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2018

Loh, Y. A.-C., & Chib, A. (2019). Tackling social inequality in development : beyond access to appropriation of ICTs for employability. *Information Technology for Development*, 25(3), 532-551. doi:10.1080/02681102.2018.1520190

<https://hdl.handle.net/10356/93595>

<https://doi.org/10.1080/02681102.2018.1520190>

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**Tackling social inequality in development: Beyond access to appropriation of ICTs for
Employability**

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Abstract

This study was motivated to investigate social inequality in developed nations, by studying the impact of ICTs upon the vulnerable unemployed and under-employed in Singapore. First, drawing upon the capability approach (Sen, 1999), we operationalize the dependent variable as self-perceived employability, conceptualized as both a measure of well-being and a livelihood capability. Secondly, we used Selwyn's (2010) digital divide hierarchical impact assessment framework, to define and measure the ICT assets of access, usage, and appropriation. Primary data was gathered from 302 under-employed and unemployed workers in Singapore, a developed Asian economy. Hierarchical regression analyses revealed that higher-order hierarchies of ICT usage and appropriation were associated with the dependent variable of employability, while access was not. We discuss the implications for development discourse in regions with ubiquitous access, advocating for policymakers to focus on ICT training. Further, we offer nuanced findings on vulnerability in developed economies as an enhancement to mainstream ICT4D scholarship, focused exclusively on poverty in developing countries.

Keywords: *ICT access, ICT appropriation, capability approach, digital divide, unemployment*

1. Introduction

The concept of development in relation to information and communication technologies (ICTs) is not limited to developing countries (Kamal, Good, & Qureshi, 2009), rather it can be extended to issues of inequality within developed economies. Conceptualizing the dimensions of development in ICT4D¹, a recent editorial for a special issue in this journal, Zheng, Hatakka, Sahay, and Andersson (2017) argue that the understanding of the consequences of ICTs for development is more important than limiting the context to developing regions only. Given this research motivation, we situate the study in Singapore, an island nation state with developed country status and boasting world-class ICT infrastructure, yet faced with issues of inequality. For example, Singapore has a high and growing Gini coefficient, an indicator of income inequality (Smith, Donaldson, Mudaliar, Kadir, & Yeoh, 2015), combined with inequality in ICT access, use and skills (Ono, 2005).

Social Inequality. The broad definition of social inequality means that society offers unequal opportunities and rewards for different social positions or statuses (Witte & Mannon, 2010). Specifically, the literature has differentiated between various classifications of inequality, along the lines of economic versus non-economic disparities (Mukhopadhaya, 2014). Social inequality, of which income inequality is one component, occurs when resources in a given community, ethnic group, gender or other demographic factors, are distributed unequally (Sernau, 2011). The meaning of income and wealth inequality essentially dictates a situation where different people have different levels of earnings from work or investments (*income*), or the total value of money and other assets minus debts (*wealth*) (Sernau, 2011). In this paper, we seek to explore the conceptual terrain of social inequality and social mobility by viewing the debate through an economic lens.

¹ ICT4D is the application of ICTs for social, economic, and political development, with a traditional orientation towards helping poor and marginalized people and communities.

Scholars find that rising inequality is increasingly prevalent (Milanović, 2016) and is contributing to the phenomenon of poverty in developed economies (Abramsky, 2012; Andreß & Lohmann, 2008; Ehrenreich, 2011), albeit decreasing in many emerging economies (International Labour Organization, 2016). While economic growth is an instrument policymakers can leverage for addressing inequality (Loewe, Altenburg, & Pegels, 2015), uneven economic recovery and successive downward revisions in economic growth projections since the 2008 financial crisis have had an adverse impact on the global employment situation (Kyrlych, 2013). The number of jobless worldwide reached 197.1 million in 2015 and was expected to increase to 200 million by end of 2017 (International Labour Organization, 2016), leading to a situation in which social inequality is changing in rapid and complex ways (Grusky, Ku, & Szelényi, 2008).

ICT4D. This study selected the vulnerable poor within a developed economy as the context of analysis to broaden the inequality lens of ICT4D, which sometimes erroneously sees development needs as originating exclusively from developing countries (Qureshi, 2015; Toyama, 2015). A substantial body of research in ICT4D, instead of focusing solely on ICTs' effects in terms of economic growth, advocates for a multidimensional approach with broader definitions of both well-being as well as for new ICT-enabled models (Walsham, 2017). We posit that there is a research gap in examining the impact of ICTs on alleviating poverty, as a key developmental measure of economic inequality, among the vulnerable unemployed and underemployed constituents in developed economies.

Research motivation. This study examines the impact of ICT access, usage, and appropriation on the personal well-being of unemployed and underemployed workers.

When it comes to the attribution of ICTs role in development, theoretical discussions about poverty are often geared towards lower-order divides, such as how ICT access and

usage (Sey et al., 2015) contribute to economic outcomes. The digital divide discourse, in recent years, has moved beyond access to include skills and usage. This paper utilizes a more nuanced examination of higher order ICT factors towards the achievement of personal outcomes.

Contribution to Research. Firstly, in terms of well-being, we situate the study within the body of work constituting the capabilities approach (Sen, 1999). The approach challenged dominant economic frameworks to incorporate a broader conception of capabilities and freedoms to achieve one's goals as a conceptualization of development. Within the capabilities approach, we argue that employability is better positioned as a livelihoods outcome, rather than employment, even though the latter has traditionally been key to providing a predictable income, social security, health insurance, and rights protections in an urban context (Garrido, Sullivan, & Gordon, 2012).

