the profits that it is (Tager, 2016), which makes the absorption of female workers to be high. As the industry become more export-oriented, the feminization phenomenon occurred in this industry. The previous studies also explained this phenomenon, associating feminization in developing countries with export growth. Trends that occur based on cross-country analysis show that an increase in exports leads to feminization occurring in developing countries (Çağatay & Özler, 1995). Feminization is interpreted as a consequence of male labor shifts with "cheap" labor associated with women (Standing, 1999). By using the plant-level data of the apparel industry from Medium/Big Industry by Statistics Indonesia, this study will analyze the relationship between export orientation and female share of employment in the Indonesian apparel industry in terms of GPN implementation.

This article aims to address the research gap by examining the decline in female employment in the apparel industry. This research focuses on analyzing the increase in apparel exports on female labor force participation. This research is a development of previous research, namely Ozler (2000) and Barrientos, Gereffi, and Rossi (2010). Kucera

and Tejani (2014) and Tager (2016). The role of female workers in industry is an interesting thing to research. Previous research focused on the skills of female workers. In this research, we want to discuss female workers from various companies in the apparel industry. The apparel industry tends to have more female workers. We conducted research on 436 companies with 6509 longitudinal observations in medium and large industries. We also compare these two industries and their impact on the female workforce.

This paper is organized into five sections. Sections 1 through 5 include an introduction, a literature review, a method section, a results section, a discussion section, and references.

2. LITERATURE REVIEWS

2.1. Global Production Network (GPN)

In the study about GPN theory explained by (Gereffi, 1995), he stated that export-oriented industries will recruit many workers from developing countries in production and services. The industry will recruit many workers, including in apparel, footwear, and agriculture. These industries exemplified the outsourcing of labor-intensive industries to low-wage countries (Gereffi, 1995). Gereffi also explains that the change in the global production and trade framework is a sign of the new era (Gereffi & Lee, 2012). In general, the implementation of the GPN framework has changed the structure of the industry.

The study of labor becomes important in terms of the implementation of Global Production Networks (GPNs). GPN analysis is a framework that examines the interactions between lead firms and suppliers, as well as the other actors that contribute to influencing and shaping global production (Bair, 2009). Global Production Networks (GPNs) take a more holistic approach and emphasize the social and institutional embeddedness of production, as well as the power dynamics between actors. This is especially relevant when sourcing is spread across multiple developing countries, as the power relations between actors can vary significantly (Barrientos et al., 2010). GPNs provide a more comprehensive view of the production process, which can help to better understand the complexities of global production systems. This framework allows for a more comprehensive understanding of the dynamics of global production, as it takes into account the social, institutional, and power relations between actors. The apparel industry has been growing and has become one of the industries that implements the GPN framework for that development. The manufacture of clothing has long been seen as one of the most viable routes to industrialization for developing countries (Dicken, 1998). It has been seen as a stepping stone to economic development, providing jobs and economic opportunities to those in least-developed and developing countries (Martin et al., 2013). This is because the garment industry is relatively easy to enter and does not require a large amount of capital or complex technology. As such, it has been a popular choice for many countries looking to develop their economy. According to the typology of the GPN framework, the apparel industry falls under the criteria of low-skilled, labor-intensive work. This phenomenon stimulated the expansion of production and employment linked to GPNs (Barrientos et al., 2010). A study that claims that a system that relied on third-party "vendors," or middlemen, that take care of the workers who are suitable with firm specifications, was able to keep the production costs of international apparel brands low (Tager, 2016) also supported this study. A study on the impact of the implementation of GPN on workers from previous studies has been done (Gereffi, 1995). Those studies explain economic and social upgrading in terms of the implementation of GPN. The shortcomings of Gereffi's study were the lack of gender discussions that became important in the study of GPN. Besides that, the concept of GPN is similar to vertical specialization theory. Vertical specialization is an interconnectedness of the production process with a trading chain stretching across many countries vertically that is specialized in a particular part of the production process (Yi, 2003).

2.2. Female Worker and Feminization

The apparel industry is often seen as a "low-skill" industry due to the fact that the skills required for the job are relatively easy to learn and many of the workers already possess the skills before training. This perception is linked

to gender, as skills associated with traditionally female occupations are seen as innate rather than acquired. The apparel industry needs cheap female labor, and an expansion of female employment (Standing, 1999). Participation in global networks influences gender equality in employment opportunities, wages, and skills (Daniele & Hoxhaj, 2022).

