

Empowering Women Through ICT: Enhancing Employment Opportunities in Vietnam

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Abstract:

This research examines the impact of ICT development on female labor market outcomes in Vietnam, drawing insights from four waves of the nationally representative Vietnam Household Living Standard Surveys spanning from 2012 to 2018. By capitalizing on the variance in ICT development levels among provinces as an exogenous factor, fixed effects models are employed to analyze the data. Our findings underscore that a 10 percent enhancement in ICT accessibility correlates with a notable increase in contract job opportunities, particularly benefiting married women, low-educated married women, and married women from minority ethnic backgrounds. These results affirm the positive role of ICT development in bolstering the local labor market and facilitating improved job matching for vulnerable women across Vietnam.

Keywords: VHLSS, ICT, Female Employment, Vietnam, Contract Job

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1. Introduction

The active participation of women in the workforce is crucial for fostering inclusive growth and achieving sustainable development objectives. Increased female involvement in the labor market leads to more responsive economies and contributes to poverty reduction by expanding household income and consumption (Galperin et al., 2022; Verick, 2018). However, despite its potential contributions to inclusive economic growth, women often encounter barriers that hinder their entry into the labor market and access to formal employment, often relegating them to informal or part-time work due to entrenched traditional gender roles (Hong, 2016).

In recent decades, there has been a growing recognition of information and communication technology (ICT) as an effective tool for stimulating economic and social development, creating various economic activities, job opportunities, and enhancing societal networking (Gonzalez-Rozada & Ruffo, 2016; Jorgenson & Vu, 2016). ICT plays a vital role in achieving global sustainable development goals by making the labor market more flexible, transparent, innovative, and inclusive, particularly for marginalized groups like women. Although ICT is acknowledged as a potential driver of economic growth and socio-economic development, its impact varies across regions and countries.

While previous literature has shown that ICT enhances labor productivity, stimulates economic growth, and influences the labor force in developed countries (Czernich et al., 2011; Edquist et al., 2018; Sinha & Sengupta, 2022), its implementation in developing countries is still relatively limited. This is due in part to the substantial public investment required to scale up ICT infrastructure (Appiah-Otoo & Song, 2021), which may hinder research efforts in these contexts. Given the heterogeneity of ICT deployment across countries with varying levels of economic development, research on the impact of ICT expansion in developing countries is essential. This

study addresses this gap by investigating how ICT deployment affects female labor outcomes in developing countries like Vietnam.

In developing countries, where vulnerable populations often struggle with economic welfare, improving the socio-economic environment is a significant policy concern, with recent developments in ICT playing a crucial role. Our study specifically focuses on women's job security, recognizing it as a fundamental determinant of a better life, and examines how environmental changes in ICT infrastructure contribute to its enhancement. By examining variations in ICT development over time and across provinces in Vietnam, we aim to understand its impact on women's employment outcomes. Using panel data from the Vietnam Household Living Standard Surveys, we employ a fixed effects model as our methodological approach and find robust evidence that ICT increases the number of secure jobs with contracts for low-educated women and women from minority ethnic groups.

This study contributes to existing knowledge in two key ways. Firstly, by examining the development of ICT over time and across provinces, it offers insights into the implications of ICT for women in both developing and developed countries, which is essential for informing policies aimed at promoting economic gender inclusion. Secondly, in addition to traditional measures of labor participation, this study investigates the impact of ICT development on contract jobs, providing a more comprehensive understanding of how ICT influences the female labor force in Vietnam.

The paper is structured as follows: Section 2 reviews relevant literature on ICT and women's employment outcomes in Vietnam, Section 3 describes the dataset and methodology, Section 4 presents and discusses the results, and the final section provides a summary.

2. Background

2.1. Literature on the effect of ICT development on female labor force outcomes

In recent decades, there has been a significant increase in both the accessibility and utilization of ICT, leading to a rapid transformation in connectivity. Despite this surge, there remains a notable scarcity of studies examining the impact of ICTs on labor market dynamics, particularly concerning women.

