

**TECHNOLOGY AND INFRASTRUCTURE CO-CREATION FROM
THE BOTTOM-UP: INSTITUTIONAL, SOCIOMATERIAL,
IMPROVISATIONAL AND SYMBOLIC ACCOUNTS FROM THE
FIELD
THE CASE OF GRASSROOTS INTERNET INFRASTRUCTURE
DEVELOPMENT IN BELARUS**

A dissertation submitted for the degree of

**DOCTEUR EN SCIENCES DE GESTION
DE L'ÉCOLE DOCTORALE
« ÉCONOMIE, MANAGEMENT, MATHÉMATIQUES DE CERGY »
ED 405**

FROM ESSEC BUSINESS SCHOOL

Presented and defended publicly on June 27th, 2012 by

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ABSTRACT

This dissertation is a multi-perspective inquiry into the phenomenon of grassroots end-user innovation. It focuses on the processes of end-user innovation and technology co-creation and investigates how these developments are embedded in the context of environmental complexities and the interplay of existing actors, institutions and infrastructures. The research setting is based on the 16-year Internet infrastructure development by residential citizens as an alternative to the government and private providers' inaction. The phenomenon included millions of users, innovations and public value creation from the grassroots, and successful cooperation with private organizations. The dissertation mainly comprises three research papers each taking a separate perspective on the phenomenon. Methodologically, the dissertation builds on the qualitative case-study approach and abductive and inductive reasonings. The dissertation provides theoretical and practical contributions to the understanding prerequisites, process and consequences of end-user innovation, co-evolution of the technology meaning and structure, grassroots links with industry, as well as organizational change in routines and technologies as embedded in larger institutional dynamics and complexities.

Key-words: technology co-creation, post-adoption technology use, sociomateriality, institutional theory, symbolic meaning of technology, improvisation, innovation, qualitative case study

RESUME

Cette thèse est une investigation multi-perspective du phénomène des innovations créées par les utilisateurs finaux. Elle est focalisée sur les procès des innovations et de co-création des technologies venu du niveau des utilisateurs finaux, c'est-à-dire sur les procès qui sont appelé dans des publications anglophones 'grassroots technologies'. Nous considérons comment ces développements se plongent dans le contexte des complications d'environnement et de ses interactions avec des acteurs déjà en jeu, i.e. institutés et des infrastructures déjà existants. Notre recherche est fondée sur le développement d'une infrastructure d'Internet, évoluant pendant 16 ans, dont est élaboré par des particuliers comme alternative à l'inaction du gouvernement et des fournisseurs d'Internet. Le phénomène a réuni millions des utilisateurs, création des innovations et des biens publics par des particuliers, ainsi que coopération fécond avec des organismes privés. La thèse comprend trois articles de recherche, chacun prenant une perspective différente du phénomène. Du point de vu de la méthodologie, ce travail est appuie sur l'approche avec les études qualitatives des cas et les raisonnements abductifs et inductifs. La thèse fournit contributions théoriques et pratiques pour compréhensions des conditions préalables, procès et conséquences des innovations par des utilisateurs finaux, la coévolution du sens et de la structure de la technologie, lien entre le niveau des innovations par des utilisateurs finaux et l'industrie, ainsi que le changement en routines et technologies quand ces dernières sont plongés dans l'ambiance de la dynamique institutionnelle et des complexités.

Mots clés: co-création des technologies, utilisation de technologie après adoption, sociomaterialité, théorie institutionnelle, sens symbolique de technologie, improvisation, innovation, étude des cas qualitative

ACKNOWLEDGEMENTS

In line with the main idea of this dissertation – co-creation – this research emerged as a result of interaction and cooperation with many amazing people, bright researchers and inspiring institutions. In this section, I would like to acknowledge them and to thank them for being a part of this process, contributing to the formation of my professional identity, enabling, inspiring and supporting me in the way that made creation of this dissertation possible.

I would like to first and foremost thank my advisor, David Avison, for spending a great amount of his time and energy during the last four years in the formation of this dissertation, for always being available to help and share his advice, for allowing me to do the kind of research I am really interested and to follow sometimes challenging but interesting and inspiring paths, and for his belief in my success during the PhD process. These all were of invaluable support and I learned a lot from this mentorship.

This is also to those individuals – administrators and users of home LANs, and representatives of Internet providers – who contributed greatly to this research despite complicated legal conditions and their everyday routines, who shared their insights and inspiration with me and who so generously gave their time through interviews that provided a rich and informative qualitative database. My heartfelt gratitude and admiration go to Alexei Brusentsov, Vitaly Danilovich, Mikalai Nikalayenka, and many others - without your help, this dissertation would not be at the same level!

I am grateful to ESSEC professors who over these four years shared their knowledge and expertise and with their research and teaching excellence inspired me to dare looking for the answers to challenging and interesting questions. I am particularly grateful to Marie-Laure Djelic, Marie-Léandre Gomez, Philippe Lorino, Anca Metiu, Jan Ondrus, Anne-Claire Pache, Stoyan Sgourev, and Raymond-Alain Thietart for their continuous support, valuable comments and advice in the process of development of this dissertation. My special acknowledgement goes to Valery Yakubovich, for inviting me to be his teaching assistant and thus allowing me to learn from the example where research and teaching excellence are mutually supportive. I would also like to sincerely thank François-Xavier de Vaujany, Bill Dutton, Brian Fitzgerald, Robert Galliers, Philippe Lorino, and Amit Mitra who agreed to share their expertise and experience by doing me the honour for being on my jury.