Reliance on female workers has been particularly characteristic of the apparel industry (Baylies & Wright, 1993). This is especially true in both the formal and informal sectors of the industry. Women are often the primary source of labor for the apparel industry, and this has been the case for many years. This is likely due to the fact that the apparel industry requires a large amount of manual labor, which is often seen as a job for women. Additionally, the apparel industry is often seen as a low-paying job, and women are more likely to take these jobs due to their lower wages. This has led to the apparel industry becoming an important employer for women.

A preference for female workers in the apparel industry is based on a variety of factors. According to Fernandez-Kelly (1983), women are valued for their handwork quality, their willingness to comply with monotonous and repetitive tasks, and their docility. Fuentes and Ehrenreich (1983) also note that women's natural patience and manual dexterity make them ideal workers. Baylies and Wright (1993) suggest that women are more reliable than men, work harder, and are more dexterous. Additionally, patriarchal ideologies make women more attractive to employers than their male counterparts due to their education and the fact that they can be employed more cheaply. This preference for female workers has been a long-standing practice in the apparel industry.

From another perspective, preference exists for female workers in the apparel industry because it is viewed as a culturally appropriate form of employment (Tager, 2016). His preference for female workers in the apparel industry is seen as a way to preserve cultural values and traditions. It is also seen as an opportunity for women to gain economic independence and have a career in a traditionally male-dominated industry. This preference for female workers in the apparel industry is an important factor to consider when discussing the industry and its future.

The apparel industry became more feminine as a result of the extensive employment of female labor to meet export-oriented requirements. Export promotion and trade liberalization policies have had a notable impact on developing countries' labor forces, according to cross-country studies. The result has been a feminization of the labor force, which has led to an increase in the number of women working in these nations. This pattern has been observed in numerous nations, indicating that trade liberalization and export promotion policies have benefited the labor force in emerging nations (Çağatay & Özler, 1995). According to general trends seen in cross-country analysis, trade liberalization and export promotion policies have had a significant impact on the labor force in developing countries. This impact has been characterized as a "feminization" of the labor force; that is, women are increasingly represented in the labor force, often in roles that were traditionally held by men. This trend has been observed in many developing countries and is attributed to the increased opportunities for export-oriented employment and the liberalization of trade policies. It suggests that this trend is likely to continue in the future as more countries adopt export promotion and trade liberalization policies.

Numerous country case studies support the general trend of feminization of the labor force in developing nations. These studies show a clear correlation between the spread of export-led industrialization and the increase in female labor force participation. This trend is seen in a variety of countries and is indicative of the changing dynamics of the workforce in these nations. As such, it is clear that the feminization of the labor force in developing countries is an ongoing and important phenomenon. This suggests that export-led industrialization has had a positive effect on the economic opportunities available to women in developing countries. This trend has been seen in many countries, providing evidence of the positive impact of export-led industrialization on female labor force participation (Çağatay & Berik, 1991). This implies that the feminization of the workforce could be a result of export-oriented industrialization, rather than the other way around (Joekes, 1995). The reversal of the feminization phenomenon is known as de-feminization. This process can occur when techniques are adopted that require more "skilled" labor or greater mechanization. De-feminization can be seen as a shift away from the use of female labor and towards the use of male labor. It is a process that can have a significant impact on the labor market and can lead to changes in the

gender balance of the workforce (Çağatay & Özler, 1995). The impact of gender essentialism is a crucial rationale for gender division in the workforce, which is still predominantly occupied by women (Løvgren & Orupabo, 2022). Additionally, it may have an effect on the deindustrialization process that Mexico and the other Central American nations are going through, as well as have an influence on employment, savings, investment, and economic growth (Cáceres, 2022).

3. METHOD

This study used a population of firms in Indonesia's apparel industry recorded by Statistics Indonesia. This study used a modified version of the model from Ozler (2000) study. Ozler investigated the impact of exports on the female share of employment in Turkish manufacturing from 1983 to 1985.

This study utilizes regression analysis for panel data, which is a type of statistical analysis that uses multiple data points collected over a period of time to identify relationships between different variables. This type of analysis is useful for understanding trends in data over time as well as for predicting future outcomes. The study will use this type of analysis to identify any relationships between different variables and to make predictions about future outcomes.

The study was conducted to analyze the effects of exports on the female labor force's participation in the manufacturing sector in Turkey. The results of the study showed that exports had a positive effect on the female share of employment in the manufacturing sector in Turkey. Furthermore, the study concluded that the effect of exports on female labor force participation was greater in larger firms compared to smaller firms. The data used in this paper is from 436 firms and 6509 observations.

