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Impact of media technology on wage changes: The case of Thailand

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Abstract. This paper aims to examine the influence of time use for media technology access on wage changes by means of applying regression analysis. The results revealed a positive correlation between media technology access and wages. The nationwide popularity of social media use has becomes an opportunity for improving skills in using media technology related devices. The findings also addressed some other factors impacting wage changes. Age was positively correlated to hourly wages. With different backgrounds of education, occupations, industries and genders, workers possibly earn different wages. In order to stimulate higher wage rates, education and training in media technology-related skills are needed as a way to induce individual income. The findings also suggested to the promotion of skill-improving and edutainment activities, including those in individuals' spare time, because this can raise not only technology-based skills' level, but also happiness from more efficient use of media technologies and communication. If workers can raise productivity using media technology, they will receive greater wage rates and then can enhance their innovation capability further.

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1. INTRODUCTION

Rapid development in technologies nowadays has changed individual behaviour drastically and technology is playing an important role in human routines and activities. From the invention of telegraph, among the very first high-technological communication devices almost two centuries ago, to radio, television, VDO's, CD's, the Internet and the worldwide dissemination of social media nowadays, media technology continues to influence the world communications, business, society, lifestyles and time allocation. Integration of technological devices facilitates not only work activities, but also has brought about changes in time allocation by raising the proportion of time spent on media access through computers and other Internet devices.

Such media technology advances as the Internet, personal computers (PCs), smartphones, tablets and social media have all quickly become widely used among the Thais, from children to the elderly. Today Thai people allocate longer hours on accessing social media. This fact raises the question whether this changing time use is exerting a substantial impact on the changes in productivity and wages. This paper fills this research gap by studying the influence of time use for high-technology media access on wage changes in Thailand. As Thai people spend a lot of time accessing information through various devices, promoting the use of these media is a way to enhance labour productivity, reduce labour costs while producing goods and services, and stimulate innovations. The benefits from workers' skills' improvement can also induce greater individual income for the Thai people.

The objectives of this paper are: Firstly, to examine the impact of time used online, using various devices, on wages. Secondly, to find the relationship between changes in wages and other factors affecting wages of the Thai people. In the next section, Thai people's Internet media use and changes in their time allocated for Internet media access activities will be investigated. Then the impact of media perception on wage changes will be calculated by using regression analysis. In order to obtain accurate estimations, the nationwide collected Thailand's Time Use Survey data, will be employed. The result from this study will indicate whether time used on the internet media helps to raise people's wage rates. With these findings, recommendations will be formulated for individuals regarding media technology-related skills' improvement, and for policymakers regarding the promotion of Thai workers' skills in media technology. This is followed by limitations and recommendation for future studies.

2. LITERATURE REVIEW: MEDIA TECHNOLOGY, INDIVIDUAL TIME USE FOR MEDIA, PRODUCTIVITY AND WAGES

Information and communication technology have provided a greater variety of alternatives for both work and non-work activities because media use with high-technology devices enables information to be accessible from everywhere including the workplace, leisure sites, and one's homes. The drastic increase in media consumption explains the reason for the changes in individuals' time allocation. Media technology advancement has transformed not only work characteristics, but also people's leisure behaviour (Maibach, 2007), from simple leisure at home or outside to integrated-leisure-work activities. For example, checking for information updates about work in one's leisure time and spending time for entertainment by using social media technology devices (which possibly benefits work performance) during work hours (Lopez Sintas et al., 2015). The internet, representing ones of the popular media technology platforms, also has increased one's time use for other leisure activities.Social networking is notonly immensely popular among the young, but also with older groups. Individuals choose to use social media in order to obtain data for making decision regarding leisure activities, including travelling and recreation (for example, Wood et al., 2013; Ghandour, R. & Bakalova, 2014; Tran et al., 2017). This individuals' behaviour change affected by media access time use is found substantially impact their labour market, productivity and wage.