I would also like to express my profound gratitude to Bill Dutton for opening the inspiring world of academic excellence in Oxford to me, and for showing me with his own example how the power of Internet technologies might connect minds across the countries and institutions. Research seminars and discussions at the Oxford Internet Institute (OII) contributed to shaping my research greatly. My thanks also go to Anne Geniets, Yana Breindl, and Laura Mann, whose warm welcome and friendship at the OII particularly touched me and who supported me greatly during the job application process.

I am also grateful to the participants of a number of conferences and workshops where I had the pleasure to present during these last four years and that with the feedback and questions, undoubtedly, improved my work. My particular thanks go Mark Aakhus, Chrisanthi Avgerou, Brian Fitzgerald, Ram Gopal, Stefan Klein, and Dirk Postma.

I would particularly like to thank the ESSEC PhD community – my PhD colleagues and friends with whom we shared the experience of PhD studentship and the highs and lows of the learning curve during these years: Shora Moteabbed, Wim Van Lent, Samia Badji, Max Chauvin, Parviz Darvish, and Araz Abbaszadeh. My thanks also go to Alireza Ahmadsimab, Ricardo Azambuja, Joel Bothello, Adrian Borbely, Imran Chowdhury, Aakanksha Gaur Lisa.Karasiewicz Baudot, Melissa Moraes, Vlad Porumb,

Chee Meng Tan, and many others – thank you for being a part of the inspiring PhD community. I am also grateful to Lina Prevost and Fadoua Tifaf for their support and making organizational issues simple.

My warm cheers go to my friends who became my ‘second family’ in France: Trafim Lasy, Ruslan Maximov, Kseniya Novozhilova, Yana Ponomor’ova, Dmitry Golubkov, Viktoria Lebed, Maksim Zhykhovich, and David Zmiaikou. Your humor, wisdom and a feeling of sincere friendship helped me a lot. Being in a company of so many PhDs (or on their way to) I just did not have a choice whether to make it or not.

I would like to especially thank my family for their love and support. My Mum, Dad, sister Mary, and my father- and mother-in-law - for their unconditional love and support for me at whatever time, place, and level of achievement. My dear Babushka for her warm caring and everyday praying for me. My grandmother and two grandfathers that did not manage to see this defense but who were always proud of my every success and taught me a lot about strength and independence. My ‘super’ aunt and ‘super’ uncle, Angela and Valery, and Kate and Kostia Zoryn for their back up and refreshing opinions. Kids Lisa, Sasha, and Sasha, Timosha and Yan for not letting me to forget that I keep staying a part of a big and noisy family no matter how far I travel. My cheers also go to Maria Paniushkina for being like a sister through all these years to me.

Most of all, however, I would like to thank my husband Evgeniy - for his enormous love, care and support for me every day, for staying my best friend in all the highs, lows, and evenness of this PhD journey, and for inspiring my way with his own bright example =).

Last but not least, following the agential realism and sociomateriality perspective employed in this study, I would like to acknowledge the agencies enabling and supporting the creation processes of this dissertation. Five different cities – Cergy, Minsk, Paris, Oxford and York, and three different institutions – the ESSEC Business School (to a great extent, indeed), the Oxford Internet Institute, and the University of York - created the perfect entanglement enabling, supporting and facilitating this dissertation to happen.

TABLE OF CONTENTS

ABSTRACT	5
RESUME.....	7
ACKNOWLEDGEMENTS.....	.9
LIST OF FIGURES	17
LIST OF TABLES	19
CHAPTER 1: Introduction	19
1. 1. Case Description	23
1. 1. 1. A Brief Description of Home LANs	23
1. 1. 2. Agential interplay in the processes of home LAN creation and development	25
1. 1. 3. Contextual prerequisites of home LAN creation.....	27
1. 2. Research Questions under Study in the Dissertation	31
1. 3. Theoretical Background of the Dissertation.....	31
1. 4. Research Process and Methodology.....	35
1. 4. 1. Focus and Epistemological Position	35
1. 4. 2. Data Sources and Data Collection Procedures	37
1. 5. Overview of Research Papers.....	41
CHAPTER 2: Co-Creating from the Bottom Up: End-User Transformative Technology Enactment and its Meaning in the Communities of ICT-Enabled Organizations.....	53
Abstract	55
2. 1. Introduction	56
2. 2. End-User co-creation of the Technological Artifact	58
2. 2. 1. End-users as Co-creators of Technology	59
2. 2. 2. Technology Structure and its Meaning in the Process of End-User Enactment.....	62
2. 3. Research Methodology.....	67
2. 3. 1. Research Design	67
2. 3. 2. Data Sources and Data Collection Procedures	68
2. 3. 3. Data Analysis Procedures.....	70
2. 4. Data Analysis	73
2. 4. 1. Episode 0. Home computer as passion and main hobby of individual users (mid 1990s)	78