Internet connectivity plays a crucial role in enhancing women's engagement and employment in the labor force. Research by Billari et al. (2019), using German panel data, reveals that broadband access notably increases work time flexibility. Similarly, Dettling (2016) in the United States finds that high-speed internet usage leads to increased labor force participation among married women, especially those with college education, largely due to telework and time-saving in household tasks.

Evidence from low- and middle-income countries mirrors the findings from high-income nations. Dell'Anno & Solomon (2014) report in their study of 16 transition economies that the benefits of ICT on business performance are more pronounced for highly skilled workers. Chun & Tang (2018) investigate the impact of the gradual liberalization of broadband internet in Vietnam from 2006 to 2009 and find that ICT significantly influences firm-level female employment, especially among college-educated workers and industries reliant on manual and physical tasks. Similarly, Chen et al. (2020) observe in Chinese firms that high-speed internet adoption leads to increased productivity and wages, particularly in industries with high skill intensity and educated workers. Studies in Indonesia demonstrate that internet access increases the likelihood of women securing full-time employment, particularly for those with lower levels of education (Kusumawardhani et al., 2021).

This study distinguishes itself from previous research by examining the evolution of ICT over time and across provinces, with a specific emphasis on its implications for women, crucial for informing policies promoting economic gender inclusion. To gain a comprehensive understanding of how ICT growth affects the Vietnamese labor force, this study investigates both traditional labor participation measures and a novel indicator, contract jobs. Moreover, this study is one of the few to explore the relationship between ICT advancement and outcomes for women in the Vietnamese labor force at the household level, offering valuable insights into how ICT progress can enhance women's workforce participation.

2.2. Background in Vietnam

In Vietnam, the field of Information and Communication Technology (ICT) has witnessed remarkable progress since its initial national introduction. Following the legalization of internet access in March 1997 through degree 21/CP, the uptake of the Internet among the Vietnamese population was modest, with only 0.25% subscribing by 2002 (Poole et al., 2017). However, as indicated in a 2020 World Bank report, it was projected that by 2022, approximately 70% of the population would be internet users, exceeding the global average of 60%. The Vietnamese government has played a crucial role in nurturing the growth of ICT over the past three decades, contributing significantly to its rapid development and establishing it as a vital driver for economic progress.

In recent years, Vietnam has introduced several significant directives aimed at bolstering ICT expansion. Notably, Decision No.1755/QĐ-TTg, issued on 22 September 2010, outlined the country's aspirations and objectives for becoming a leading ICT nation by 2020, focusing on four key pillars: ICT Infrastructure, ICT Application, ICT Human Resources, and ICT Industry. This initiative served as the foundational framework for the nationwide implementation of ICT. Firstly,

the national ICT infrastructure has been extensively developed and expanded to cover a wide geographic area. The telecommunications network now encompasses over 1 million kilometers of fiber optic cables reaching villages, communes, and wards across the nation (Ministry of Information and Communications, 2021). The quality of information technology and infrastructure has seen rapid enhancement, with robust broadband systems in place. Vietnam ranks 42nd out of 100 countries in the Inclusive Internet Index, reflecting its accessibility, affordability, relevance, and readiness for internet usage (The Economist, 2018). The average download speed has surpassed 6.9 Mbps, positioning Vietnam 75th out of 200 countries, outpacing regional counterparts like Indonesia (5.8 Mbps) and the Philippines (5.2 Mbps) (Cameron et al., 2019). The number of fixed broadband subscribers approached nearly 13 million in 2018, with approximately 12.5 million enjoying speeds exceeding 10 Mbps (Ministry of Information and Communications, 2020). Mobile network coverage has also expanded significantly, with 3G and 4G waves reaching 99.7% of the population by 2018 (Ministry of Information and Communications, 2019). Internet subscription rates have surged, surpassing 75 million subscribers, including both landline and mobile users, with 61 million being internet subscribers (Ministry of Information and Communications, 2019), surpassing both regional and global averages (World Bank, 2020).