Based on a modified version of the model from the study conducted by Ozler (2000). Ozler investigated the impact of exports on the female share of employment in Turkey manufacturing sector. This paper uses the following panel regression model in Equation 1.

Equation 1. Fixed effect model:

$$FEM_{i,t} = \alpha_{i,t} + VS_{i,t} + SKILLED_{i,t} + \log(WGP_{i,t}) + \log(WGNP_{i,t}) + FIXCAP_{i,t} + \varepsilon_{i,t} \quad (1)$$

$i=1,2,\dots,N$ (firm).

$t=1,2,\dots,N$ (period).

VS_{it} = Vertical Specialization on i firm at t period.

$SKILLED_{i,t}$ = skill worker on i firm at t period.

$WGP_{i,t}$ = Wage for production on i firm at t period.

$FIXCAP_{i,t}$ = Fix capital on i firm at t period.

Panel data regression modeling research is divided into several models. The Fixed Effect Model (FEM) has an approach that assumes that the intercept and regressor coefficients are assumed to be constant for all unit areas as well as time units. This approach is also known as Least Square Dummy Variable (LSDV) because it uses a dummy variable to pay attention to unit cross sections and time series. The most frequently used approach is to allow the intercept to vary between unit cross sections, but still with the assumption that the slope of the coefficient between cross sections is constant.

FEM stands for a female share of total employment. This dependent variable will be used as a proxy to observe female workers' intensity in this study. VS stands for Vertical Specialization. This variable has included exports, imported intermediaries, and output.

Equation 2: Vertical Specialization

$$VS_{ki} = \left(\frac{\text{Imported Intermediaries}_{ki}}{\text{Gross Output}_{ki}} \right) Exports_{ki} \quad (2)$$

VS acts as the main variable in this study in Equation 2. It is used for measuring participation in the Global Production Network (GNP) framework, as Yi (2003) states that the concept of vertical specialization is similar to

Global Production Network (GNP). Furthermore, internationalized linked firms might be more or less intensive on female workers than other firms (Shepherd & Stone, 2013). Skill acts as the share of skilled workers, portraying the number of non-production workers divided by the total of workers. The Variable SKILL was used in the previous study that found de-feminization occurrences were caused by the need for skilled workers (Çağatay & Özler, 1995). Also, the intensity of female workers is low in firms with a "high-skilled" worker composition compared to those with a "low-skilled" worker composition (Ozler, 2000). Another study also stated that the increasing demand for skilled laborers (mostly male) threatens mostly female workers. SKILL is used to observe under what conditions the composition of workers would cause a de-feminization phenomenon to occur. Wages for production workers (WGP) and wages for Non-production workers (WGPN) stand for wages for production and non-production workers. Based on Ozler (2000), women are indicated to be employed in low-paying jobs (Baylies & Wright, 1993), which also states that women tend to be concentrated in areas where wages are similarly low. It separated the wage for production workers and non-production workers because of the condition of the data available. This also applies to the data available in Medium- and Big-Industry Surveys. The reason for using those variables is to capture the effect of wages on all of the female workers, both working in production and non-production. WGP and WGPN are also useful to observe the impact of wage amount for both types of workers on the de-feminization phenomenon. Meanwhile, FIXCAP stands for the estimated value of all fixed capital that the firm owns. According to the previous study, greater mechanization may result in de-feminization as a result of increased export orientation (Çağatay & Berik, 1991). In addition, workers in the labor-intensive industry faced a high risk of getting laid off because of the increasing use of machinery, which also applied in Indonesia's apparel industry. The concept of the FIXCAP variable is similar to the concept of the sum of new investment in machinery (INVMA) variable on the Ozler model. But in FIXCAP, no expenditure for research is in INVMA. Other than that, the contents of their variables are the same. Because of this, the FIXCAP variable was raised to see whether the ownership of fixed capital has an impact on feminization.

4. RESULTS AND DISCUSSION

This section explains a descriptive analysis of the variables used in this research to analyze the recent situation of Indonesia's apparel industry. Through analyzing these variables, we will be able to gain a better understanding of the current state of the apparel industry in Indonesia. Additionally, we will be able to identify any potential issues that may be impacting the industry, as well as any potential opportunities that may exist. By understanding the current situation of the apparel industry in Indonesia, we will be able to make more informed decisions about the future of the industry. From the composition of workers based on gender, the number of female workers is almost five times larger than that of male workers. Then, if we analyze the data on the share of the two genders, it appears that both males and females have a stable number of shares. It is noticeable that the share of female workers remains above 80%. Despite the narrowing share of female workers and male workers (evidence is in 2001, where the share was 66%, and in 2015, where it was 62%), Indonesia's apparel industry corresponds to the previous study, whose argument stated that reliance on female workers has been a particular characteristic of the apparel industry. However, if we investigate further, there was a decrease in the share of females in total employment in 2007. The author suggests that the decline is due to a decreasing number of exports in that year.