Focusing on work, this study presents employability, as opposed to employment, as a dimension of human capabilities. Employment has traditionally been an important outcome in the context of urban livelihoods because it can provide predictable income, occasionally supplemented by important welfare benefits such as social security, health insurance, and rights protections (Garrido et al., 2012). However, employment has become an inadequate measurement of livelihood success because of its reliance on fluctuating labor market movements at the aggregate level, which can put an individual out of work at any time (P. Brown & Hesketh, 2004). As posited by P. Brown and Hesketh (2004), merely being employed is not sufficient for sustained livelihood success nowadays because of labor market variability over which an individual has little control. As such, employability, as opposed to a lifetime of employment, is being posited as a conceptualization of sustainable livelihoods (Forrier & Sels, 2003). We therefore operationalize self-perceived employability of the individual as a dependent variable in this study.

1.1 Research Questions

Prior studies have mainly used the binary digital divide model, e.g. the haves-versus-have-nots, to explain social inequality (Yu & Zhou, 2016). However, we argue that this model is insufficient, as the degrees of access to information and communication technologies are affected by different factors, such as ethnicity, age, gender and household income (Burbules, Callister, & Taaffe, 2006). We argue that the binary digital divide model of with- or without-access to ICTs is insufficient to reflect the dynamics of societies with high digital inequality (Hargittai, 2002; Hilbert, 2011; Ono, 2005). Therefore, we suggest using a more systematic digital divide impact assessment framework, which includes higher order ICT assets in addressing digital inequalities. We utilize Selwyn (2004)'s digital divide impact assessment framework, which is based on a hierarchy of ICT access-usage-appropriation factors. Therefore, our first research question proposed is: *How do the access, usage and appropriation of ICTs relate to the self-perceived employability of vulnerable workers in developed economies?*

Selwyn (2004, 2010) further demonstrates that each gap in the level of the access-usage-appropriation divide has consequences for the individual in terms of the entire chain of development outcomes. It is therefore necessary to decompose the relative influence of these ICT indicators on livelihood capabilities. Therefore, our second research question concerns: *What is the relative influence of the hierarchical predictors of ICT access, usage, and appropriation on the individual's self-perceived employability?*

In summary, the research objective in this paper is to extend the ICT4D debate on social inclusion. To do so, we adopt the multi-dimensional approach advocated by Walsham (2017) to examine the effect of the independent variable — ICT *access* and *usage*, applied strategically to promote a higher-order acquisition of ICT assets (*appropriation*) — on the

dependent variable — *self-perceived employability* as a function of well-being and capabilities.

Context - Singapore. From a development perspective, some see ICTs as a solution to social inequality due to their ability to improve productivity and connectivity, thus improving the employability of individuals (Wet, Koekemoer, & Nel, 2016). As a consequence, policymakers plan ICT-based programs to create pathways to employment in aging societies such as Singapore, which is facing anemic economic and population growth rates (Obi, Auffret, & Iwasaki, 2013). Kamal and Qureshi (2009) similarly categorize Singapore into a country cluster characterized by a highly saturated ICT infrastructure, yet still exhibiting average economic growth rates. These researchers argue that improved digital skills are required to boost economic growth. Despite investments in the National Information Infrastructure in Singapore, A. Brown, Tan, and Ye (2011) argue that limited manpower resources in the form of digital skills constitute a major challenge for the advancement of the populace. For example, training programs that exclude vulnerable segments of the population such as the unemployed continue to pose conditions of near-poverty for some.

Employability in Singapore. There is no better example of Castells (1999)'s *dual city*, a divided information society, than the South-East Asian state of Singapore. Once considered an economic miracle ensconced in an ICT-intensive and business-friendly environment, rising costs and stagnating wages dominated the elections discourse in 2011 (Bhaskaran et al., 2012; Cheng, 2015). Policymakers became concerned with the estimated 67,400 residents who were unemployed (Ministry of Manpower Singapore, 2017) as well as the 105,000 households (estimated at 6.34% of the population) earning below S\$1,500 (US\$1,060) per month, termed as the 'working poor' (Basu, 2013; Chan & Basu, 2013). At the time of the study, these households earned less than half the national's median monthly pay of S\$8,666 (US\$6,489) (Singapore Department of Statistics, 2016a). The poorest Singaporeans find it

demanding to eke out a subsistence in an expensive metropolis where the high cost of living is exacerbated by ongoing inflation, without corresponding increases in real wages (Nair, 2014).

ICT access and usage in Singapore. The island state has a peculiar aspect; more than 30 per cent of its workforce has less than primary school education and are limited in their English language proficiency (Seah, 2001), yet the mobile phone penetration rate is higher than most OECD countries at 150.1% (Infocomm Development Authority of Singapore, 2016). It seems that possessing a mobile phone is not enough for employability as 750,000 Singaporeans, comprising low income earners, senior citizens and the disabled still do not possess the relevant skills to work with higher levels of technology (Pant, 2008), unlike younger and higher-educated workers (Ho & Tan, 2008). This is particularly ironic because ICT usage is high across all occupations in Singapore (Sung, Loke, Ramos, & Ng, 2011). As Lim and Guo (2015) discovered, the long-term impact of ICT access and usage to improve social inclusion is inconclusive due to the lack of longitudinal research in Singapore. As stated in the research objectives, we aim to close this research gap by examining how social inclusion can be impacted through the enhancement of ICT assets. This paper is structured by first presenting well-being from the perspective of the capability approach, from which is derived the dependent variable of self-perceived employability. The second section examines the hierarchy of ICT-enabled models of access, usage, and appropriation, going beyond the traditional digital divide frame. The analytical section tests the framework with primary data gathered from 302 unemployed and/or underemployed low-wage workers in Singapore using hierarchical regression techniques. The paper concludes with theoretical and policy implications.