Secondly, the government has actively promoted the adoption of ICT within its own institutions as well as in the private sector. As part of its transition towards a digital government, internal information networks and information technology utilization have been encouraged within leading agencies of the Party, State, Ministries, Central Agencies, as well as enterprises; with over 44% of private sector firms having websites (Ministry of Information and Communications, 2019).

3. Materials and methods

3.1. Data and variable definitions

This study utilizes data from the Vietnam Household Living Standard Surveys (VHLSS) conducted biannually in 2012, 2014, 2016, and 2018. These surveys are carried out by the General Statistics Office of Vietnam (GSO), with technical support provided by the World Bank. They encompass a wide range of information on individuals and households, covering basic demographics, employment status, and participation in the labor force. For the scope of this study, our focus is specifically on married women aged between 18 and 55 years, who fall within the employable age range.

Information regarding households' adoption of ICT is sourced from the 'Report on assessing and ranking the readiness level for IT development and application in Vietnam – Vietnam ICT Index', compiled collaboratively by the Ministry of Information and Communications and the Vietnam Informatics Association. The ICT index is computed based on various factors, encompassing technical infrastructure, human resources, applications, manufacturing and business capabilities, organizational aspects, and policy environment.

Data concerning provincial characteristics are collected from various reliable sources. Employment-related data, including the unemployment rate, are extracted from the 'Report of Labor and Employment' conducted by the GSO. Moreover, information on government revenues at the provincial level is gathered from the Ministry of Finance of Vietnam.

To explore the impact of ICT on wives' employment status, we calculated two primary indicators. Firstly, we establish a binary variable labeled 'having a job', assigning '1' if the wife is employed and '0' otherwise. Subsequently, we derive a dichotomous variable denoted as 'having

a contract job’, where ‘1’ signifies the wife having employment with a labor contract, and ‘0’ denotes otherwise.

The descriptive statistics are outlined in Table 4.1, illustrating that on average, approximately 81.4% of wives were employed, with 47% holding contract jobs. Furthermore, around 56.7% of households resided in rural areas.

Table 1: Descriptive statistics

	Mean	Standard Deviation
ICT Index	0.47	0.13
Wife has job	0.81	0.39
Wife has contract job	0.47	0.50
Living in rural area	0.57	0.50
Women’s age	40.41	8.21
Women’s educational level	2.08	1.36
Wife’s income (thousand vnd)	45021.02	39743.32
Log of wife’s income	8.84	4.06
Husband’s age	43.59	8.55
Husband’s educational level	2.04	1.311
Husband’s income (thousand vnd)	50639.54	53738.26
Log of husband’s income	7.92	4.91
Household size	4.04	1.15
Ratio of dependent people in household	0.27	0.21
Log of value of total assets	10.36	1.18
Unemployment rate at province level	2.75	3.75
Population density at province level (person/km ²)	789.89	958.51
Log of government’s revenue at province level	16.03	1.61

Notes: This is descriptive statistics for the main estimation sample. The number of the observations is 5,406.

3.2. Identification strategy

In this study, we used a fixed-effects regression to measure the effect of ICT development at the provincial level in Vietnam on married females. Specifically, we assumed the following function:

$$Y_{ijt} = \alpha_0 + \alpha_1 ICTIndex_{jt} + \alpha_2 X_{ijt} + \alpha_3 D_{jt} + \phi_{ij} + \lambda_{jt} + \varepsilon_{ijt} \quad (1)$$

where Y_{ijt} is the labor market outcome variable of individual i in province j in year t , including job status and contract job; X_{ijt} refers to characteristics of wife/husband, and household, including their age, their educational level, their logarithm of income, rural status, household size, the proportion of dependent people in the household, and logarithm of the total value of assets; D_{jt} is a vector of characteristics of the province, including revenue, population density, and unemployment rate; ϕ_{ij} refers to individual fixed effects, that is, time-invariant family heterogeneity such as women's career motivations and socio-economic characteristics; λ_{jt} are provincial time trends; and ε_{ijt} are error terms.