2. 4. 2. Episode 1. Home LAN as substitute for lacking Internet access (1995-1998).....	79
2. 4. 3. Episode 2. Home LAN as a symbol of belonging to a special culture (1999-2003).....	81
2. 4. 4. Episode 3. Home LAN as a means to get cheap and quality Internet access (2003-2006).....	85
2. 4. 5. Episode 4. Home LAN as an important supplement to cheap and quality Internet access (2006-2007).	87
2. 4. 6. Episode 5. Home LAN as a symbol of an identity choice (2008-2010) ...	88
2. 4. 7. General Pattern of End-user Transformative Technology Enactment	90
2. 5. Discussion and Conclusion	92
CHAPTER 3: How Sociomateriality and Institutions Entangle: A Case Study of End-User Communities and Internet Infrastructure Development	103
Abstract	105
3. 1. Introduction	106
3. 2. Organizational Change in Technologies and routines:Sociomateriality and institutional Theory Perspectives	108
3. 2. 1. Sociomateriality as a Lens to Study Technology-Enabled Organizational Change.....	108
3. 2. 2. Processes and Mechanisms of Sociomaterial Imbrications.....	110
3. 2. 3. Sociomaterial Imbrications and Institutional Dynamics: Unstudied Field of Research	112
3. 2. 4. Institutional Theory Perspective on Organizational Change and Stability	114
3. 2. 5. Field Structure Characteristics Influencing Sociomaterial Imbrications	117
3. 2. 6. Organizational filters.....	120
3. 3. Methodology	121
3. 3. 1. Case Selection	122
3. 3. 2. Data Sources.....	123
3. 3. 3. Data Analysis Procedures.....	125
3. 4. Data Analysis	127
3. 4. 1. Phase I: Home LANs not interacting with other Internet actors directly (1995-1999)	129
3. 4. 1. 1. Sociomaterial Entanglements in the Institutional Context	131

3. 4. 1. 2. Field structure characteristics and the foreground pattern of sociomaterial imbrications.....	133
3. 4. 2. Phase II: Home LANs interaction with private ISPs (2000-2005).....	135
3. 4. 2. 1. Sociomaterial Entanglements in the Institutional Context	135
3. 4. 2. 2. Field structure characteristics and the foreground pattern of sociomaterial imbrications.....	137
3. 4. 2. 3. LAN sociomaterial imbrications as embedded in the field structure characteristics.....	138
3. 4. 3. Phase III: Interplay between Home LANs and Private and Government ISPs (2006-2010).....	139
3. 4. 3. 1. Sociomaterial Entanglements in the Institutional Context	139
3. 4. 3. 2. LAN sociomaterial imbrications as embedded in the field structure characteristics.....	143
3. 5. Discussion and implications.....	144
3. 5. 1. Implications to Theory and Suggestions for Further Avenues.....	147
3. 5. 2. Implications to Practice	149
3. 5. 3. Limitations and Further Research	150
CHAPTER 4: Successful innovation with scarce resources:	157
Improvisation and experiential learning in the community-based organizations...	157
Abstract	159
4. 1. Introduction	160
4. 2. Triggers of successful innovation.....	162
4. 2. 1. The Context and the Environment of Innovation.....	163
4. 2. 2. Challenges of organizational innovation in the context	164
4. 2. 3. Innovating and Improvising	165
4. 2. 4. Organizational Process of Experiential Learning.....	169
4. 3. Methodology	171
4. 4. Data Analysis	174
4. 4. 1. Home LANs and their Context.....	174
4. 4. 2. The Selected Cases.....	177
4. 4. 3. Case 1. EAST home LAN	178
4. 4. 4. Case 2. CENTRE home LAN	182
4. 4. 5. Case 3. WEST home LAN	184
4. 5. Discussion and Conclusion	186

CHAPTER 5: Conclusion	195
5.1. Dissertation Summary	195
5.2. Implications of the Research	196
5. 2. 1. End-user Innovation	196
5. 2. 2. Community Networking	197
5.3. Theoretical Contributions.....	198
5.4. Limitations of this Research.....	200
CHAPTER 6 : Resume substantioel en Français	198
6. 1. Introduction	205
6. 2. Description de Cas	210
6. 2. 1. Une brève description de LAN domestiques.....	211
6. 2. 2. L’interaction agentielle dans les processus de création et développement de LAN domestiques	213
6. 2. 3. Les conditions préalables contextuelles de création des LAN domestiques	215
6. 3. Questions de Recherche a L’étude de la Thèse.....	218
6. 4. Fondements Theoriques de These	219
6. 5. Processus de Recherche et Méthodologie	223
6. 5. 1. Focus et position épistémologique	223
6. 5. 2. Procédures de sources de données et de collecte de données.....	225
6. 6. Vue D’ensemble des Articles de la Thèse.....	227
6. 6. Conclusion.....	231
6. 6. 1. Résumé de la thèse	231
6. 6. 2. Implications de la recherche.....	232
6. 6. 3. Réseautage communautaire.....	233
6. 6. 4. Limites de la présente étude	234
APPENDIX: Interview Questionnaires.....	240
Appendix A. Questionnaire for Administrators of Home LANs	240
Appendix B. Questionnaire for Users of Home LANs	242
Appendix C. Example of questionnaire for private Internet provider (adapted to the ‘Solo’ company profile and history)	244
Appendix D. Questionnaire for the Beltelecom Telecommunication Company.....	246