2. Literature Review -- Conceptualization of Employability as Development

2.1 Capability approach, Social Inequality, and Employability

The capability approach (Sen, 1999) emphasizes the freedom to achieve well-being in terms of people's capabilities, that is, their real opportunities to do and be what they have reason to value (Ibrahim & Tiwari, 2014).. Zheng (2009) proposes the capability framework as an evaluative space to understand inequality. This approach can provide comprehensive instruments for the evaluation of individual welfare in social policies (Olejniczak, 2012), particularly towards narrowing the inequality gap for citizens. The capability approach is determined largely by its context, such that the possession of tools (like technology) or the ability to utilize these tools (capabilities) are only relevant if they allow a person to work productively (van der Klink et al., 2016).

Employability. Employability refers to the knowledge and skills that individuals bring to an employer, what Heijde and Van Der Heijden (2006) call ‘occupational expertise’ (p.454), which employers value as the candidates’ ability to do the job (Hogan, Chamorro-Premuzic, & Kaiser, 2013). In terms of effects, Williams, Dodd, Steele, and Randall (2016) found that employability was associated with job satisfaction, employee satisfaction, job success, preservation of employment, and employee potential. Of the measurable quantitative constructs developed, Fugate, Kinicki, and Ashforth (2004)’s model defines employability as a psycho-social concept independent from one’s employment status comprising adaptability, career identity, and human and social capital.

Inequality and employability. This paper examines the concept of social inequality by viewing the debate through an economic lens. To address the unemployment and underemployment problem in developed economies, it is widely believed that a capability approach to enhancing one’s employability will reduce social inequality. Specifically,

activities such as education, job training, and career counselling – those which enhance one's capabilities, will result in better remuneration and reduced unemployment for the individual (Bovin & Farvaque, 2007). On the other hand, in programs where well-meaning voluntary welfare organizations recommend low-wage jobs to their higher-educated unemployed constituents, such interventions often overlook the plight of the underemployed and the lack of functionings and capabilities that result (Comim, Qizilbash, & Alkire, 2008). A capability approach centered labor policy would consider the situation of each jobseeker in terms of his or her capabilities and functionings (Bonvin & Farvaque, 2007). At the individual-level, policies customized to enhancing the employability of each individual will address social inequality by enabling access to decent work and achievement of economic well-being (International Labour Organization, 2015).

2.2 Employability and ICTs

There is a considerable literature on both the beneficial and deleterious effects of ICTs on employability. Naysayers include scholars such Webster (2007), who argues that the advent of ICTs is a key contributing factor towards workers' job anxieties, and van de Klundert (2008), who reasons that information technology will only increase existing inequalities. Indeed, globalization of the world economy, coupled with technological change that is biased in favor of skilled labor, has resulted in a deterioration in the economic position of the unskilled in OECD countries (Juhn, Murphy, & Topel, 1991). In Singapore, the site of the study, (Authors) demonstrate that increasing investment in ICTs at the workplace was associated with declining wages for workers.

The application of computers in factories, for example, means that blue-collar workers can expect limited job expansion, with many trades now demanding digital dexterity, requiring organizations as well as the workforce to adapt to constantly improving technology. This ICT-driven phenomenon is premised on the growing mismatch between the

technological requirement of jobs and the skills that people possess, particularly elderly constituents of the population (Moreno-Galbis & Sopraseuth, 2014), in what scholars term as skill-biased technological change (Berman, Bound, & Machin, 1998; Machin, 2001; Violante, 1990). Further, as industries evolve and technological progress occurs, younger workers too face adaptation struggles, especially in cases where the educational system fails to impart the requisite skills for workplace success (Goldin & Katz, 2008; Jayaram & Engmann, 2014).

It is evident that technological advances, as embodied in ICTs, favor skilled (e.g., more educated, more capable, more experienced) labor over unskilled workers due to greater relative productivity, creating comparatively higher demand and a wage premium for the former (Violante, 1990). Economists have posited that wage differences have moved in tandem with the rapid diffusion of ICTs in the workplace (van de Klundert, 2008). This means that those without access to the internet and mobile-based technologies will be increasingly disadvantaged in market economies (Nicholas, 2015; Selwyn & Facer, 2007; Valadez & Durán, 2007). It seems that ICTs may eliminate work, increase inequalities and create a large dependent class subsisting on welfare. The question arises whether the same technology can be used to end inequality?

In an information society, digital skills are considered a gateway to employment (Walton, Cynthia, Erica, & Beth, 2009), without which an individual's chances of securing a good job would be hampered (Garrido et al., 2012). Wagner et al. (2005) posit that the contemporary labor market has made enhancing digital job skills for vulnerable members of society more crucial than ever. Moreover, ICT skills can serve to enhance a person's employability profile, particularly when combined with other foundational skills such as communication, critical thinking and teamwork (Casner-Lotto, 2006).

However, earlier research indicates that the diffusion of ICTs and the accompanying social and economic advantages have been quite uneven, causing what has come to be known

as the ‘digital divide’ (OECD, 2001; Selwyn, 2004; Selwyn & Facer, 2007; van Dijk & Hacker, 2003). Andreasson (2015)’s tome noted that the term was traditionally used to describe computer and internet access inequalities between groups of people with specific social or cultural identifiers such as race, sex, socioeconomic class, and disability status, among other classifying factors. Singapore is the world’s most networked country in the Networked Readiness Index (World Economic Forum, 2016), suggesting that the government-led initiatives have improved accessibility and usage of formal technology. In such situations, when ICTs are ubiquitous, the digital divide paradigm framed within access issues is insufficient to explain their impact. To assess the dynamic and multi-stage impact of ICTs on an individual’s self-perceived employability, we next explicate the hierarchy of ICT access-usage-appropriation factors.