4. Results and discussions

4.1. Effects of ICT on wives' outcomes

In this section, we delve into the findings derived from estimating the effects of the ICT index on the employment outcomes of both wives and husbands. Table 2 reports the outcomes of fixed-effects regressions, delving into the correlation between ICT development and job status, encompassing contract jobs, for both wives and husbands.

Panel A presents the results for wives. Our analysis highlights an intriguing trend: although the impact of ICT on the likelihood of securing a job seems negligible, it distinctly influences the acquisition of a contract job. Specifically, the coefficient suggests that a 10 percent increase in ICT is associated with a noteworthy increase in the probability of obtaining a contract job by 2.5

percentage points. Moving to Panel B, we examine the effects of ICT development on husbands' employment outcomes. Similar to the findings observed for wives in Panel A, we find no significant impact of ICT development on men's job status. However, there is a notable effect on men's contract jobs. A 10 percent enhancement in ICT is linked to a 2 percentage point increase in job contracts.

Table 2: Effects of ICT on wife's employment outcomes

	Having a job	Having a contract job
Panel A: Effects of ICT on wife's employment outcomes		
ICT Index	-0.058 (0.123)	0.287** (0.137)
Observations	5,406	5,406
R ²	0.077	0.077
Number of households	3,618	3,618
Panel B: Effects of ICT on husband's employment outcomes		
ICT Index	-0.032 (0.076)	0.203* (0.107)
Observations	6,587	6,587
R ²	0.055	0.064
Number of households	3,618	3,618

Notes: All regression controls for wife's characteristics, husband's characteristics, household characteristics, provincial characteristics, and province specific time trends. Standard errors clustered at the provincial level are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A crucial assumption of the fixed-effects model is that the trajectory of labor market outcomes in provinces with varying degrees of ICT development would be the same without ICT. However, provinces with higher levels of ICT development have different characteristics than those with lower levels of ICT development. Improved ICT development is associated with better

job results. These provinces possibly had a better job growth pattern before ICT development, which may have driven the link between ICT and employment. To overcome this, we estimated fixed-effects models using a variety of time-trend variables.

Table 3 presents the ICT coefficients along with various time trend variables incorporated into the model for both wives' and husbands' employment outcomes in Panels A and B, respectively. Columns (1) through (5) introduce different linear time trend components, none of which alter the primary coefficient of interest. Column (1) incorporates state time trend variables, while Column (2) includes employment growth time trends. Notably, the magnitude of the ICT coefficient remains largely consistent across these different time trend components.

Table 3: Robustness check

	(1)	(2)	(3)	(4)	(5)
Panel A: Effects of ICT on wife's employment outcomes					
A. Having a job	0.093 (0.088)	0.106 (0.094)	0.080 (0.097)	0.065 (0.098)	0.094 (0.087)
B. Having a contract job	0.266** (0.109)	0.264** (0.110)	0.238** (0.103)	0.273** (0.112)	0.273** (0.109)
Panel B: Effects of ICT on husband's employment outcomes					
A. Having a job	-0.042 (0.054)	-0.041 (0.054)	-0.036 (0.055)	-0.047 (0.055)	-0.041 (0.053)
B. Having a contract job	0.154** (0.064)	0.165** (0.079)	0.198** (0.078)	0.192** (0.074)	0.191** (0.074)
Region × Time	Yes	No	No	No	No
Population Density × Time	No	Yes	No	No	No
Employment Growth × Time	No	No	Yes	No	No

Income × Time	No	No	No	Yes	No
Year Trend	No	No	No	No	Yes

Notes: All regression controls for wife’s characteristics, husband’s characteristics, household characteristics, provincial characteristics, and specific time trends. Standard errors are clustered at province level. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.2. Heterogeneous analysis

We investigate whether the observed effects vary among married women and men with different characteristics, as depicted in Panel A and Panel B of Table 4, respectively.