Based on the Big/Medium Industry Survey, on average, in fifteen years, there will be 2,504 firms in the apparel industry that operate in Indonesia. The number of firms above is divided into firms that are doing the GPN framework and those that are not. On average, in fifteen years, there were 156 firms that followed the GPN framework and 2,349 firms that did not follow the GPN framework. But if we just take a look at firms that are doing the GPN framework, the trend shows that the number of firms has been relatively stable in the past fifteen years. This trend indicates that the number of firms is not significantly fluctuating but rather is consistent over time. This could be due to a variety of factors, such as market conditions, the availability of resources, and the overall economic climate. It is important to note that this trend could change in the future, but for now, it appears that the number of firms is relatively stable.

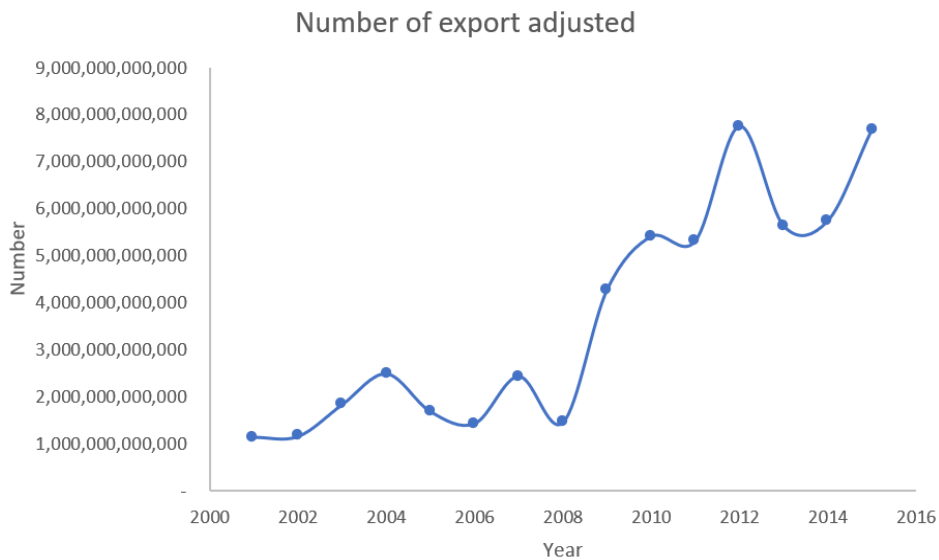


Figure 1. Number of export apparel industry.

Based on the previous study, the increase in exports led to feminization. The data above shows that the number of exports adjusted by inflation in Indonesia's apparel industry has increased in the past fifteen years. To see if previous studies have also occurred in the current study, we need to look at the female share of employment in the Indonesian apparel industry in Figure 1.

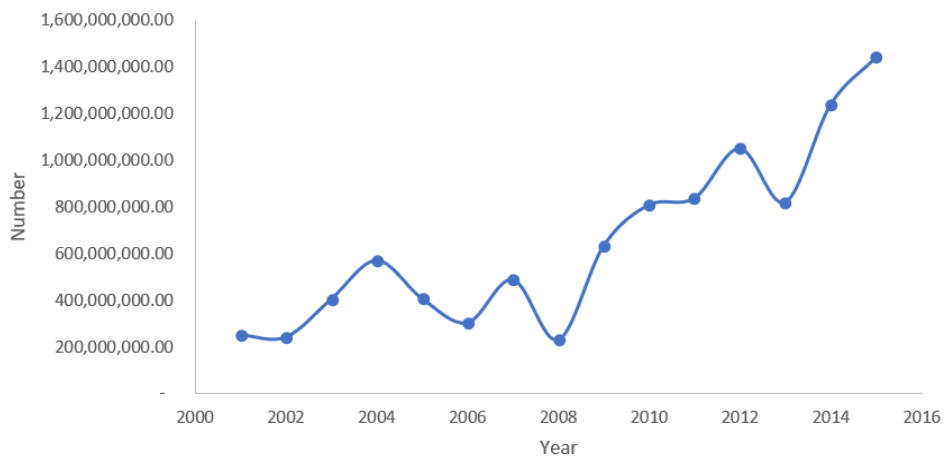


Figure 2. Vertical specialization.

