The emergence of the intra-rural digital divide: A critical review of the adoption of ICTs in rural areas and the farming community

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Abstract: *The impact of ICTs on (rural) development is a much contested issue. Contrary to the proponents of ICTs who take an optimistic view and highlight the positive (potential) effects of ICTs, another strand takes a pessimistic view stressing that the existing socio-economic inequalities do not allow for such prospects; the so-called 'digital divide' is highlighted as one of the most visible components of the current development divide. In the present paper a brief review of the evolution of the concept 'digital divide' is followed by an outline of research findings showing an urban-rural divide. Further, based on a review of the available international literature, in both developing and developed countries, and examples from Greece it is argued that the adoption and use of ICTs by farmers (especially as far as ICTs are being envisaged as powerful extension tools) and their potential impact needs to be approached with caution. Findings suggest the emergence of an intra-rural digital divide which, in turn, may be detrimental to human development, and thus to sustainable rural development. It is therefore maintained that the dominant, 'supply-driven' policy approach needs to be reversed; to this end, the experience from the fields of sustainable rural development and rural extension, especially of participatory processes, is invaluable.*

Keywords: *ICTs, farmers, extension, intra-rural digital divide*

Introduction

Over the last decades, within the discourse of 'information society', 'knowledge society', 'information economy' and the like, it is maintained that information and knowledge play a key role in ensuring (sustainable) development. Consequently, the potential impact of Information and Communication Technologies (ICTs) on development, enabling low-cost creation, access and distribution of information, and re-structuring and re-organising the spheres of production, distribution and circulation has become a much contested issue. Debates have also emerged concerning the 'dream' of the pioneers of the 'information age' who envisaged ICTs (particularly the Internet) as the mechanism towards self-government. The impressive development of ICTs and especially their appeal to youth has led many to support the optimistic scenario claiming that new media can fill the existing 'communicative void', stimulate participation and revitalize civil society (see: Alexopoulos et al., 2010).

In the framework of (agricultural and rural) development and poverty alleviation, ICTs' potential impact on the innovation-diffusion process has drawn the attention of both scholars and practitioners and has resulted in lively debates as well (Richardson, 1997; O'Farrell, et al., 1999; Chapman and Slaymaker, 2002; FAO, 2003; Dean, 2007). For the FAO, for example, the challenge in assisting farmers and, generally, rural populations to develop implies the need for new technologies, new skills, changed attitudes and practices, and new ways to collaborate. This, in turn, requires that rural populations have access to relevant information and knowledge and ICTs are envisaged to play a decisive role in or drive (rural) development (see: Koutsouris, 2006).

The digital divide

Nevertheless, contrary to the proponents of ICTs who take an optimistic view and highlight the positive (potential) effects of ICTs, especially the Internet, to create new economic, social and political opportunities, another strand takes a pessimistic view stressing that the existing socio-

economic inequalities do not allow for such prospects (Gigler, 2004; McElhiney, 2005; Newholm, et al., 2008). Thus, for example, the UN while appreciating media's importance to social justice and acknowledging that access to information is a basic human right, also note the persistence of the so-called 'digital divide' (UN, 2006, p. 25).

The term owes to concerns expressed in the United States where, since the mid-1990s, a series of studies undertaken by the National Technical Information Administration (NTIA) documented persistent differences in the rates at which members of different groups use the new media. As a result, a dichotomous distinction between people who have access to the Internet or not, resulting from varying socio-economic, cognitive, and cultural resources, was highlighted (Buente and Robin, 2008; Warschauer, 2003; Zheng and Walsham, 2008).

Since then, the digital divide gained much research attention and has become a hot subject today. In parallel, the abovementioned dichotomous approach (haves vs. have-nots) has been challenged as oversimplified, if not confusing - since other phenomena such as differences in use were either ignored or confused with physical access (DiMaggio and Hargittai, 2001; Gunkel, 2003; Selwyn, 2004; Van Dijk and Hacker, 2003). Consequently, in the last decade, the concept of the digital divide was modified as a) not only a technological, but a social problem, i.e. a phenomenon reflecting broader social, economic, cultural, and learning inequalities and b) concerning not only physical access but the required skills for using computers/the Internet and what users do with them as well (Buente and Robin, 2008; Cho et al., 2003; Dewan and Riggins, 2005; Fuchs, 2009). Thus, the digital divide proves a multifaceted, "complex and dynamic phenomenon" (Van Dijk and Hacker 2003, p. 315).