In Panel A, we initially conduct separate regressions based on female education levels. A binary variable indicating a low education level is set to ‘1’ if a woman has less than upper secondary schooling and ‘0’ otherwise. Our estimations in Columns (1) and (2) reveal that ICT development does not yield statistically significant effects on job status for either group. However, it does enhance job contracts for low-educated women while having no impact on their counterparts. Additionally, we explore whether the effect of ICT development varies based on the ethnicity of women. Columns (3) and (4) present the findings, indicating similar patterns to our main results in Table 2. However, the magnitude of ICT development on women’s job contracts is more pronounced for the minor ethnic group compared to the Kinh group. We further rerun our regression for women employed in non-agricultural settings. In Column (5), the results mirror the patterns observed in the main findings presented in Table 2.

Additionally, we re-estimate the main regression for men to ascertain whether the findings differ according to men’s backgrounds in Panel B. These results diverge from those obtained for women. The expansion of the regional ICT environment enhances the likelihood of securing contract jobs for highly educated men, those from the Kinh group, and those employed in the non-agricultural sector.

Table 4: Heterogeneous effects of ICT development on wife/husband's labor force outcomes

	Low Education (1)	High Education (2)	Minority Group (3)	Kinh Group (4)	Non-agricultural workplace (5)
Panel A: Wife's outcomes					
A. Having a job	-0.198 (0.186)	0.187 (0.125)	0.364 (0.467)	-0.123 (0.122)	-0.049 (0.194)
B. Having a contract job	0.305* (0.169)	0.304 (0.250)	0.837** (0.343)	0.288** (0.140)	0.411** (0.174)
Observations	3,285	2,121	536	4,870	2,312
Number of households	2,312	1,386	399	3,240	2,707
Panel B: Husband's outcomes					
A. Having a job	-0.143 (0.104)	0.046 (0.112)	-0.040 (0.133)	-0.053 (0.082)	0.045 (0.146)
B. Having a contract job	0.156 (0.121)	0.434* (0.236)	0.240 (0.230)	0.221* (0.129)	0.688*** (0.206)
Observations	4,287	2,300	779	5,808	3,848
Number of households	2,865	1,546	550	3,778	2,707

Note: Low education group include people whose education level is less than upper secondary level. Non-agricultural workplaces include independent production and business households, collective, private, state-run and foreign-invested organization. All regression controls for wife's characteristics, husband's characteristics, household characteristics, provincial characteristics, and specific time trends. Standard errors clustered at the provincial level are shown in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

4.3. Interpreting the results: why does ICT development enhance contract jobs?

The findings of this study affirm that ICT development plays a significant role in enhancing contract jobs, particularly for low-educated women and women from minor ethnic groups. These

results open up avenues for exploring the various pathways through which ICT deployment influences contract jobs.

On the labor demand side, the evidence suggests that the expansion of firms and capital leads to increased job opportunities. As depicted in Columns (1) and (2) of Table 5, ICT development is shown to have a significant impact on the number of firms and capital expansion. While the significance levels are 13.4% and 14.1% for the number of firms and capital, respectively, these findings imply that ICT development contributes to the proliferation of firms and capital, thereby fostering the creation of new employment opportunities.

Turning to the labor supply side, Columns (3) and (4) of Table 5 reveal that ICT development correlates with increased mobile phone usage among low-educated women and women from minor ethnic backgrounds. By embracing ICT advancements and leveraging mobile phone technology, these demographic groups can readily access the internet, thereby gaining access to a plethora of opportunities. Existing literature corroborates this association, as studies conducted in developing countries like South Africa (Klonner & Nolen, 2010), Nigeria (Aker, 2011), and Peru (Guerrero Barreto & Ritter Burga, 2014) have demonstrated the positive impact of mobile phone usage on employment outcomes, further bolstering the link between mobile phone adoption and improved employment prospects.