Based on the study explained above, Figure 2: Vertical Specialization can explain the implementation of the GPN framework. So, this study will use that, using data on imported intermediaries, gross output, and total exports over the year. Based on the data, the result shows that Vertical Specialization for fifteen years is increasing. Meaning that over the past fifteen years, although the number of firms doing GPN has been relatively stable, the increase in Vertical Specialization shows that the Indonesian apparel industry is more integrated into the GPN framework of the apparel industry.

Labor overview and feminization is a concept that looks at the changing demographics of the labor force and the increasing number of women entering the workforce. It examines the impact of this shift on the labor market, including the implications for wages, job security, and working conditions. It also looks at the impact of this changing labor force on the economy, including the effects on economic growth and the labor market. Finally, it looks at the implications of this shift for gender equality, including the potential for increased workplace discrimination against women.

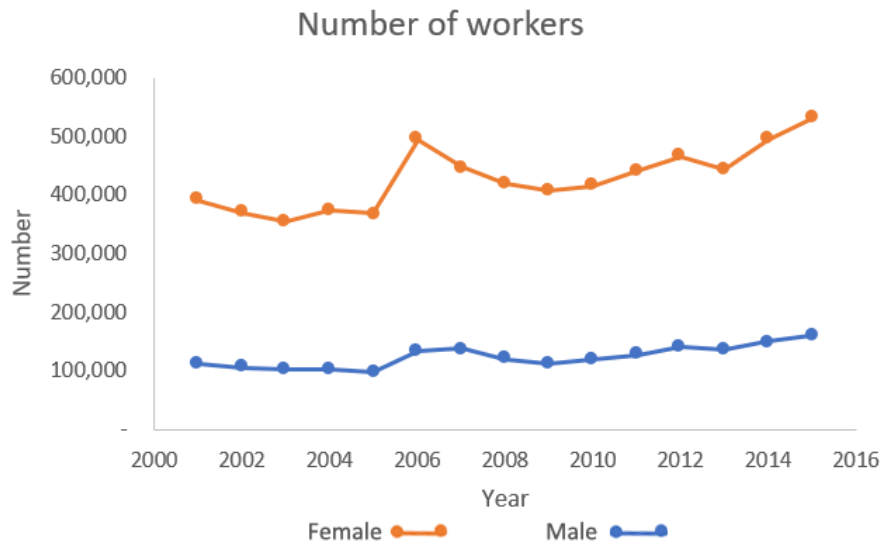


Figure 3. Total workers of Indonesia apparel industry.

The data Figure 3 shows an overview of the condition of labor proportion based on gender in the Indonesian apparel industry; the orange line is female workers, and the blue line is male workers. The data presented in the graph shows that the orange lines, which represent the number of women workers, far exceed the blue lines, which represent the number of men workers. This suggests that women make up a sizable portion of the workforce in this sector, which is consistent with the previous study's findings. The presence of women in this industry is essential to its success, as they make up the majority of the workforce. Women bring a unique set of skills, experience, and perspectives that are invaluable to the industry. The industry relies heavily on the dedication and hard work of its female workers, and their contributions are invaluable. Women are essential to the success of the industry, and their presence is essential to its continued growth and success.

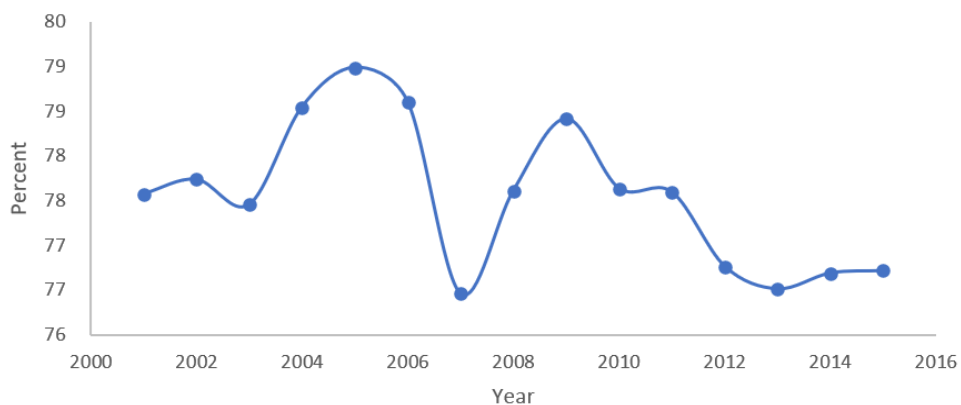


Figure 4. Female percentage of total employment.