The relationship between media technology access and labour productivity is obvious. According to economic theory, firms pay labour costs at the amount based on labour productivity. The higher is the output produced, the greater are the wages that a worker earns. A number of empirical researches have confirmed the relationship between wages and productivity (for example, Bildirici, 2008; Feldstein, 2008; Mihaljek & Saxena, 2010; Rezaei et al., 2014; Abri & Mahmoudzadeh, 2015). Progress in media technology is expected to enhance labour productivity and the skills relevant to work, and improving productivity enables workers to earn higher wages and income.The use of media access, though various media, depending on the level of technology, also contributes to a positive change in labour productivity and

wages. One technological advancement in media, which has substantially impacted workers and has been argued to have brought about productivity improvement, is computer information technology. Organizations have heavily relied on communication through media technology devices since it can reduce costs and raise outputs andinformation technology had a positive direct effect on work process because it develops communication performance (Subriadi et al., 2013). This leads to an increase in employees' productivity. Media technology facilitates communication and causes the rapid flow of information and consequently enhances labour productivity through human capital development. (Gargallo-Castel & Galve-Gorriz, 2007). These findings correspond to Jorgenson et al.'s work (2007), which confirmed productivity growth in industries with more intensive use of information technology as the main medium for both communication and work.

Media technological progress has played a key role in all activities, including Internet communication and social networking. The internet has even facilitated communication by increasing the quality of communication, shortening time and reducing cost. As one of the most popular media technology devices in the world, the Internet has contributed to improvement of a variety of industries and has enhanced productivity by reducing transaction costs and increasing allocative efficiency in business. Moreover, Internet communication plays a crucial role in business and in the economy, culture, and society (Salahuddin & Gow, 2015; Johnson, 2016). This progress can be seen in the social media as the dissemination of social media does change people's communication platform. Mobile and PC applications for chats can now also be found in formal business communications. It has been confirmed that the media today are clearly driving effective collaboration between employees, leading to greater knowledge sharing and productivity increases (Ferreira & du Plessis, 2009). To work in the market productively, skills in social media access have become essential since businesses and organizations are applying the media technology as business tools. Firms are likely to employ media technology to a greater extent now for work because it has been indicated that labour could give more productivity by combining skills with media technology resources (Leftheriotis & Giannakos, 2014; Adzovie et al., 2017).

Besides media technology devices, there are a number of factors influencing wages. According to the Mincer Earnings Function (Mincer, 1974), education level also strongly influences productivity. Empirical studies have shown declare a clear positive relationship between level of education and wages, which stems from different skills in using technological devices (for example, Forbes et al., 2010; Valletta, 2015). Another interesting factor influencing wages, especially for the country with an increasing ageing population, is age. There has been concern whether productivity will decrease for firms with a larger share of old workers. Moreover, empirical research studies found the unconfirmed relationship between age and productivity (for example, Bertschek & Meyer, 2008; Van Ours & Stoeldraijer, 2010; Mahlberg, Freund, Cuaresma & Prskawetz, 2013).

In order to elaborate on how each of those factors causes changes in wages, this paper examines not only the effect of time use for media technology access on the hourly wages of Thai people, but also the impacts of other variables on wages.

3. TIME ALLOCATION FOR MEDIA TECHNOLOGY, PRODUCTIVITY, AND WAGES OF THAI PEOPLE

As mentioned, the advancement of communication through social media has impacted individual time allocation extensively. Thailand has also experienced dramatic growth in Internet users in the last decade. Table 1 illustrates the numbers of Thai internet users by age groups. The young at the age of 15 or above allocated the longest time for Internet access, compared to the older groups (National Statistical Office, 2017b). The number of Internet users in the last decade increased in every age range throughout the years.

This implies that there has been a rising trend in Internet media exposure of the Thais since the Thai people have gained more accessibility to multimedia. Teenagers were the group with the greatest rate of Internet access. However, people aged 35 and above possessed more than double the growth rate, indicating the higher popularity in Internet access for the elderly. Internet and social media communication have become popularized among both the Thai elderly and youngsters.

These changes in Thai people's behavior and time allocation raise the question how much of an impact the changing time use has on productivity. It has been argued that media technology advancement stimulates labor productivity.