2.3 ICT Access, Usage, and Appropriation

The simple issue of access (or lack thereof) to ICTs raises complex questions of levels of connectivity in terms of the capability and distribution of the access concerned (Selwyn, 2004). For example, material access to ICTs is impractical without the necessary skills, knowledge and support to use the technology productively (van Dijk, 2005). The concept of digital skills needs to be addressed as it is one of the first factors economists use to explain inequality caused by skill-biased technological change (Card & DiNardo, 2002). On the other hand, digital divide models focusing on access have been critiqued as often being too complex, while the basic ones tend to be either too theoretical, or with overly broad applicability (Dodel, 2014). Given these considerations, we found that Selwyn (2004, 2010)’s digital divide framework provided the most relevant exemplar for this research paper. The model encompasses the key hierarchical stages of ICT *access*, *usage*, and *appropriation* on an individual’s development. The final theoretical section presents the rationale for hypotheses testing related to the two research questions: *How do access, usage and*

appropriation of ICTs, relates to the employability of vulnerable workers in developed economies? and What is the relative influence of the hierarchical predictors of ICT access, usage, and appropriation on self-perceived employability?

ICT access, as a first-order digital divide, is defined in policy lingua franca as the provision of material ICT artefacts to all citizens, and has been the focus of political discussions within both developed and developing countries (Zheng, 2009). Selwyn (2004) argues that this notion of access in terms of whether technology is available or not obfuscate subtle differences in the paradigm of ICT access. For example, foraging for online information and resources from a home-based computer is diametrically different to accessing the internet via an open access workstation in a public library or at another community-based ICT center. The argument is that time, cost and quality of the technology, the environment, qualitative concerns about privacy and ease of use are all crucial mediating factors in how people access ICTs (Davis, 1993). ICT access therefore needs to be viewed as a multifaceted construct, encompassing both material and location factors. As explained by Selwyn (2004), ICT access is a nuanced continuum, based on the combination of home and mobile internet access, as well as the participants' expectations of benefits derived from the technology access. Such expectations determine how people anticipate positive changes that access would bring, where high expectations about positive outcomes arising from ICT access, may lead to different forms of access (Chen, Li, & Straubhaar, 2017). For example, some people expect that accessing ICTs and the internet will help improve one's labor market participation and employment opportunities (Evangelista, Guerrieri, & Meliciani, 2014). In the UK, over 6,000 Online Centers were set up to enable those with little or no access to ICTs to enable them to exploit opportunities for training and employment (Goodison, Green, Owen, & Rooney, 2004). The researchers interviewed 222 clients of these centers and found that the individuals felt more positive about their personal employability after being able to

access the computers in the center (Goodison et al, 2004). In this same vein, policymakers hope that the provision of ICT access will result in socio-better jobs and livelihoods for their constituents (European Commission, 2017), while others counter that the relationship (and causality) between ICT access and economic growth is spurious at best (Avgerou, 2002).

Given the above arguments -- the first hypothesis (H1) related to ICT access' influence on livelihood outcomes, as measure of development, is thus advanced: *Access (material and location) to ICTs is positively correlated to self-perceived employability.*

ICT usage, whose impact continues to be contested among researchers, has been termed a “second order digital divide” (Brotcorne et al., 2010, p. 2). DiMaggio and Hargittai (2001) identified the *purpose of usage* as one of five critical dimensions to counter digital inequality, suggesting that meaningful usage would occur as a result of fulfillment of tangible purposes. For example, Ershova, Hohlov, and Shaposhnik (2015) found that livelihood purposes were the main conditions for ICT usage in Russia, because usage enhances one's economic productivity. Hoyos et al. (2013) found that usage of ICT affects employability by influencing the individual's decision to enter the labor market and to invest in training, which in turn increase the likelihood of obtaining job offers. We therefore conclude that higher-order divides such as purposeful ICT usage can find conceptual relevance when considering the relationship between ICTs and self-perceived employability as a function of development. This leads to the second hypothesis (H2) related to ICT usage: *Usage of ICTs is positively correlated to self-perceived employability.*

ICT appropriation is posited as a third order digital divide, defined as customization of technology; the way in which ICT artefacts are adopted, shaped and then used by the individual (Kirk, Swain, & Gaskin, 2015). Selwyn (2004), in presenting the digital divide model, explains that appropriation is “meaningful use of ICT...where the ‘user’ exerts a degree of control and choice over the technology and its content, thus leading to a meaning,

significance and utility for the individual concerned” (p.349). In an example of how ICT appropriation can be applied for employability, Hargittai and Hinnant (2008) posit that users who engage in capital-enhancing activities on the internet, e.g. seeking government information, financial and health services, or exploring career or job opportunities, are more likely to enjoy upward mobility. In a study of African cities, Cheneau-Loquay (2008) found that the appropriation of ICTs contributed to new services which are adapted to its poor constituents and as a result, generated informal employment opportunities for the communities there.

At this third level of the digital hierarchy, such advanced ICT usage is indicative of higher digital skills and literacy (Warschauer, 2003), which in turn are necessary for advanced employability, as discussed earlier in this paper. For Brotcorne, Damhuis, Laurent, Valenduc, and Vendramin (2010), the appropriation process for ICTs involves a series of individual core competences - what the researchers term as “digital skills” (p. 2). Diener (2003) suggests that whether a person can achieve personal outcomes depends on how he or she utilizes the existing skills and resources available. Accordingly, we present the third hypothesis (H3) for this study: *Appropriation of ICTs will be positively correlated to self-perceived employability.*

It is worth mentioning that most of the above-mentioned studies focus on single factors of ICT access, usage and appropriation, when ideally, all three dimensions should be considered. For example, a digital access divide study would look at access and usage, but exclude appropriation and outcomes metrics. A few exceptions include research done by DiMaggio and Hargittai (2001); Selwyn (2010); Wei, Teo, Chan, and Tan (2011) and Dodel (2014) – with detailed investigation on the individual benefits of having such ICT assets for different subgroups, depending on the individual’s demographics and socio-economic status. This research paper offers a guide to future studies to consider how the amalgamation of

access, usage and appropriation of ICTs are holistically, and differentially, associated with personal outcomes, in the context of inequality research.