LIST OF FIGURES

Figure 1.1. Cable connected ‘by air’ linking two houses of the same home LAN.....	24
Figure 1. 2. Structure of a typical home LAN.....	24
Figure 1. 3. Main actors of the Internet infrastructure in Minsk in 1995 – 2005.....	25
Figure 1. 4. Main actors of the Internet infrastructure in Minsk in 2006 – 2010.....	27
Figure 1. 5. General information on geography and demography of Belarus.....	27
Figure 1. 6. 16-year temporal chronology of home LAN creation and development.....	30
Figure 1. 7. The process of inductive and abductive theory building in the qualitative inquiry (Cecez-Kecmanovic, 2011).....	37
Figure 1. 8. Synopsis of the dissertation.....	41
Figure 2. 1. Framework of end-user technology enactment and change.....	63
Figure 2. 2. The meaning of technological artifact and its use as a tool in collective enquiry (developed from Rabardel (1995) and Kern (2008)).....	64
Figure 2. 3. The map of home LANs in Minsk (red-white points signify the networks situated in the city areas).....	74
Figure 2. 4. Main actors of Internet infrastructure development in Minsk.....	79
Figure 2. 5a. Home LAN cable connecting two multi-storied buildings.....	81
Figure 2. 5b. Home LAN switch situated at attic of a multi-storied building.....	81
Figure 2. 6. Change in the technology structure: transformation of a central processing unit into an FTP server.....	83
Figure 2. 7. ‘Network football’ – competition between the members of neighboring home LANs.....	84
Figure 3. 1. Model of within organizational sociomaterial imbrications of routines and technologies embedded in the field dynamics and complexity.....	117
Figure 3. 2. Sociomaterial assemblages of routines and technologies in the Internet infrastructure at the organizational and field levels.....	128
Figure 3. 3. Home LAN hub with each cable corresponding to an individual user and inscribing his details.....	129
Figure 3. 4. Sociomaterial agencies: constructing a home LAN by building an “air” cable connection between users in neighboring buildings.....	127
Figure 4. 1. Dewey’s model of experiential learning [adopted from Kolb (1984)].....	130
Figure 4. 2. Multiple-case study design (adapted from (Yin, 2009)).....	171

Figure 4. 3. Illustration of a hand-made lightning rod – a device to keep home LAN wired connection safe during storms.....	176
Figure 6. 1. Câble aérien liant deux bâtiments séparés du même LAN domestique.....	211
Figure 6. 2. Schéma typique du LAN domestique.....	212
Figure 6. 3. Acteurs principaux de l'infrastructure d'Internet à Minsk, 1995 – 2005....	213
Figure 6. 4. Acteurs principaux de l'infrastructure d'Internet à Minsk, 2006 – 2010....	215
Figure 6. 5. Information générale sur la géographie et la démographie de la Biélorussie. (Source: http://travel.nationalgeographic.com/travel/countries/belarus-map/#)...	216

LIST OF TABLES

Table 1. 1. Overview of the research papers.....	42
Table 2. 1. The Process of Data Collection.....	69
Table 2. 2. Data Sources.....	70
Table 2. 3. Data Analysis Phases.....	73
Table 2. 4. Summary Table of All Episodes.....	75
Table 3. 1. Data Sources.....	124
Table 3. 2. Data Analysis Procedures.....	126
Table 3. 3. Field Structure Characteristics and home LAN Filters in Phase I (1995-1999).....	133
Table 3. 4. Field Structure Characteristics and home LAN Filters in Phase II (2000-2005).....	134
Table 3. 5 Field Structure Characteristics and home LAN Filters in Phase III (2006-2010).....	143
Table 3. 6. Summary Table of the Influence of Institutional Dynamics and Complexity on the Processes and Patterns of Sociomaterial Imbrications over three phases of home LAN development.....	146
Table 4. 1. Characteristics of home LANs selected for the analysis and their innovation processes.....	178

Chapter 1:

INTRODUCTION

“There are really vibrant grassroots innovations going on... They are not only about taking the technology systems and making them work a little better but about totally transforming the experience to make it more social, more transparent, and more inclusive...”

“What happens right now is very much driven by the industry vision. There is a possibility that we won’t get into the future of technologies that are both big and profitable and reflect open and democratic values and culture. We have industries coming and painting its vision on the city organized around their technologies and not listening to what is going on in the grassroots that have a very different vision and goals... If we could only start having a conversation...”

Anthony Townsend (IESE, 2011)

The preceding quotations come from the interview of Anthony Townsend, the research director at the Institute for the Future, given at the 2011 Word Congress “Smart City: Aligning Industry and the Grassroots”¹. These quotations highlight the importance of grassroots innovations, their transformative power and difference from traditional industry visions. This dissertation investigates the phenomenon of ICT-enabled grassroots innovation and views the above developments as being grounded at the changing nature of contemporary technology and user-technology interaction.