Table 1

Number of Internet Users by Age Groups in Thailand (Selected Years)

Age/Year	2007	2010	2013	2016
15-19	2,860,389	3,561,664	3,801,827	4,248,553
20-24	1,326,579	1,673,500	2,180,208	4,009,189
25-29	982,509	1,443,857	1,849,606	3,673,246
30-34	727,679	1,182,792	1,685,169	3,378,074
35-39	550,786	916,039	1,328,287	3,078,040
40-49	762,083	1,292,261	1,723,326	4,154,477
50-59	359,387	580,546	983,901	2,146,781
60 and above	46,075	80,453	191,234	641,209
Total	7,615,487	10,731,112	13,743,558	25,329,569
Total Users Growth Rate (%)	-	40.91%	28.07%	84.30%

Source: Adapted from National Statistical Office. (2017b). Number of Internet users by age groups, whole kingdom: 2007-2016. Bangkok: National Statistical Office.

Thai people typically accessed the Internet through a variety of media technology devices. In the last decade, most people have accessed the Internet with their PCs. The progress in media technology and the development of social media have changed people's behavior by increasing the number of people choosing to allocate their time to access the Internet each year. Table 2 and Table 3 illustrate the number of smartphone users in Thailand, from 2012-2016 and the proportion of each Internet medium use activity respectively (National Statistical Office, 2017a). As can be seen, people use the Internet for both work and leisure.

Table 2

Percentage of Thai Smartphone Users in 2012-2016

Year	Percentage of Users
2012	8.0%
2013	14.8%
2014	26.4%
2015	37.9%
2016	50.5%

Source: Adapted from National Statistical Office. 2017a. Household Survey on the Use of Information and Communication Technology. Bangkok: National Statistical Office.

Smartphones, one of technology devices used for accessing various media, have become popular among the Thais because of their decreasing prices and there are various products offered in the market. The percentage of people using smartphones instead of traditional cell phones, is rising dramatically. With

more than a 10 percent increase annually, there were approximately 40 million and 50 million smartphones used among the Thais in 2015 and 2016 respectively. Thailand has become one of the countries with the highest growth rate of smartphone users, and this widespread smartphone use has accelerateed the rise of contemporary media technology access.

Table 3

Percentage of Thai Smartphone Users Categorized by Activities in 2012-2016

Activities	Percentage of Users
Social Networks	91.5%
Movie, Music & Downloading	88.0%
Uploading Data	55.9%
News and Information Updates	46.5%

Source: Adapted from National Statistical Office, 2017a.

Thailand is one of the countries with the highest rate of social media use, with more than 90% of Internet users regularly accessing social networks. People can update all news and information by using social networks through popular social media applications, for example, Facebook, Line and Twitter. Those applications provide news and updates through news agency web accounts and fan pages. Besides these, uploading data has become a way to share information and create relationship in social communities. The survey in Table 3 shows the large proportion of users for entertainment purpose, as shown by 88% using the media for movies and music.

The dramatic growth of Internet and social network access corresponds to changes in time allocation for Internet social media usage through technological devices. This behavior enhances the time allocation for accessing all media. The significant rise in time allocation for Internet and social media use is evident in Table 4.

Table 4

Number of Hours of Thai Smartphone Use in 2012-2016

Time Use for Media Activities (hours)	Year 2009 (hours)	Year 2014 – 2015 (hours)	Change in Time Use
Internet Access	2.1	2.0	0.32%
Television	2.9	3.0	2.21%
VDO's	2.4	2.1	-1.88%
Listening to the Radio	1.5	1.6	1.94%
Reading Books	1.1	1.2	0.59%
Other Media Access, e.g., CDs	1.7	1.3	-3.18%
Average Time Use for Media Access	3.8	3.2	-16.1%

Source: Adapted from National Statistical Office, 2016.

Table 4 illustrates the average free time hours used for media access of Thai people. As Thailand's Time Use Survey is conducted only every 5 years, the data for the past 10 years were those collected in 2009 and during 2014-2015. Although the time used for accessing types of media using technology devices fell during the last few years, a moderate percentage rise of time use for some other activities was found: for example, surfing the Internet, watching TV, and listening to the radio, were detected. With increasing numbers of both smartphone users and an increase in the level of technology devices that allow access to various media, the rise in the leisure time used for media access indicates that Thai people are also likely to use media technology for leisure activities.