3. Methodology

3.1 Sample and procedure

The study sample included 302 adults in Singapore attending ICT training at a not-for-profit employment assistance organization, called the Employment and Employability Institute (e2i, for short). The institute's mandate is to help the unemployed find jobs through counselling, placement and job training (e2i, 2016). Data were collected utilizing a survey instrument containing 81 items, with a 5-point Likert-scale ranging from 'Strongly Agree' to 'Strongly Disagree'. Demographic information sought pertained to race/ethnicity, gender, age, education level, household income and current employment status. This questionnaire was tested with a pilot group of Nanyang Technological University students (n = 194), held 22 February to 23 March 2016. Items that pilot participants perceived as unclear were simplified.

Nanyang Technological University's Institutional Review Board granted approval on 25 September 2015. Surveys were administered in 15 ICT classes at the Employment and Employability Institute (e2i), between 1 April 2016 – 18 May 2016. All research participants signed informed-consent-forms and received a S\$5 (US\$3.6) voucher for their time. The response rate averaged 98%, suggesting low likelihood of a non-response bias (Dillman, Christian, & Smyth, 2014).

Respondents were either citizens or permanent residents of Singapore. The race/ethnicity composition was Chinese (64.57%), Malay (15.89%), Indian (12.91%) and Others (6.62%). The gender ratio was relatively balanced at Female (52.65%) and Male (47.35%). Most respondents were older Singapore residents aged 45 years old and above (62.25%), while 42.72% of the participants possessed only secondary school education

qualifications. Around half reported household income in the lower 50% of the national median monthly wage, i.e., most respondents were below the unofficial poverty line of S\$4,333 per month income (US\$3,244/month). A demographic and socio-economic comparison of respondents versus the Singapore population can be found in Table 1, Appendix 1.

Employment status. More than half (55.96%) of the participants were unemployed at the time of the survey, some for more than 6 months (21.52%). About a fifth (21.49%) of the participants reported some form of economic activity in paid part-time (15.89%) or self-employed (5.63%) work during the period of study (Figure 1).

Time-related underemployment. According to the International Labour Organisation (ILO), individuals who are working less than the normal duration and seeking additional work during the reference period, are considered ‘underemployed’ (International Labour Organization, 1998).

Skill-related inadequate employment. As per the ILO, individuals in this form of inadequate employment are not utilizing their current skills adequately even though they are available to do so.

3.2. Measures

Employability. The 24-item perceived employability scale was derived from Fugate et al. (2004)’s measurement model, consisting of five inter-correlated psycho-social dimensions: career exploration, career planning, social capital, human capital and career identity. The full scale was tested in McArdle, Waters, Briscoe, and Hall (2007)’s study of 416 unemployed Australians as well as Koen, Klehe, and Van Vianen (2013)’s 3,438 participants across two time frames ($\alpha = .89$, Time 1; $\alpha = .91$, Time 2). An example of an employability question used was, “circle the number that best fits your personal agreement regarding your skills and

qualifications, e.g. I have a good work history”. The employability scale used in this study, with relevant descriptive statistics are in Table 2.

ICT Access. In accordance with Selwyn (2004)’s digital divide model, ICT access depends on location as well as the type of device (material). ICT access factors were measured on a continuous Likert scale of 1 – 5, where 1 – No Access, 2 – One day per week, 3 – Between two to three days per week, 4 – Between four to six days per week and 5 – Every day of the week. Location measures for places of internet and mobile broadband access were referenced from Selwyn, Gorard, and Furlong (2004) and Awadhiya and Gowthaman (2014). An example of a question asked was, “circle the frequency that best fits your personal agreement regarding your place of internet access since January this year, e.g. your own home?” The scales measuring ICT material access to devices such as the personal computer and mobile phone scales were taken from Zhang (2014), Mendonça, Crespo, and Simões (2015) and van Deursen and van Dijk (2015)’s studies. An example of material access questions in this study was “circle the frequency that best fits your personal agreement regarding your ICT access since January this year, e.g. desktop personal computer?”. The ICT access scale’s items and descriptive statistics are found in

Table 3.

ICT Usage was measured using scales for computer, mobile phone and internet usage variables, derived from Barry, Murphy, and Drew (2015) and Selwyn et al. (2004). An example of a usage question implemented in this study was, “how often do you use your ICT devices to look for information related to your work, on the worldwide web?”. The ICT usage variables were measured on a continuous Likert scale of 1 – 5, where 1 – No Usage, 2 – One day per week, 3 – Between two to three days per week, 4 – Between four to six days per week and 5 – Every day of the week. The alpha (α) reliability score for the ICT usage scale items, together with the rest of its details, are found in Table 4.

ICT Appropriation variables were based using the earlier stated theoretical conceptualization supplemented by personal relevance measures. As such, employability-related appropriation items were taken from Araque et al. (2013)'s study on low-educated, low-income adults in an urban community in south Los Angeles, while personally relevant items were based on Wong, Chen, Lee, Fung, and Law (2014)'s interviews of 250 senior citizens in Hong Kong. Details of the ICT appropriation scale items are found in Table 5.

Nested (or hierarchical) regression analysis using STATA was used to answer the research questions. Blocks of variables such as demographic and socio-economic and ICT Access (Block 1), ICT Usage (Block 2) and ICT Appropriation (Block 3), were entered in sequence.

3. Results

The full results of the hierarchical regression are shown in Table 6. We found that ICT access, usage and appropriation explained 23.27% of the variance in employability. The Model $R^2 = .2327, F(3, 298) = 30.13, p < .001$. ICT access was not significantly correlated to perceived employability, thus the first hypothesis, H1, was not supported. The second and third hypotheses were validated, i.e., both ICT usage, $t(301) = 2.98, p < .01, b = .14, \beta = .22$. and ICT appropriation, $t(301) = 5.18, p < .01, b = .254, \beta = .30$, were positively correlated with self-perceived employability. The standardized coefficients indicate that ICT appropriation ($\beta=0.30$) had a stronger correlation with self-perceived employability, than ICT usage ($\beta=0.22$).