The multidimensionality of the digital divide implies that, despite their importance, no single factor (such as gender, age, race, education, income or geographic location; see, for example Dada, 2006; Dewan and Riggins, 2005; Korupp and Szydlick, 2005; Yu, 2006) can alone fully explain the first order (physical access) gap. The same is true as far as the second level (ability to use) digital gap (and the resulting 'knowledge gap') is also concerned. For example, Internet use has been found to depend on factors such as education, gender, autonomy of use, motivation, family structure, information technology literacy and IT skill (and experience), social support, type of employment, language, kinds of information (content), involvement in social/civic pursuits, satisfaction, etc. (see, for example: Chen and Wellman, 2004; Cho et al., 2003; Dewan and Riggins, 2005; Gil-Garcia et al., 2006; Hargittai and Hinnant, 2008).

The urban-rural divide

Despite the fact that much of the literature on the use of ICTs concerns the potential that relevant investments may offer to rural areas, such a 'techno-optimist' account ignores the fact that on a worldwide scale rural areas are lagging behind in terms of access (thus referred to as the 'last mile of connectivity'; Paisley and Richardson 1999) and taking advantage of the benefits of the ICTs (Koutsouris, 2006). The digital divide between urban and rural areas is a well established phenomenon as shown by research in the US, Canada, Australia and the European Union (Demoussis and Giannakopoulos, 2006; Fucks, 2009; Gil-Garcia et al., 2006; Ramirez, 2001; Willis and Tranter, 2006). Furthermore, Donnermeyer and Hollifield (2003) have found that there is also a digital divide between rural communities as well as between rural people at the same place.

Farmers and ICTs

Especially as far as farmers are concerned findings in both developed and developing countries underline the need to approach the adoption/diffusion of ICTs with caution. In developing countries, constraints relating to physical access, such as poor infrastructure and high costs, are quite common, aggravated by the lack of skills and the dissemination of inappropriate (i.e. provider-driven) information to farmers, including language barriers (Akpabio, et al., 2007; Annor-Frempong, et al., 2006; Kalusopa, 2005; Munyua, 2007). Furthermore, Park et al. (2007) verify the findings of previous studies indicating that modern communication strategies (ICTs) are less preferred by farmers and

ascertain that farmers are constrained by time and finances, commitment to family and jobs, and responsibilities in the operation of the family farm or business. Iranian wheat farmers were also found to trust research and extension centres as compared to other communication means, including various ICTs (Saadi et al., 2006). Research findings in both Iran (ibid.) and Turkey (Demiryurek, 2006) support the generalizations of diffusion theory, i.e. that there are positive relations between ICTs' adoption and farmers' socio-economic characteristics and communication behaviours.

The case of developed countries is more revealing. In the case of the USA, as early as 1986, Lasley and Buntena found that 20% of the surveyed 2,400 Iowa farmers opposed the use of personal computers. Furthermore, Abbott and Yarbrough (1991) in their studies on ICTs adoption among Iowa and New York farmers note that new communication technologies will probably never be adopted by many farmers as well as that adoption and use have created substantial inequalities. They also found that, on the one hand, scale of farming operations and farmers' skills determine the perceived potential benefits and thus adoption of ICTs, and, on the other hand, there is no overall pattern of all ICTs.

Recent research findings show that the Internet and electronic mail are of less use to producers than other sources. For example, swine producers in Illinois were found, on the one hand, not to use computers as a source of information despite the fact that they have access to on-farm computers and, on the other hand, that they rely on popular publications, corporate representatives, extension newsletters, and current users of new technologies to advance within the swine industry (Brashear, et al., 2000). Gloy et al. (2000) found that crop and livestock farmers consider crop/livestock-specific publication and general farm publications as the most useful sources. Lasley et al. (2001) showed that Iowa farmers, regardless of technological sophistication (including ICTs), desire a wide range of information delivery channels and show a strong preference for personalized communication. Research in Michigan showed that farmers currently prefer traditional written materials over computers and the Internet to learn about watershed conservation (Howell and Harbon, 2004); printed information is also the channel most often used for information among beef cattle producers in northwest Florida (Vergot, et al., 2005). Ohio farmers were found to be significantly less likely to use electronic media compared to traditional media, especially print media (Diekmann and Batte, 2009). Utah small-acreage farmers are most likely to obtain information from friends or relatives followed by extension printed materials and personal contact with Extension agents (Brunson and Price, 2009).