The percentage of female employment has fluctuated since 2000 until now. However, the number of female employees is more than 76% of the total workers, as shown in Figure 4. In terms of the female share of total employment, or feminization, in Indonesia's apparel industry, the data shows that in fifteen years, the trend of feminization has decreased over the years. This result is contrary to the previous study (Ozler, 2000), which states that the increase in export led to feminization. But the results that we found can strengthen the argument (Joekes, 1995), which states that maybe there are inverse results about feminization. There are a number of causes for the declining female employment share. As explained above by Çağatay and Özler (1995), a process of de-feminization can result from the adoption of techniques that require more "skilled" labor or greater mechanization. So, we'll examine whether greater mechanization or an increase in skilled laborers is to blame for the de-feminization.

Skilled labor uses highly trained workers to complete tasks and produce goods. This type of labor requires a high level of expertise in a particular field and is often more expensive than labor that does not require specialized training. Greater mechanization, on the other hand, is the use of machines to automate processes and complete tasks. This type of labor is often cheaper than skilled labor but can be more efficient and less prone to human error. Both skilled labor and greater mechanization have their advantages and disadvantages and can be used to achieve different results.

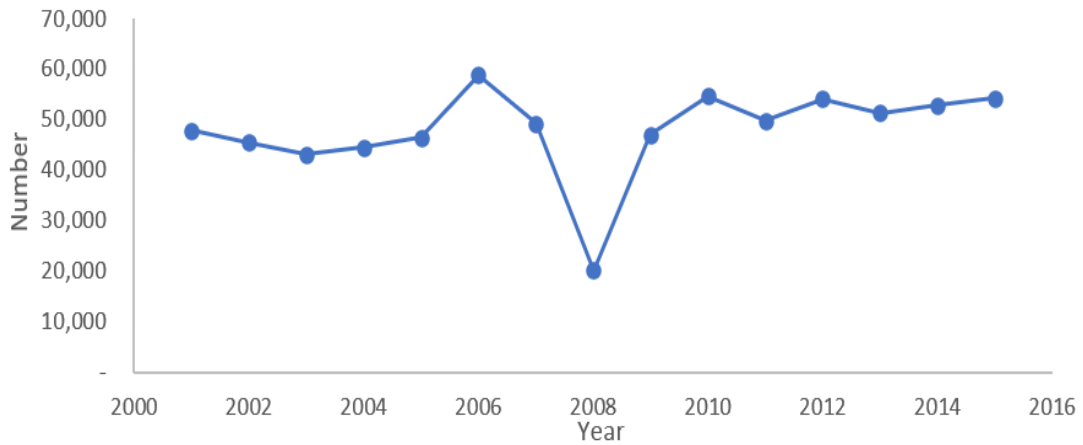


Figure 5. Number of skilled workers.

From the data in Figure 5, the results show that in fifteen years, the trend of the number of skilled workers has increased. The skilled workers here are those categorized as non-production workers based on (Ozler, 2000) paper. Therefore, we can conclude that the de-feminization phenomenon is a result of the growing number of skilled workers in the Indonesian apparel industry. Another cause of de-feminization is greater mechanization. To prove the greater mechanization, this study will use the data variable "fixed capital." This study assumes that the use of fixed capital is directly proportional to the use of machinery in this industry, so we assume these data variables can show the trend of mechanization in this industry.

Fixed capital is a term used in economics to describe capital that is used in the production process and remains in the same form over time. It is also known as fixed assets or tangible capital and includes items such as machinery, buildings, and equipment. Fixed capital is an important component of a company's capital structure, as it is used to generate income and increase productivity. In addition, it can also be used to finance long-term projects, such as research and development, or to purchase new assets. Fixed capital is typically financed through long-term debt or equity and is often used to finance the acquisition of new assets.

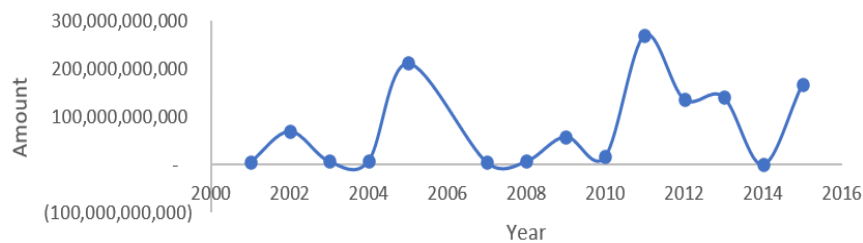


Figure 6. Fixed capital.