Research has acknowledged some dramatic changes going on related to the nature of technological artifacts and related technology user enactments. Among these research contributions are the arguments that technology becomes increasingly complex and knowledge intensive (Nambisan, Agarwal, and Tanniru, 1999); flexible and modular (Leonardi, 2011); symbolic and not neutral (Aakhus and Jackson, 2005; Ågerfalk, 2010); ubiquitous and used in different contexts (Attewell and Savill-Smith, 1992) while its meaning cannot be transmitted and should continuously be discovered “de novo” by users (Attewell and Savill-Smith, 1992; Nambisan et al., 1999). These changes transform the way users enact technology: users increasingly become co-producers of technology (Castells, 1996, 2002; Green, 2001; von Hippel, 2005, 2007, 2009), mobilize and innovate from the grassroots (Heeks, 2010), create new ICT- and social media-enabled informal and alternative social structures (Aakhus and Jackson, 2005; Ågerfalk, Aakhus, and Lind, 2009), and transformatively network with more traditional actors of the society (Dutton, 2009; Dutton and Eynon, 2009). In the light of these changes, new lenses and

¹ The World Congress incorporated 51 large IT organizations, including CISCO, IBM, Siemens, Schneider Electronics, Indra, etc., and researchers worldwide

theoretical insights are required that can explain contemporary technology use and development in organizations (Orlikowski and Scott, 2008; Orlikowski, 2009; Scott and Orlikowski, 2009).

The dissertation provides an inquiry into the phenomenon of end-user technology co-creation (as opposed to industry-driven technology change) and the processes and effects of grassroots innovation developments. The underlining question of the dissertation is the following:

How do ICT and social media technologies become a background for end-user innovation and citizen bottom-up mobilizations and how might these developments change and create alternatives to the existing infrastructures, institutions and actors?

In order to answer this question, the dissertation takes the process view of the phenomenon that evolves the context – the interplay and entanglements of different actors and environmental complexities – and addresses the phenomenon at multiple levels. In so doing, the dissertation mobilizes the perspectives of institutional theory, practice theories (i.e. sociomateriality theory, theories of technology-in-practice and technology enactment), theory of symbolic interaction, organizational improvisation and experiential learning, as well as theories to deal with process data and contextual analysis of change. Methodologically, the dissertation is based on a qualitative in-depth inquiry building on the abductive and inductive approaches, and case study research.

The dissertation comprises three research papers all sharing the same research setting and contributing to knowledge on the underlying research inquiry. The papers are as follows (and hereafter referred to as Papers I, II and III):

- I- Co-Creating from the Bottom Up: End-User Transformative Technology Enactment and its Meaning in the Community-based Organizations.
- II- How Sociomateriality and Institutions Entangle: A Case Study of End-User Communities and Internet Infrastructure Development.
- III- Successful Innovation with Scarce Resources: Improvisation and Experiential Learning in the Community-Based Organizations.

The research setting of the dissertation is based on the 16-year community-based grassroots Internet infrastructure co-creation in Minsk, Belarus, by the organizations of residential citizens called ‘home local area networks’ (home LANs). These organizations developed the alternative Internet infrastructure that came about as a result of the inability of the government and private providers to create an affordable Internet infrastructure for individual users.

The phenomenon of home LAN grassroots Internet infrastructure co-creation in Minsk provides a rich background to answering the underlying inquiry of the dissertation and understanding the phenomenon of end-user technology co-creation from multiple perspectives. The case is particularly interesting for a number of reasons:

- 1) Home LANs created an alternative Internet infrastructure for more than one million users.
- 2) Citizens developed successful technological and organizational innovations in conditions of limited financial resources, lack of special managerial knowledge and through a variety of institutional field logics, complexities and dynamics. Nevertheless, they remained one of the main forms of Internet-access services for citizens during the 16 years from 1995 to 2010.
- 3) Technological innovations developed in home LANs were copied by private and government providers, incorporated to their own platforms and later became the prototypes of the national Ethernet standards.
- 4) For a significant period of their development, home LANs managed to cooperate successfully with private and municipal organizations, thus providing a case of grassroots-industry collaboration.
- 5) The case of home LANs as new organizational forms developed on an informal basis by citizens themselves from the bottom-up, making the process of Internet infrastructure development more inclusive, social and transparent and this coincides with the phenomena of grassroots ICT-enabled transformative development models (Heeks, 2010), collaborative network organizations (Dutton, 1999), community-based technological activism and citizen mobilization (Powell and Meinrath, 2008).

Phenomena similar to home LANs in Belarus (but at a relatively small scale) took place in some other countries such as Russia, Ukraine, Poland and Romania, as well as in North America (the creation of the alternative Internet infrastructure by Canadian wireless communities) (Powell and Meinrath, 2008) and the Netherlands (van Oost, Verhaegh, and Oudshoorn, 2009). However, the grassroots organizations of Internet-access developed, for instance in Russia and Ukraine, though initially having free origins, were quickly transformed to more commercially viable forms, driven by the market completion of private Internet-providers. In Belarus, the process of Internet infrastructure co-creation by grassroots organizations and their transformation into more commercially viable forms (Fitzgerald, 2006) was greatly procrastinated due to the administrative

conditions, a state monopoly on Internet channel sale and undeveloped market conditions. Such procrastination creates a rare opportunity to study and understand the process of Internet infrastructure and technologies co-creation and development in depth. As a result, this study refers to a phenomenon which is not unique but provides insights to a phenomenon largely under theorized in the literature. Further details on the case are given in the section 1.1 as well as in the three research papers that form chapters 2, 3 and 4 of this dissertation.