4. Conclusion & Discussion

4.1 ICT's Hierarchy of Effects

It is evident that ICT is not a silver bullet to fix the inequality problem and scholars such as Millard (2015) caution against a one-size-fits-all approach. Even though the results of this study appear to show a strong correlation to the outcomes of personal well-being, with ICT

appropriation found to positively correlate with self-perceived employability, we need to highlight that ICT solutions to address inequality requires adequate consideration of the context and the level of an individual's digital achievements.

4.1.1 From ICT access to usage

The possession of technological assets helps people to become empowered with the creation and possible dissemination of their own informal media innovations (Bivens, 2014). This idea alleviates the individual from being a passive media consumer, who was previously just viewing or enjoying the creations of others, to becoming a media producer (Jaw & Chen, 2007). This study found that *ICT usage and appropriation* determine the outcomes of self-perceived employability. Future policy decisions in Singapore need to consider *what* types of emerging ICTs should be made available as well as *where* and *how* people access communication technologies. Current policies that concern software and tool-centered definitions of devices do not always correspond to “serious” or “worthwhile” uses of technology (Kolko & Racadio, 2014, p.47).

4.1.2 From ICT usage to appropriation

What Kolko and Racadio (2014) termed serious or worthwhile usage is also akin to the *ICT usage* factors derived in this study. Participants who receive support for *ICT usage* activities, for example, creating spreadsheets and documents, are generally conducted through structured ICT training. On the other hand, ICT usage for leisure activities, such as watching videos and listening to music, are primarily learned through informal training or from friends (Bivens, 2014). This is also the case in Singapore where workers seek formal training to gain *ICT usage* skills and competencies that offer higher perceived payoffs in terms of improved occupational specializations or better income. The findings in this study reveal that ICT appropriation is positively correlated with self-perceived employability. This indicates the participant's attribution of their uses of ICTs, towards the purpose of economic well-being.

The results support statements by scholars such as Humphreys, Von Pape, and Karnowski (2013) that one's appropriation of ICTs, in everyday life, transcends mere physical access and usage of the ICT devices, and participants differentiate between owning the technology and using it. As such, the key to overcoming inequalities is to focus on ICT usage and appropriation, rather than ICT access.

4.2 Theoretical contribution

The objective of this research study was to incorporate the issue of social inequalities into on-going disciplinary debates in the ICT4D field. This study makes two theoretical contributions related to Walsham's (2017) agenda for future ICT4D research. First, drawing upon the capabilities approach (Sen, 1999), we conceptualize well-being in the form of gaining capabilities for employability, rather than just employment outcomes. Sen deliberately left his theory 'thin', neither providing any form of checklist as to what the approach might mean in practice. Scholars like Orton (2011) expressed optimism that this flexibility opens up opportunities for Sen's approach in development studies to transcend beyond tangible measurements like income. This relates to Sen (1992)'s concerns about poverty analysis where capability should be the focus of attention of analysts instead of achievements, even though, as he acknowledged, we may "use information about achievement to try to surmise the capability enjoyed by a person" (p.112). Specifically, Sen and Foster (1997) have suggested the measurement of "instrumental variables other than income which are expected to influence the determination of capabilities" (p.214). This study's focus on self-perceived employability provides theoretical clarification of the capability approach in the context of livelihoods.

A second theoretical contribution relates to the decomposition of ICTs in terms of relative influence. One of the debates within the research community is the relentless innovation of technology and its changing deployment, creating new possibilities for the

ICT4D field (Banks, 2011). We critique ICT artefact-centric approaches, such as the latest avatars of big data and social media suggested by Walsham (2017), in terms of providing theoretical contributions. Instead, this study operationalizes Selwyn (2004)'s digital divide impact framework of ICT access-usage-appropriation factors, providing a more granular examination of the relationship between an individual's context and his or her digital assets.

We bring these two contributions together, measuring the impact of ICT assets on self-perceived employability, as a measure of development. Indeed, Kleine (2010) encourages the inclusion of non-economic measures of ICTs' higher-order impact with a wider and more humanistic achievements of individual capabilities, by connecting technology appropriation to the wider development discourse. Overall, the findings reveal that higher order hierarchical ICT assets of usage and appropriation were associated with development outcomes of employability. This result affirms calls made by scholars like Donner (2015) that access and effective usage are clearly different things, as one's appropriation of ICTs in everyday life transcends material access.

We can consider these findings unique to the context of the ubiquitous access to ICTs found in Singapore, in which almost the entire population has some form of ICT access. However, we argue that a scenario of universal access, even in developing regions, is not a distant futuristic scenario, and generalization from this study would be possible. Going forward, the operationalization of the digital divide impact framework offers us a nuanced method to measure the comparative value of ICT access, usage and appropriation.

4.3 Policy Implications

With both ICT usage and appropriation emphasizing digital skills, policy solutions are required to enable residents to constantly sharpen their capabilities to sustain their employability and keep pace with technology changes, as called for by Kamal and Qureshi (2009). While formal ICT appropriation may improve the self-perceived employability of

workers, it has limited benefit in this new post-industrial work world, where training becomes obsolete quickly. It is therefore important to address the technological disruptions in the work environment when developing national-level ICT training. Policymakers will do well to look out for a more granular level of categorization for the skills required to survive in the current information society. These detailed bite-sized, stackable ICT skills are what Niederman and Ferratt (2006) consider sustainable skills for workers in the post-industrial society. There are opportunities for private learning institutions to move to the supply side of higher-order ICT skills, beyond traditional institutions such as schools and universities. Private training schools, such as General Assembly, which started in mid-town Manhattan in 2011 (General Assembly, 2016), demonstrate that the private marketplace of skills provision is a viable avenue of filling existing skills gaps more quickly. Governments can affect social justice by enabling more of such speed-to-market providers, through subsidies or tax incentives, to patch skills gaps caused by quickly-evolving skill-biased technological change. We encourage researchers in developed areas with social inequality issues, to examine nuanced impacts of ICTs, given the rapid transformations in technological infrastructure, and the consequent effects on labor markets.