4. EMPIRICAL RESULTS AND DISCUSSION

This paper employed Thailand's Time Use Survey, for obtaining the data on individuals' time use nationwide. The data provided a list of each respondent's activities during the previous day. Consecutive activities, from getting up in the morning to the next 24 hours, were recorded in minute lengths. Since wages and income were not recorded, we used Thailand's Labor Force Survey to obtain those earning data. The two data sets were collected at the same time, so that they could be merged together to get a complete data set for estimation. Because of the lack of individual productivity data in both the Time Use Survey and the Labor Force Survey, this paper applied a person's hourly wage as a proxy of labour productivity. Time use for media access was calculated from the length of time used for media access activities including non-work time. The findings indicates whether the time allocation for those activities contributed to a rise on the person's wage.

The regression of hourly wage was on a number of independent variables, socio-economic characteristics, e.g., age, gender, level of education, occupation and industrial sector. Wage and income were alsoincluded together with time used for media access. The model for estimation is presented in Eq. 1,

$$ln\ w_i = a_0 + a_1 ln\ inc_i + a_2 ln\ tech_i + a_3 SC_i + \mu_i \quad (1)$$

whereas in w_i, ln inc_i, and ln $tech_i$ are the logarithm form of hourly wages, monthly income and time usefor media technology devices respectively. Various factors categorized according on socio-economic characteristics are represented in SC_i while μ_i is the error terms and α_i are the coefficients.

Table 5 illustrates the estimation of wage changes by using the pooled data of both genders as well as the regression for the wage changes of males and females separately. The results indicated that there were some factors significantly causing wage changes, including time used for media access. While marital status was not correlated with wage change, positive relationships between wage changes and age and age^2 were found as the older individuals are presumed to be more experienced in Thai culture. Additionally, the more educated are likely to receive more earnings because the higher educated are perceived to be more productive and education level is one of the main criteria for wage determination in the Thai labor market. Professionals and technicians also clearly have greater wage rates. Among the people working in the three industries, those working in the manufacturing sectors are likely to earn the highest wage. The reasons are that the workers qualified for those jobs tend to be not only more capable in technological device usage, but also are more likely to be skillful in technical work.

The findings also confirm the existence of gender discrimination in the Thai labor market, as female workers' wages are still significantly lower. As the result indicates that there is no other distinctive factor driving men's wages, it implies the existence of gaps between men's and women's wages. Thai people earn significantly greater proportion of wage income than non-labor income, as shown by the great positive impact of monthly income on hourly wage changes. It could be inferred from the results that for Thai people, most monthly income rises are caused by hourly wage increases. Ultimately, the positive impact in the change in time used for accessing technological devices for media use on hourly wage changes revealed that media access contributes to ta wage increase because media usage helps to boost an individual's productivity.

Table 5

Estimation of Hourly Wage Changes including Time Used for Changes in Media Access

Variables	log (*Hourly Wage*)	Male's log (*Hourly Wage*)	Female's log (*Hourly Wage*)
log (Monthly Income)	0.949*** *(0.002)*	0.947*** *(0.003)*	0.953*** *(0.004)*
log (Media Access)	0.0152*** *(0.003)*	0.0152*** *(0.003)*	0.0155*** *(0.004)*
Age	0.00562*** *(0.001)*	0.00530*** *(0.001)*	0.00616*** *(0.001)*
Age^2	0.00004*** *(0.00001)*	-0.00003*** *(0.00002)*	-0.00005*** *(0.00001)*
Female (Male is the reference)	-0.0167*** *(0.004)*	- -	- -
Married (Single is the reference)	No	No	No
Household Head (Non-household is the reference)	-0.0279*** *(0.005)*	-0.0332*** *(0.009)*	-0.0258*** *(0.006)*
Education (No education is the reference)	Yes	Yes	Yes
Occupation (Elementary occupation is the reference)	Yes	Yes	Yes
Industry (Agriculture industry is the reference)	Yes	Yes	Yes
Constant	-6.358***	-6.340***	-6.420***
	(0.03)	*(0.04)*	*(0.04)*
Observations	9,218	5,216	4,002
R-squared	0.959	0.95	0.97

* Indicates significance level at 0.10 level, ** indicates significance level at 0.05 level, *** indicates significance level at 0.01 level

Source: Author's calculation.