Table 5: Paths that ICT development enhances the likelihood of having a contract job

	Number of firms (1)	Capitals (2)	Mobiles (*) (3)	Mobiles (**) (4)
ICT Index	8815.00 (5885.70) [0.134]	641208.4 (435906.5) [0.141]	0.181 (0.120) [0.130]	0.901* (0.500) [0.074]
Observations	3171	3171	1758	249

Notes: (*) refers to the regression for only low-educated group and (**) refers to the regression for only minor ethnic group. All regression controls for wife’s characteristics, husband’s characteristics, household characteristics, provincial characteristics, and specific time trends. Standard errors are clustered at province level and presented in parentheses. p-value is displayed in square brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Ultimately, ICT development appears to have improved the job matching process in Vietnam. Although our study faces data limitations, we see positive trends in job creation within several economic sectors between 2012 and 2018 (Table 6). Notably, the manufacturing sector and accommodation/food service activities show growth in both firms and workers. This expansion, fueled in part by textile and shoe outsourcing, creates many routine, low-skill jobs. The increased demand for workers, especially women, likely leads to a higher rate of job contracts for women – suggesting they're becoming better integrated into the labor market.

Table 6: Number of firms and workers in different sectors in 2012, 2014, 2016, and 2018

		2012	2014	2016	2018
Agriculture, forestry, and fishing	Number of firms	3308	3656	4447	6844
	Numbers of workers	269116	264485	250835	258002
Mining and quarrying	Number of firms	2545	2590	2702	3495
	Numbers of workers	202940	195664	171908	160069
Manufacturing	Number of firms	52587	58688	75351	96715
	Numbers of workers	4990858	5807577	6758015	7303704
Accommodation and food services activities	Number of firms	13137	15010	18717	22644
	Numbers of workers	246948	285885	337900	370180

Source: Statistical Yearbook 2012, 2014, 2016 and 2018

5. Conclusions

This study investigates the impact of ICT development on female labor market outcomes throughout Vietnam, utilizing data from four rounds of the nationally representative VHLSS conducted in 2012, 2014, 2016, and 2018. Employing the development of ICT environment as an exogenous variable across provinces over time, we examine how the expansion of ICT infrastructure influences female employment. Our findings, derived from fixed effects models, indicate that a 10 percent enhancement in ICT correlates with an 8 percentage point increase in the prevalence of contract jobs for married women. Specifically, among low-educated married women, this increase is 3 percentage points, and among those with minor ethnic backgrounds, it is 8 percentage points. Furthermore, these findings remain robust across various data definitions and model specifications.

To shed light on these outcomes, we explore several underlying mechanisms. Our investigation uncovers that ICT deployment stimulates the establishment of firms and capital inflows, consequently driving up labor demand. Moreover, the development of ICT at the provincial level enhances the likelihood of labor market participation among low-educated women and individuals from minority backgrounds. This improvement is facilitated by increased mobile phone usage, which provides greater access to employment opportunities.

These findings carry important implications for policymakers aiming to promote gender equality and economic development in Vietnam. Firstly, the positive association between ICT development and female employment suggests that investment in ICT infrastructure should be prioritized as a means to stimulate job creation and facilitate women's access to employment opportunities. Policymakers should focus on expanding broadband connectivity and improving digital literacy among women, particularly those with lower levels of education and from minority

ethnic backgrounds, to ensure their inclusion in the digital economy. Furthermore, the observed increase in labor market participation among low-educated women and individuals from minority backgrounds in response to ICT development underscores the importance of targeted interventions to address disparities in access to technology and employment opportunities. Initiatives aimed at providing skills training and vocational education tailored to the needs of these groups can help enhance their employability and enable them to fully benefit from the opportunities offered by ICT. Additionally, the role of mobile phone usage in facilitating labor market participation highlights the importance of leveraging mobile technology as a tool for promoting women's economic empowerment. Efforts to expand mobile phone coverage and promote the use of mobile-based platforms for job search and skill development can help bridge the digital divide and empower women to actively engage in the labor market. In conclusion, the findings of this study underscore the critical role of ICT development in driving female labor market outcomes in Vietnam. By harnessing the potential of technology and implementing targeted policies to promote digital inclusion and skill development, policymakers can foster a more inclusive and equitable labor market that benefits women and contributes to overall economic growth and development.

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