From the data in Figure 6, the results show that in fifteen years, the fixed capital in this industry has shown an increasing trend. Fixed capital in this data includes the number of machines and equipment used in this industry. Based on the increase in skilled workers and fixed capital, over the past fifteen years, there have been greater mechanization phenomena that led to de-feminization in Indonesia's apparel industry. Over the past fifteen years, Indonesia's apparel industry has seen an increase in the number of skilled workers and fixed capital, leading to a

greater mechanization phenomenon. This has resulted in a de-feminization of the industry as more men are employed in the production of goods. The industry has experienced greater productivity and efficiency as a result of the increased availability of mechanized equipment, which has driven this shift. As a result, women have been pushed out of the industry in favour of men, who are better able to operate the machinery. This has had a significant impact on the gender dynamics of the industry, with fewer women employed in the sector than in the past.

Specialization is an economic concept that describes the process of a business focusing on one specific area of production. This specialization allows businesses to focus their resources on a single product or service, allowing them to become experts in that particular area and gain a competitive advantage. By specializing in a specific product or service, businesses can become more efficient and productive, leading to increased profits. Vertical Specialization can also lead to increased innovation, as businesses can focus their resources on developing new products or services. Additionally, Vertical Specialization can lead to increased market power, as businesses can control the supply of their product or service, allowing them to have greater influence over pricing.

As explained before, the vertical specialization variable has two possible signs after the regression process. It is the export in the vertical specialization that makes the variable have two possible relationships with the female share of employment in Indonesia's apparel industry. The other independent variable is the control variable. The share of skilled workers variable has a negative relationship with the female share of employment. The higher share of skilled workers in the industry means that the female share of employment in the industry would be lower. The previous study also found that female workers are concentrated in firms with a "low-skilled" worker composition compared to firms with a "high-skilled" worker composition (Ozler, 2000).

The wage for production and non-production variables has a significant negative relationship with the female share of employment. This is supported by a previous study that found female workers would have high intensity in firms that paid less than females (Tager, 2016). The fixed capital variable is hypothesized to have a significant negative relationship with a female share of employment. It means that the higher fixed capital a firm has, the lower the female share of employment in those firms. This is supported by a previous study that found the increase in export orientation may lead to de-feminization caused by greater mechanization (Çağatay & Özler, 1995).

After conducting a panel regression to find out the effect of the implementation of the Global Production Network (GPN) using the "Vertical Specialization" framework on the feminization phenomenon as well as with several control variables such as the share of skilled workers (SKILLED) wages for production workers (WGP) and nonproduction (WGNP) and fixed capital ownership estimates (FIXCAP) with models.

The number of observations is 6.509, from 436 firms. This regression uses a fixed effect based on the Hausman test, wherein the initial results of this model have heteroscedasticity and autocorrelation. Because of these diseases, we used the Generalized Least Square (GLS) method to cure this model of both diseases. Based on the result, log-likelihood = 16.83972, Wald-chisquare= 222.58, probability= 0.000, it can be concluded that together the independent variables significantly affect the dependent variable in Equation 3.

Equation 3. The Result of Fixed Effect:

$$FEM_{i,t} = 0.68 - +0.131VS_{i,t} - 0.0373SKILLED_{i,t} - 0.24\log(WGP_{i,t}) + 0.0678\log(WGNP_{i,t}) + 0.00368FIXCAP_{i,t} + \varepsilon_{i,t} \quad (3)$$

GPN, represented by "Vertical Specialization" has a positive and significant relationship with the phenomenon of feminization. This indicates that the increased integration of the GPN tends to employ female workers, thereby increasing the share of female workers in the industry. This means that over the last 15 years, the more integrated the Indonesian apparel industry is into the GPN, the more this feminization phenomenon has occurred. The wage variable for production workers and the share of skilled workers have a negative and significant relationship to the phenomenon of feminization. This means that the phenomenon of feminization is higher in industries with low wages for production workers. Then the phenomenon of feminization occurs in industries where the composition of workers is more "low-skilled". If these two variables have a negative relationship with the phenomenon of feminization, then

if there is an increase in these two variables, the phenomenon that occurs is de-feminization. Meanwhile, the estimated fixed capital ownership does not have a significant effect on the feminization phenomenon. This shows that in the last 15 years in the Indonesian apparel industry, the phenomenon of de-feminization caused by the adoption of technology represented by fixed capital has not occurred in this industry.

Table 1. Result of panel regression.

Variables	Coef.	P value
Vertical specialization	0.131***	0.009
Share of skilled workers	-0.037***	0.000
Wage for production workers	-0.240***	0.026
Wage for non-production workers	0.068***	0.013
Fixed capital	0.004	0.728
Constanta	0.680***	0.000

Note: *** significant at 5%.