5. CONCLUSIONS AND RECOMMENDATIONS

Thai people are increasingly spending time accessing information using technological devices for media access in a variety of forms. The openness of the new media and technology could be an opportunity for policymakers to improve the skills of Thai workers and for the increase of individuals' income.

Improving one's skills for media access using today's technology, including Internet and social media, is essential since technological devices are likely to replace some jobs that require merely elementary skills. Instead, productive workers are inevitably required to combine their skill endowments with technological capital goods to maximize the value of production. Investment in education and training for skills improvement, especially in terms of working with media technology, is essential since skill improvement is

a way to make workers less-substitutable. Furthermore, it is necessary to promote education in the fields that potentially generate higher earnings, e.g., technicians and specific-skilled professionals. Training, especially in media technology-related skills for those working in the market, is also a way to boost productivity and wages. Government support for media technology communication, especially critical Internet infrastructure and Internet use, is essential for creating the productive use of media technology, and stimulating media access for edutainment purposes is another way to raise labour skills and productivity and innovation.

The influence of time used for media technology access confirms that it is essential to increase Internet penetration as well as stimulate media access for improving skills. For the Thai labour market, there still exists a skilled manpower shortage. In order to develop Thai worker's skills effectively, not only should skill improvement during work time be emphasized, but it is also necessary to promote skill-enhancing activities for leisure, as productive leisure can both improve skills and enhance a person's happiness, for example, high-and-advanced media technology recreational parks, provided with a variety of activities for families and communities. Policymakers can provide on-line activities that efficiently enhance valuable work skills for the Thai workers that are likely to spend substantially more time with social media communication. This will enable the improvement of skills, knowledge, people's enthusiasm and openness toward new technologies. Moreover, skill improvements can further stimulate innovation and labour productivity. In this way media technology for work and communication can become a way to raise an individual's earning and happiness.

6. LIMITATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The empirical findings in this paper were obtained from the estimations of two data sets, Thailand's Time Use Survey and the Labor Force Survey. These data provide the time use for each activity, socio-economic characteristics, as well as the wage and income of the same individuals nationwide. However, data on individuals' productivity are not included in the sets, making information on Thai workers' productivity and wage links unavailable. This paper implicitly assumed that wages reflect productivity. For multiple-job workers, the data also lacked the the specific income received from each job. Additionally, though the data provide individuals' occupations and the industries in which they worked, there was no information concerning the media technology-based skills required for each worker's job and position. Therefore, there are no explicit data linking the importance of the skill in using media technology, productivity, and wages. For this reason, the influence of media technology on the wages of the Thais should be further explored by including individuals' labor productivity, more detailed data on individuals' and information concerning the level of media technology extertise required for individuals' jobs in order to better understand the relationship between media technology-related skills and wages.

REFERENCES

Abri, A.G., & Mahmoudzadeh, M. (2015). Impact of information technology on productivity and efficiency in Iranian manufacturing industries. *Journal of Industrial Engineering International.* 11 (1), 143-157.

Adzovie, D.E., Nyieku, I.E., & Keku, J.A. (2017). Influence of Facebook usage on employee productivity: A case of university of cape coast staff. *African Journal of Business Management*. 11 (6), 110-116.

Bertschek, I., & Meyer, J. (2008). Do older workers lower IT-enabled productivity? Firm-level evidence from Germany. *Journal of Economics and Statistics*. 229(2-3), 327-342.

Bildirici, M., & Alp, A. (2008). The relationship between wages and productivity: TAR unit root and TAR cointegration approach. *International Journal of Applied Econometrics and Quantitative Studies*. 5, 93–110. Retrieved from http://www.usc.es/economet/reviews/ijaeqs517.pdf (08.01.2018).

Feldstein, M. (2008). Did wages reflect growth in productivity? *Journal of Policy Modeling*. 30 (4), 591-594.

Ferreira, A., & du Plessis, T. (2009). Effect of online social networking on employee productivity. *Journal of Information Management*. 11(1), 1-16. Retrieved from https://www.researchgate.net/publication/264842754

Forbes, M., Barker, A., & Turner, S. (2010). *The Effects of Education and Health on Wages and Productivity*. Staff Working Papers 101, Productivity Commission, Government of Australia.