4.4 Limitations and Future Research

In the quest for information robustness, it is possible to over-rely on quantitative methodology and numbers only. Future research investigating the ICTs hierarchy of assets may employ an iterative research process that includes qualitative methods as well. This will help explain the ‘why’ behind the quantitative statistics conducted here. For example, the constructs of ICT access, usage and appropriation offer a rich plethora of research directions on understanding why and how participants determine and differentiate lower-order ICT assets from the higher-order hierarchies.

We also acknowledge that this paper does not examine the correlations between ICT usage, social capital and self-perceived employability. This is because one's social networks have been posited to be a crucial conversion factor for ICT impacts on well-being, having been extensively discussed in the literature (Hampton & Wellman, 2003). The concept would be clearly linked to informal ICT appropriation and consumption ICT usage (Gaved & Anderson, 2006). This can be an important direction for future research.

Appendix 1

Tables

Table 1:

Respondents demographics and socio-economic status versus population

	Demographics	Respondents	Singapore Population²
Racial/Ethnicity	Chinese	64.57%	74.30%
	Malay	15.89%	13.40%
	Indian	12.91%	9.10%
	Others	6.62%	3.20%
Gender ratio	Female	52.65%	50.90%
	Male	47.35%	49.10%
Age	18-24yrs old	2.98%	6.63%
	25-34yrs old	11.92%	14.38%
	35-44yrs old	22.85%	15.65%
	45-54yrs old	33.77%	15.68%
	55-64yrs old	18.21%	14.02%
	65yrs & above	10.26%	12.40%
Education	Below secondary school	7.62%	29.10%
	Secondary school	42.72%	18.90%
	Post-secondary school	6.95%	9.10%
	Polytechnic Diploma	16.56%	14.70%
	University	26.16%	28.20%
Employment Status	Long-term Unemployed (i.e. jobless for more than 6 months)	21.52%	3.10% (Ministry of Manpower Singapore, 2016)
	Short-term Unemployed (i.e. jobless for less than 6 months)	34.44%	
	Freelance / self-employed	5.53%	14.00% (ChannelNewsAsia, 2016)
	Working part-time	15.89%	6.21% (Ministry of Social and Family Development, 2018)
	Working full-time	22.52%	76.69%

² Source: Singapore Department of Statistics (2016a) and Singapore Department of Statistics (2016b)

Table 2:*Details of the self-perceived Employability scale, sources and descriptive statistics*

Category	Source	Employability Statement	Factor Loading	Cronbach's Alpha	Mean	SD
Career Exploration	Stumpf, Colarelli, and Hartman (1983)	Went to various career orientation programs?	0.77	0.87	1.94	1.10
		Obtained information on specific jobs or companies?	0.67	0.87	2.50	1.37
		Initiated conversations with knowledgeable individuals in my career area?	0.88	0.87	2.33	1.22
		Obtained information on the labor market and general job opportunities in my career area?	0.75	0.87	2.45	1.32
		Sought information on specific areas of career interest?	0.87	0.87	2.53	1.31
Career Planning	Gould (1979)	I have a plan for my career	0.81	0.87	3.71	0.10
		I have a strategy for achieving my career goals.	0.87	0.87	3.62	0.83
		I know what I need to do to reach my career goals.	0.80	0.87	3.73	0.79
Social Capital	Anderson-Butcher, Iachini, and Amorose (2008)	I am good at making friends	0.76	0.87	3.59	0.95
		I help other people	0.88	0.87	3.76	0.86
		I ask others if I can be of help	0.84	0.87	3.52	0.96
		I do nice things for people	0.84	0.87	3.77	0.84
Human Capital	Wanberg, Hough, and Song (2002)	My level of education is sufficient for getting a job in my area of work	0.65	0.87	3.44	0.94
		My skills for doing the type of work I want to do are up-to-date	0.54	0.87	3.50	0.89
		I have a good work history	0.69	0.87	3.87	0.80
		An employer would be impressed with my qualifications	0.72	0.87	3.43	0.89
		I have good job reference	0.71	0.87	3.61	0.85
		My work qualifications are not very good *	0.45	0.88	3.29	1.03
Career Identity	Warr, Cook, and Wall (1979)	Even if I won a great deal of money at 4D or ToTo, I would continue to work somewhere	0.53	0.87	4.06	0.90
		Having a job is very important to me	0.72	0.87	4.22	0.75
		I would hate to be on welfare, e.g. long-term Comcare etc.	0.68	0.88	3.74	1.06
		I would soon get very bored if I have no work to do	0.76	0.87	4.06	0.91
		The most important things that happen to me involve work	0.69	0.87	3.82	0.87
		If welfare benefits were really high, I would still prefer to work	0.74	0.87	4.12	0.71
SCALE TOTAL/ OVERALL				0.87	3.41	0.50