The research papers build on the above research setting. However, each paper takes a particular perspective on the phenomenon and might be considered an independent research project. The first paper, ‘Co-Creating from the Bottom Up: End-User Transformative Technology Enactment and its Meaning in the Community-based Organizations’, introduces the reader to the theoretical accounts and practical cases of end-user innovation and develops a model to study end-user technology enactment and change. Further, it investigates how technological artifacts and their meaning co-evolved in the communities of home LAN users over the 16 years changing from the residential use of home computers to the development of an alternative Internet infrastructure. The second paper, ‘How Sociomateriality and Institutions Entangle: A Case Study of End-User Communities and Internet Infrastructure Development’, looks at the foreground patterns of change in home LAN technologies and routines and their sociomaterial imbrications as embedded in larger institutional dynamics.

This paper contributes to our understanding of how sociomateriality entanglements and foreground patterns of change in organizational routines and/or technologies are formed in practice. The third paper, ‘Successful Innovation with Scarce Resources: Improvisational Practices and Experiential Learning in the Community-Based Organizations’, looks at the processes of innovation creation, improvisation and experiential learning in home LANs. The paper aims to understand and explain how home LANs managed to innovate and develop successfully in the environment of scarce resources, high uncertainty and competition with organizations with wider access to resources and higher legitimacy. Further details on the papers including their overview, units of analysis and main contributions are provided in section 1.5.

With the research papers mentioned above, the dissertation provides theoretical and practical contributions related to the prerequisites, process and consequences of end-user innovation and technology co-creation, co-evolution of the technology meaning and structure, community-based technological activism, grassroots potential and links with

industry, as well as understanding the foreground patterns of sociomaterial entanglements and change in routines and technologies (i.e. the interplay of human and material agencies) as embedded in larger extra-organizational dynamics and complexities.

This introductory chapter gives an overview of the research. Section 1.1 provides a description of home LAN Internet infrastructure grassroots development in Belarus. Section 1.2 provides an overview of the research questions under study. Section 1.3 discusses the theoretical background of the dissertation. Section 1.4 gives details on the research methods, data sources, and data collection procedures. Finally, the last section of the introductory chapter offers a synopsis of the three papers constituting the main part of this dissertation and provides an overview in terms of their research questions, theoretical insights and research processes, units of analysis and main contributions.

The three research papers are presented in chapters two, three, and four of the dissertation. Chapter five concludes the dissertation, discussing its main findings and the theoretical and practical contributions of the study, as well as its limitations and suggestions for further research.

1. 1. CASE DESCRIPTION

The dissertation investigates the 16-year period of home LAN creation and development in Minsk, the capital of Belarus, from 1995 when home LANs were first created by citizens until 2010 following a government law announcing that these organizations were to be illegal. This subsection provides details of the case and the context of the home LAN phenomenon. After describing home LANs, I introduce insights into the context of their creation and describe other actors important to Internet infrastructure development in Minsk.

1. 1. 1. A Brief Description of Home LANs

The first home LANs appeared around 1994 and 1995. They were created mainly by young people who were inspired and strongly interested in personal computers (PCs) that only started to become affordable in Belarus in the mid-1990s. A wish to play multi-party computer games and the need for resource sharing were important motives behind the home LANs' creation. However, because Internet access for individual users was not available until 1999, the need found other ways to be satisfied. As early creators of home LANs mention, they decided to create their own local version of the Internet, i.e. a "home

network” linking residential users of home computers together with coaxial cables and later with optic fiber and radio modems connecting users through different flats and multistoried buildings (see Figure 1.1).



Figure 1. 1. Cable connected ‘by air’ linking two houses of the same home LAN

Within the network, users’ computers are linked with special technological devices, such as hubs and switches, repeaters, cables and (later) optical fiber connecting users in different flats and multistoried buildings.

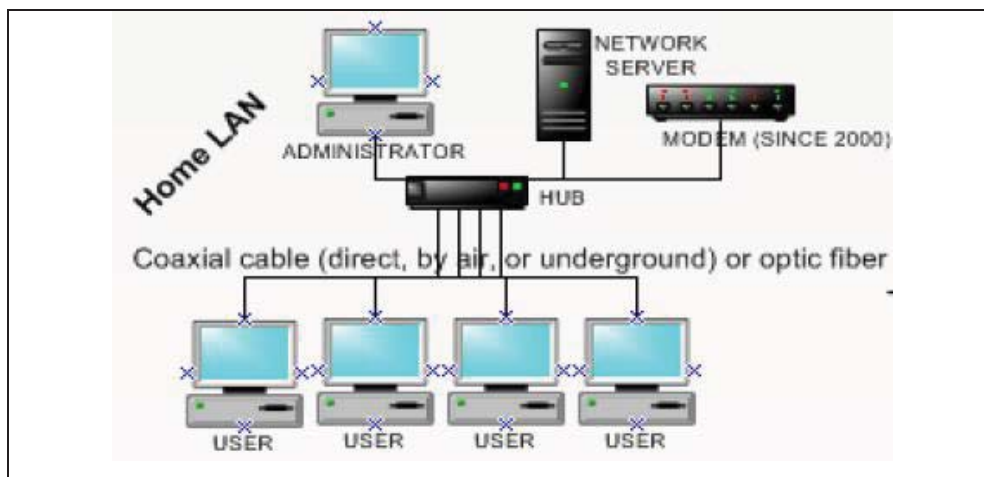


Figure 1. 2. Structure of a typical home LAN

A typical home LAN consists of a computer belonging to administrator(s), a person (or persons) responsible for organizing and support of the home LAN, and ‘ordinary’ users (Figure 1.2). In order to build a home LAN, its administrators and users