Furthermore, research among farm leaders in southeast Alabama, northwest Florida, and southwest Georgia concluded that the dominant factors in PC and Internet adoption are type of farm production and age, with education being a supporting factor. In parallel, a large segment of the farm population has not adopted the PC and an even larger segment is not connected to the Internet, a fact attributed to the lack of infrastructure in rural areas (Hall, et al., 2003). In Michigan, farmers' preferences for computers and Internet related to gross annual income level, age and education (Howell and Harbon, 2004). In North Carolina forest landowners' characteristics, including socio-demographics, land ownership, and management experience, relate to their delivery method preferences (Bardon et al., 2007). Diekmann and Batte (2009) have also identified 4 clusters of search strategies among Ohio farmers each corresponding to different farm and farmer's characteristics. Recent research among livestock farmers in Tennessee concluded that farmer and farm characteristics influence the use of information sources (Jensen et al., 2009). Finally, there is evidence that GIS-GPS-RS technologies have widened the digital divide, leaving many with little understanding of the technology and potential applications (Milla et al., 2005).

In Ireland, surveys show farmers as one of the most marginalized sectors in the 'information society' owing to low ICT skills and lack of appreciation of ICT benefits (or motivation) (Morrow et al., 2004; McCarthy and Melvin, 2005). Furthermore, research shows that less than two-thirds of the farmers with access to ICT use it for farming purposes, while farming households with off-farm employment are more likely to have adopted ICT than full-time farmers. In parallel, farmers engaged in specialist enterprises as well as those with medium-sizes farms are more likely to have adopted ICT (Wims, 2007). Research has also shown that dairy farmers are more involved in ICT use than less profitable

farmers and has pointed to a growing digital divide in Ireland (Leveque et al., 2007). Similar evidence comes from England (Warren, 2002); additionally both Warren (ibid.) and DEFRA (2004) have showed that technological factors are only part of the story of non-use of the Internet by farmers; much of the inhibition relates to human factors (competence and motivation).

The Greek experience

The Greek setting

In the European context, research has shown the existence of both regional digital divides, notable one between Northern and Southern European countries, and intra-national divides (based on a multiplicity of socioeconomic factors) (for example, Carveth and Kretchmer, 2002; Cuervo and Menendez, 2006; Orvisca and Hudson, 2009). Consequently, Milicevic and Gareis (2003) have argued that rhetorical arguments supporting the 'death of distance' are not firmly founded upon empirical evidence.

In Greece, the adoption of PCs and the use of Internet at home has, between 2005 and 2008, risen from 43% to 54% (vs. EU27: 68% and EU15: 72%, in 2008) and from 24.21% to 39.4% (vs. EU27: 60% and EU15: 64%, in 2008). In parallel, there has been a substantial increase in households' broadband connections from 1% to 23% (vs. EU27: 49% and EU15: 52%, in 2008) (OGIS, 2009). Large differences are observed according to gender, age and education. Furthermore, Greek rural areas are lagging behind in the use of both PCs (20.5% vs. 37.5% in urban areas; 2006) and the Internet (15.9% vs. 30.1% respectively) (VPRC, 2007). Major factors impending the use of Internet, especially in rural areas, are poor infrastructure, the high cost of services and equipment and the lack of training and thus of IT skills (OGIS, 2009). Overall, according to the UN (2008), Greece rates, among 192 countries, 44th in terms of the eGovernment Readiness Index (and last among the Southern European EU member-states), and 104th in terms of the eParticipation Index.