Table 3:*Details of the ICT Access scale, sources and descriptive statistics*

Activities Category	Source	Activities	Factor Loading	Cronbach's Alpha	Mean	SD
Location measures for places of internet and mobile broadband access	Selwyn et al. (2004)	Cyber cafe or Internet Café	0.70	0.82	1.50	1.00
		A relative's home	0.74	0.82	1.67	1.15
		A friend's home	0.78	0.81	1.62	1.14
		My workplace	0.52	0.82	2.67	1.75
		My place of study	0.63	0.82	1.97	1.53
		Community Clubs / Community Centers	0.77	0.81	1.62	1.14
		Public libraries	0.75	0.81	1.73	1.19
		Internet in my own home	0.70	0.82	4.18	1.36
ICT material access to devices such as the personal computer and mobile phone scales	Zhang (2014), Mendonça et al. (2015) and van Deursen and van Dijk (2015)	Tablet e.g. Apple iPad, Samsung Galaxy Tab etc.	0.42	0.82	2.96	1.71
		Digital reader device, e.g. Kindle	0.59	0.82	1.69	1.26
		Gaming device, e.g. Xbox, Nintendo, PlayStation	0.56	0.82	1.40	0.96
		Smartphone e.g. iPhone, Samsung, Blackberry etc. with internet connection.	0.73	0.83	4.14	1.43
		Smartphone e.g. iPhone, Blackberry, Samsung etc. without internet connection.	0.46	0.83	2.38	1.75
		Feature mobile phone e.g. Nokia 100, 130 etc., with internet connection	0.55	0.83	1.86	1.51
		Feature mobile phone e.g. Nokia 100, 130 etc., without internet connection	0.59	0.82	1.48	1.13
		Desktop personal computer (PC)	0.60	0.82	3.36	1.60
		Mobile computer, e.g. laptop, netbook	0.70	0.82	3.74	1.56
		SCALE TOTAL/ OVERALL		0.83	2.35	0.72

Table 4:*Details of the ICT Usage scale, sources and descriptive statistics*

Category	Source	Activities	Factor Loading	Cronbach's Alpha	Mean	SD
Scales for computer, mobile phone and internet usage variables	Barry et al. (2015) and Selwyn et al. (2004)	Perform online-banking transactions	0.54	0.90	2.17	1.31
		Write and edit letters, reports and other documents	0.74	0.90	2.65	1.50
		Look for products and services/gathering product information online.	0.74	0.90	2.81	1.40
		Fiddle around on your ICT device/explore different parts of the device to develop your own knowledge.	0.66	0.90	2.71	1.41
		Look for information related to work/business/study on the worldwide web.	0.74	0.90	3.05	1.40
		Organize the ICT device's files/memory.	0.66	0.90	2.34	1.31
		Create and manipulate images, e.g. photographs.	0.57	0.90	2.22	1.28
		Download software, music, films or images from the Internet.	0.50	0.90	2.29	1.34
		Access online gamble sites, e.g. <i>singaporepools.com.sg</i> , to place bets.	0.62	0.91	1.35	0.88
		Create music.	0.78	0.91	1.43	0.99
		Create films or animations or videos.	0.88	0.91	1.37	0.94
		Participate in educational courses/lessons, e.g. <i>Coursera</i> , on the World Wide Web.	0.66	0.91	1.66	1.05
		Make / maintain your own website product information.	0.77	0.91	1.54	1.06
		Surf the Internet.	0.82	0.90	4.06	1.40
		Send/read emails.	0.75	0.90	3.88	1.44
		Access online news.	0.78	0.90	3.84	1.45
		Send text messages.	0.81	0.91	4.18	1.28
		Access social media, e.g. Facebook, Twitter.	0.66	0.91	3.70	1.61
		Play games.	0.63	0.91	2.23	1.54
		Listen to music.	0.79	0.91	3.11	1.55
		Watch videos.	0.80	0.91	2.94	1.50
		Buy goods and services on-line.	0.64	0.90	1.72	1.06
		Browse/surf the worldwide web for no specific purpose.	0.54	0.90	2.50	1.56
SCALE TOTAL/ OVERALL				0.91	2.65.	0.77

Table 5:*Details of the ICT Appropriation scale, sources and descriptive statistics*

Category	Source	ICT Appropriation Statement	Factor Loading	Alpha Cronbach Reliability	Mean	SD
ICT appropriation items related to personal statements	Wong et al. (2014)	Knowing about ICTs makes me feel as though I am ‘at the cutting edge’	0.60	0.86	3.53	0.92
		Through information provided by ICTs, I understand more about what is happening in society	0.69	0.85	3.92	0.79
		I feel that I am quite smart because I have learnt to use ICTs	0.56	0.86	3.41	0.94
		Learning how to use ICTs creates more topics for me to communicate with others	0.79	0.85	3.87	0.80
		Learning how to use ICTs enables me to make more friends	0.77	0.86	3.82	0.82
		Learning how to use ICTs provides me with more ways to connect with overseas relatives and friends	0.74	0.85	3.99	0.79
		If I do not know about ICTs, I may become an outcast in society	0.69	0.87	3.59	1.02
		If I do not learn how to use ICTs, I may experience more inconvenience in my life	0.76	0.86	3.81	0.96
ICT appropriation items related to profession and employment	Araque et al. (2013)	Having access to ICTs can help me get a job	0.64	0.86	3.85	0.91
		I know how to subscribe to websites, e.g. JobStreet.com, National Jobs Bank etc.,	0.83	0.86	3.94	0.99
		I have filled out job applications online	0.87	0.86	3.66	1.20
		I have used ICTs to submit my resume/job application	0.87	0.86	3.68	1.22
SCALE TOTAL/ OVERALL				0.87	3.76	0.61

Table 6:*Regression table - ICT access, ICT usage and ICT appropriation on self-perceived Employability*

Source	SS	df	MS	Number of Observations	=	302
Model	17.822264	3	5.94075466	F(3, 298)	=	30.13
Residual	58.7585863	298	.197176464	Prob > F	=	0.0000
				R-squared	=	0.2327
				Adj R-squared	=	0.2250
Total	76.5808502	301	.254421429	Root MSE	=	.44405

DV: Employability	Coef.	Std. Err.	t	P>t	Beta
ICT Access	0.03	0.05	0.74	0.46	0.05
IC Usage	0.14	0.05	2.98	0.00	0.22
ICT Appropriation	0.25	0.05	5.18	0.00	0.30
_cons	2.00	0.17	12.06	0.00	.

Figure 1: Bar Chart showing the Employment Status of the Participants

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