combined professional networking devices (such as D-link, Genius LAN, etc.) that they afforded by pooling money together with bricolage-made (Baker, Miner, and Eesley, 2003; Baker and Nelson, 2005) devices such as boxes for hardware storage in attics and lightning rods.

Home local area networks were the main form of Internet-access and resources-sharing for 16 years in Minsk. They included thousands of members and covered all the city areas, giving their users cheap Internet access, network resources sharing, online and real social communication opportunities.

Because the dissertation emphasizes home LAN technology co-creation in the *context* and *agential interplay*, I provide details on both below.

1. 1. 2. Agential interplay in the processes of home LAN creation and development

In contrast to many other countries where the Internet infrastructure is traditionally developed by state and private providers, the Internet infrastructure in Belarus was developed by the interplay of three different types of actors: state provider, private providers and home local area networks (Figure 1.3).

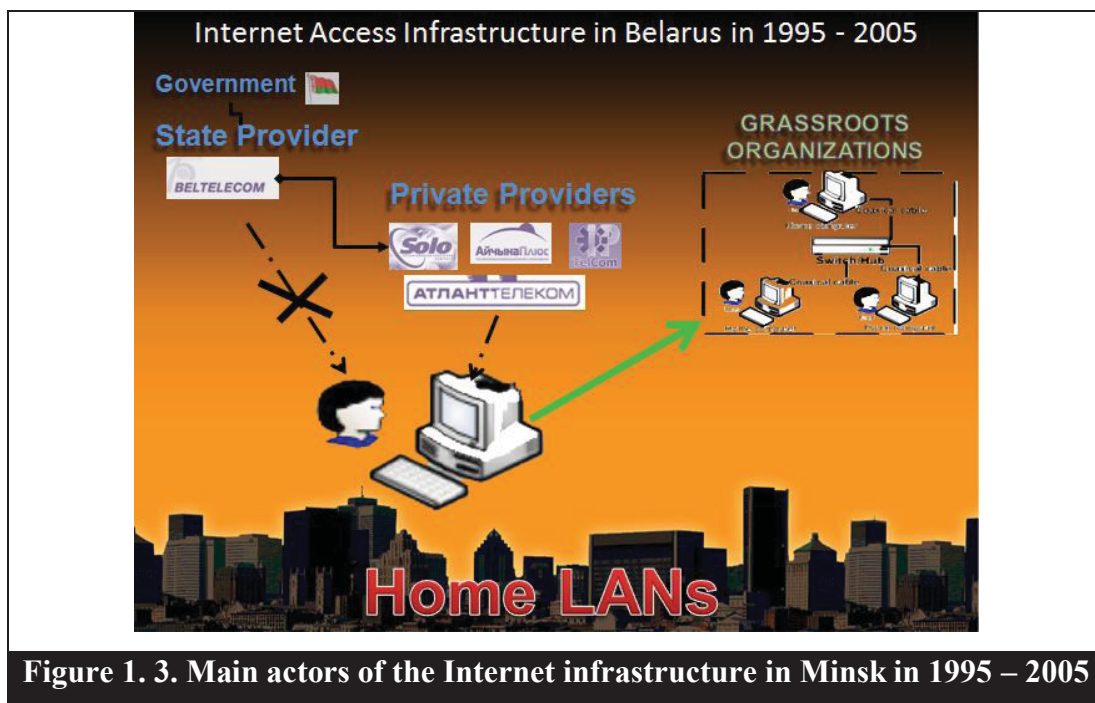


Figure 1. 3. Main actors of the Internet infrastructure in Minsk in 1995 – 2005

Initially, home LANs were developed in the communities of friends. Later, friends of friends started joining the networks. From the beginning of their creation, home LANs managed to cooperate successfully with municipal services. When building a network for the increasing number of users, home LAN creators needed the keys and access to the

attics and basements of multi-storied residential buildings in order to place the network equipment, build the connections between two buildings, etc. Many home LAN creators managed to persuade municipal services workers that networks would create social and public value and thus they gained access to the premises. Eventually, when the average number of people in a network reached about 500, administrators of some home LANs contacted private Internet providers. They offered them a huge number of users if they would develop affordable Internet access (in terms of price) for home LANs.

Initially, only some private Internet providers agreed on this and they even proposed to develop special departments within their organizations to work with home LANs. Later, other private providers, seeing that the cooperation was successful, followed the same path. As a result of this cooperation, home LANs received high quality and cheap Internet-access by using the same modem for 30-50 users and cross-multiplying the Internet channel. Private providers gained many individual users that previously would be outside their reach because of the unaffordable price of individual Internet-access. Additionally, private providers proposed a number of bonuses for home LAN users and administrators. They also used to monitor service and technological innovations developed within home LANs and copy these onto their own platforms in order to attract new users. Successful cooperation between home LANs and private providers changed the power balance in the field significantly. As some experts acknowledge, about 90% of all home computers in Minsk were connected to the Internet through the home LANs-private providers' cooperation.