Gargallo-Castel, A., & Galve-Gorriz, A. (2007). Information technology, complementaries and three measures of organizational performance: Empirical evidence from Spain. *Journal of Information Technology Impact*. 7(1), 43-58.

Ghandour, R., & Bakalova, R. (2014). Social media influence on the holiday decision-making process in the UK. *Journal of Organisational Studies and Innovation*. 1 (2), 41-54.

Johnson, K.A. (2016). Do internet and human capital matter for economic growth in developing countries?: Empirical evidence from WAEMU countries. *Modern Economy*. 7, 1186-1197. doi: http://dx.doi.org/10.4236/me.2016.711116

Jorgenson, D. W., Ho, D. W., Samuels, J.D., & Stiroh, K.J. (2007). Industry origins of the American productivity resurgence. *Economic Systems Research*. 19(3), 229-252.

Leftheriotis, I., & Giannakos, M.N. (2014). Using social media for work: Losing your time or improving your work?. *Computers in Human Behavior*. 31(2014), 134-142.

Lopez Sintas, J., Rojas de Francisco, L., & Garcia Alvarez, E. (2015). The nature of leisure revisited: An interpretation of digital leisure. *Journal of Leisure Research*. 47(1), 79–101.

Mahlberg, B., Freund, I., Cuaresma, J.C., & Prskawetz, A. (2013). Ageing, productivity and wages in Austria. *Labour Economics*. 22, 5–15.

Maibach, E. (2007). The influence of the media environment on physical activity: Looking for the big picture. *American Journal of Health Promotion*. 21(4), 353-362.

Mihaljek, D., & Saxena, S. (2010). Wages, productivity and "structural" inflation in emerging market economies. in Monetary and Economic Department (ed.). *Monetary Policy and the Measurement of Inflation: Prices, Wages and Expectations*. 49, 53-75. Bank for International Settlements.

Mincer, J.A. (1974). The human capital earnings function, in schooling, experience, and earnings. in Mincer, J.A. *Schooling, Experience, and Earnings. Massachusetts*: Bureau of Economic Research. 83-96.

National Statistical Office. (2016). *Time Use Survey*. Bangkok: National Statistical Office.

National Statistical Office. (2017a). *Household Survey on the Use of Information and Communication Technology*. Bangkok: National Statistical Office.

National Statistical Office. (2017b). Numbers of internet users by age groups, Whole kingdom: 2007-2016. *The Information and Communication Technology Survey on Household*. Bangkok: National Statistical Office.

Rezaei, M., Rezaei, M., Zare, M., Akbarzadeh, H., & Zare, F. (2014). The effect of information technology (IT) on Employee productivity in Shahr Bank (Case study of Shiraz, Iran). *Applied Mathematics in Engineering, Management and Technology*. The Special Issue in Management and Technology, 1208-1214.

Salahuddin, M., & Gow, J. (2015). The effects of Internet usage, financial development and trade openness on economic growth in South Africa: A time series analysis. *Telematics and Informatics*. doi: http://dx.doi.org/10.1016/j.tele.2015.11.006

Subriadi, A.P., Hadiwidjojo, D., Djumilah, Rhahyu, & M., Sanrno, R. (2013). Information technology productivity paradox: A resource-based view and information technology strategic alignment perspective for measuring information technology contribution on performance. *Journal of Theoretical and Applied Information Technology*. 54(3), 541-552.

Tran, V.T.T., Phan, N.V.N., Nguyen, T.N., & Do, S.S. (2017). An impact of social media and online travel information search in Vietnam. *Global Review of Research in Tourism, Hospitality and Leisure Management*. 3 (1), 414-439.

Valletta, R. (2015). Higher education, wages, and polarization. *FRBSF Economic Letter*. 2015-02. Retrieved from https://www.frbsf.org/economic-research/files/el2015-02.pdf.

Van Ours, J.C., & Stoeldraijer, L. (2010). Age, wage and productivity. *IZA Discussion Paper 4765*. Bonn: Institute of Labor Economics.

Wood, S.A., Guerry, A.D., Silver, J.M., & Lacayo, M. (2013). Using social media to quantify nature-based tourism and recreation. *Scientific Reports*. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3797992/ doi 10.1038/srep02976