The result in [Table 1](#) shows that vertical specialization is statistically significant with a positive sign after it was controlled by other variables, which means that the increase in the value of vertical specialization shows the degree of integration in GPN. Therefore, the increasing value of vertical specialization shows the degree of integration in GPN. Therefore, the increasing value of vertical specialization means that Indonesia's apparel industry is more integrated into GPN. When the industry is more integrated into GPN, firms in this industry tend to have a high frequency of global trade activities. Moreover, the regression results on the relationship between GPN and female share of employment do not follow the argument by [Joeques \(1995\)](#) and [Sundaram \(2009\)](#), who stated that de-feminization still happens despite the structure of the industry. It also violates the argument stated by [Çağatay and Berik \(1991\)](#) that in export-oriented industries, de-feminization can occur. However, the earlier study ([Baylies & Wright, 1993](#)), which argued that the apparel industry's dependence on female workers is undeniable, supports the findings of this study. Therefore, when the apparel industry is integrated into GPN, it will require female workers to generate more production outputs to fulfill global trade activities. The other study stated that firms with international linkages, on the other hand, are more likely to hire a larger share of female workers ([Shepherd & Stone, 2013](#)). To summarize, previous studies show that the international linkage, or in this case, GPN, tends to hire female workers. Therefore, we can conclude that the more integrated the industry is on GPN, the more the female share of employment will not decrease, or, in other words, the intensity of female workers in Indonesia's apparel industry will not fall as well. De-feminization would not occur in this condition. Something similar happened in India. Economic globalization in India has led to the restructuring of global production processes. Of course, this also causes a decline in women's participation in the formal and private sectors. The lack of labor or labor standards in Indian zones makes migrant workers more vulnerable and subject to discrimination due to being denied the basic right to work ([Prasad, 2018](#)). The problem that still exists in the results of this regression is the effect of wages on non-production workers, which is significant but has the opposite direction or relationship from the findings of the reference study that I used. I still haven't found another reference journal as a basis for why wages for non-production workers have a positive relationship with this feminization phenomenon.

5. CONCLUSION AND RECOMMENDATION

The idea of the study came from the theory that export-oriented industries cause two possible phenomena: feminization and de-feminization. Besides that, the theory about the industry with international linkage—in this case, GPN—has an impact on the intensity of female workers, which is also the background of this study. From the two theories, this study attempted to observe the impact of GPN on the intensity of female workers in Indonesia's apparel industry. This study aims to see the feminization phenomenon in the Indonesian apparel industry in fifteen years using the data from the Medium/Big industry survey by Statistics Indonesia. Using descriptive analysis data, the

results show that Indonesia's apparel industry in fifteen years showed decreasing trends that led to the de-feminization phenomenon. De-feminization phenomenon is a term used to describe the process of women being excluded from certain occupations or roles in society. This phenomenon has been observed in many different countries and cultures, and it can take many forms. For example, some countries may have laws that prevent women from working in certain positions or industries, while in other countries, women may be discouraged from working in certain positions or industries through social norms or expectations. Additionally, women may be excluded from certain roles due to their gender, such as not being allowed to serve in the military or not being allowed to become priest. This phenomenon can have a significant impact on women's economic opportunities as well as their ability to participate in society. The de-feminization phenomenon is caused by the increasing number of skilled laborers and greater mechanization in this industry, which was shown by increasing the number of skilled laborers and increasing fixed capital used. In conclusion, in Indonesia, the apparel industry has shown a de-feminization phenomenon over the past fifteen years. If we look further, the absence of de-feminization in Indonesia's apparel industry is a positive phenomenon. In order to prevent a high unemployment rate in Indonesia, the industries must absorb as many of the country's large female workforces as possible. De-feminization could cause low absorption of the female workforce. However, the result of this study showed that there is an absence of de-feminization, which means that the absorption of the female workforce in Indonesia's apparel industry is not decreasing and could still be maximally absorbed.

The effects of the absence of de-feminization on Indonesia's apparel industry on the country's economy need to be investigated further; however, previous studies have found this condition to have a positive impact (Aguirre, Hoteit, Rupp, & Sabbagh, 2012), which stated that the absence of de-feminization contributes to the increase in GNP. This has been the case for the United States, Japan, the United Arab Emirates, and Egypt. This happens because the female would prefer to spend household income on education for her children. Therefore, the country's future generations would grow into skilled and educated workers.

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Data Availability Statement: The corresponding author can provide the supporting data of this study upon a reasonable request.

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