Research in Greece

Following, two recent papers addressing the issue of the utilisation of ICTs by Greek farmers are outlined. The first one (Alexopoulos et al., 2010) aimed at identifying the existence (or not) of (some form of) a 'digital divide' within rural areas in Greece. More specifically, it aimed at exploring which characteristics (socio-demographic, economic, etc.) of (young) rural inhabitants relate to the use of PCs, the ownership of PCs and the use of Internet. Utilising data drawn from a large-scale survey (853 completed questionnaires) concerning young rural inhabitants (18-45 years old), in 7 out of the 52 Greek Prefectures (2005), the differences occurring within, first, the totality of (young) rural inhabitants (whether farmers or not) and, second, the farming community were explored.

Results are in line with previous studies addressing the (general) phenomenon 'digital divide'. The use of PCs and the Internet on the part of young rural inhabitants (total sample) is found to be affected by characteristics mainly relating to educational attainment (i.e., moved away from residence area for education; knowledge of foreign language; spouse's education) as well as attitudes towards knowledge, and occupation (i.e., non-farmers are more likely to use PCs and the Internet). Ownership of PC is also affected by age, with older inhabitants and younger spouses been less likely to own a PC. Further, those inhabiting plain areas are less likely to have PC at home probably due to the fact that multiple information sources are available in such areas (compared to mountainous and LFAs) as well as that since the majority of young non-farmers live in such areas they may use PC at work or in Internet cafes. Finally, Internet use additionally relates to experience with PCs (measured as years of PC use). The same characteristics determine, in general lines, farmers' (subsample) behaviour as well. In the case of farmers it is worth mentioning that gender appears to influence Internet use (i.e., women are less likely to use the Internet).

Therefore, it seems that, besides the well established urban-rural divide, further 'sub-divides' emerge within rural areas: on the one hand, between non-farmers and farmers and, on the other hand,

among farmers. Cultural resources appear to determine a great part of this phenomenon (also due to relationships to occupation and income). Occupation emerges as the second important factor determining PC and Internet use with farmers being left in the 'wrong side' of the divide. The fact that education is found to be a major factor determining differential Internet use (Gil-Garcia et al., 2006; Hargittai and Hinnant, 2008) may also imply that a 'second level' divide is also in place. Hence, it is suggested that, in order to acquire a more nuanced account of the 'sub-divides' within rural areas, future research will have to address issues such as the 'second level divide' and 'unfavourable inclusion' (Zheng and Walsham, 2008) as well as the relationship between different groups of non-users (Reddick, 2000) and media use selection.

The second paper (Michailidis et al., 2010) aimed at exploring farmers' use of ICTs and their views on preferred extension methods, utilising data drawn from a survey (490 questionnaires) addressing farmers in the region of West Macedonia (Northern Greece; 2006). In the first place, analysis showed the existence of three farmers' classes regarding the use of a range of ICTs: 'high' (10%), 'medium' (40%) and 'low tech' (50%) farmers. The first class use mobile telephones, PCs, internet and e-mail very often while the third one rarely or never. Furthermore, the three classes were found to differ in terms of gender, marital status, farming mode (full or part-time farming), income sources and estimated (farm) net worth. Further, ICTs adoption is significantly related to factors such as annual income, farmers' classification, familiarity with ICTs and education, with gender being a supporting factor.

It is further shown that, regardless of the level of communication sophistication, farmers favour a wide range of information delivery channels, particularly on-farm demonstrations and farmers' involvement in applied research. This is in line with Reisner's (1992) claim that farmers prefer symmetrical (face-to-face) communication, and Raedeke and Rikoon (1997) for whom on-site farm trials emphasising local applications is a more accessible to farmers' communication means. Furthermore, according to Easdown and Starasts (2004) farmers' learning and information seeking processes are highly situational and experiential and mismatch with the information provided in the Internet while for Baaijen and Perez (1995) the scientific method does not necessarily fit farmers' rationale and thus ICTs cannot replace farmers' decision making.

Finally, research findings support the thesis that the introduction of ICTs should adjust to the context of established communication systems as well as that ICTs should facilitate the work of extension – not replace it (Rivera and Qamar, 2003). As Richardson (2007, p. 88) maintains extensionists "*while embracing newer technologies logically … must always focus on the informational needs of [their] intended audiences and tailor [their] delivery and accountability resources in a manner that assures that these intended audiences are adequately served and not left behind*"; extensionists need to be able "*to get in the field where the crops and livestock are grown, and provide the kinds of information and advice that are applicable and understandable to each specific client based on their individual circumstances, rather than sitting behind a computer monitor …*". Hence, it is suggested that future research will also have to address the issue of extensionists' new roles (i.e., ICTs trainers and/or infomediaries, creators and facilitators of local (ICT) learning spaces, etc.).

Future research

Overall, empirical findings support, more or less, Rogers' (1995) socio-economic generalizations about early adopters. Nevertheless, further research is needed a) along the lines of diffusion theory (addressing, for example, the role of personality traits and product attributes in ICT adoption) and its extensions (Li, 2004), and b) the technology acceptance model (TAM) suggesting that perceived ease of use and perceived usefulness are the most important factors in explaining ICTs use (Davis, 1989) and its extensions (Legris, et al., 2003; Yi and Hwang, 2003).

Aftermath

The preceding literature review shows that considerable, identifiable segments within the farming community are being deprived of access to PCs and the Internet. This, in turn, means that the farmers concerned are, more or less, excluded from certain information on, at least, agricultural and rural development. It thus seems highly probable that an *intra-rural or within the farming community digital divide* emerges; farmers who do not have (or are not able to acquire) the chances and abilities to use ICTs, particularly the Internet, may well be deprived of capabilities to participate in development processes and improve their lives.

In order to avoid a self-reinforcing cycle that will deepen the identified gaps (digital divides), policies concerning new media (and extension) must concentrate on the facilitation of people to acquire both technical and cognitive capacities (i.e., to acquire, interpret and use information as part and in the context of their everyday lives). This, in turn, will increase their abilities to effectively use electronic spaces, to enhance their opportunities to make choices between alternatives and to participate in public deliberation and development processes.

Moreover, as already argued, the successful ICT introduction and use is multidimensional and thus depends on the social and human infrastructure as well as on complementary (technological, institutional, entrepreneurial, etc.) and contextual factors (Oakley and Campbell, 2002; Rooksby, et al., 2003; Hearn, et al., 2005). When ignored, supply-side policies and efforts concerning ICTs will pay leap service to the bridging of the digital divide. However, it seems that, currently, governments (and extension services) heavily focus on the 'access to technology' problem with ICTs' development based on a 'customer-centric' model (Cibbora, 2005), i.e., an inflexible model that provides people with information and services online rather than with tools to enable capabilities. Consequently, this technocentric (technological deterministic) approach in creating a developmental process fosters material access and technology adoption per se and largely fails, on the one hand, to appreciate the complexity of the factors stalling ICT projects in rural areas (i.e., the digital divide phenomenon) and, on the other hand, to address those people and groups who have least access to new media and seem to be socially, economically and politically marginalised. Based on both the literature review and the Greek experiences previously outlined, such an approach proves to be questionable and may have major repercussions as far as (sustainable) agricultural and rural development is concerned.

Conversely, the experiences of Farming Systems Research/Extension (Collinson, 2000) and participatory development may well serve to integrate ICTs in rural development through participatory processes. In such a case the 'supply-driven' approach is reversed as follows: first, people's and communities' interests are identified; then, the type of information necessary to satisfy such needs is determined; finally, the way technology can support those interests is decided. In this respect, the development of ICT projects should be planned and evaluated in common with the people concerned and thus with respect to their context (see: Joseph and Andrew, 2008; Panchard and Osterwalder, 2005; Koutsouris, 2008; Thomas, 2009; Haviarova and Vlosky, 2009; Chapman and Slaymaker, 2002; Parkinson and Ramirez, 2006). This for rural areas, especially farmers, implies an understanding of the local knowledge systems which are mainly based on experience and the support of local organizations, and concerns both farm and non-farm decisions.

To conclude, although "the idea that ICTs are intrinsically desirable and beneficial to the society is still prevalent" the present study confirms that "ICTs can contribute to the exacerbation of social exclusion, or can be tools to bridge gaps" (Trauth and Howcroft, 2006, in Zheng and Walsham, 2008, p. 222).

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