Unexpectedly, in 2006 the government provider joined the market of individual Internet-access by proposing high quality and rather affordable Internet services. This changed the agential interplay in the field (see Figure 1.4). Additionally, it also proposed the service of unlimited Internet access traffic (only affordable from the state monopolist). As a result, private providers launched a movement to de-monopolize the state provider. This project was accepted by Parliament in 2008 (but later rejected by the President). In 2008 and later in 2010 government laws were passed that announced home LANs illegal and required their 'voluntary' winding-up. Different home LANs reacted in different ways to this: some home LANs followed the requirement and ceased or became part of the private providers' infrastructure, some home LANs turned into private providers themselves, while a significant number of home LANs went underground and still continue functioning in this form.

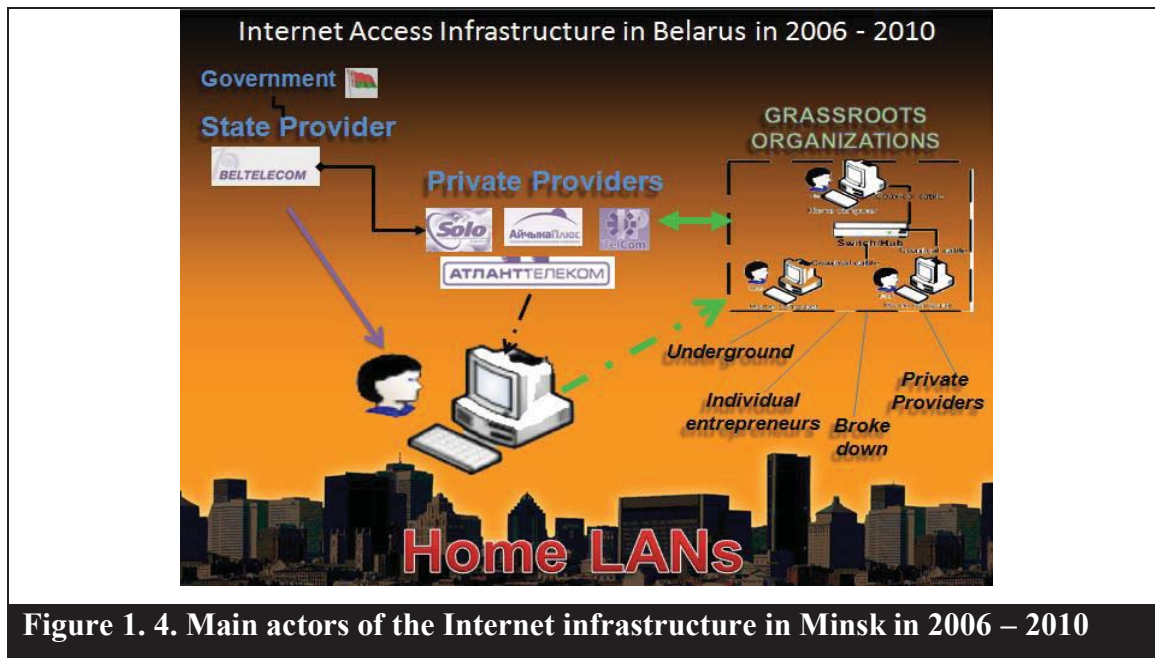


Figure 1. 4. Main actors of the Internet infrastructure in Minsk in 2006 – 2010

1. 1. 3. Contextual prerequisites of home LAN creation

Belarus is a country situated in Eastern Europe and has a population of about ten million people (see Figure 1.5). During the Soviet Union times, Belarus, originally lacking in rich mineral resources, was ‘designated’ as one of the main strategic centers of mathematics, electronics and informatics in the Soviet Union. According to the Global Outsourcing Report, “Belarus was an ‘assembly plant’ of the former Soviet Union, which resulted in a skilled and well-qualified labor force, along with a number of technical universities, schools, labs and scientific institutions” (Minevich and Richter, 2005, p.46). In particular, Belarus used to manufacture over 50% of the computers and computer components in the former USSR (Radkevitch, 2005).



Figure 1. 5. General information on geography and demography of Belarus

Source: <http://and.travel.nationalgeographic.com> and travelandcountriesandbelarus-map.com

Minsk itself has several huge universities specialized in these areas and educating thousands of students: large Mathematical and Radio Physics Departments of the country's oldest Belarusian State University (with a strong school of mathematics, second after Moscow), a huge National Technical University (now Polytechnic Academy) and Radio Technical Institute (now State University of Informatics and Radio Electronics).

Graduates from these universities were being evenly distributed into a huge Soviet industrial and educational system. However, after the Soviet Union broke down, the educational system and the academic school and traditions remained. Since this time Belarus educates more graduates than could be employed in its domestic sectors. Even though a significant number of IT and IS specialists have emigrated to Canada, USA, Western Europe and Russia, the concentration of people having engineering background in Belarus is still significant. The situation is particularly evident in Minsk which is a place of dense concentration of IT and IS students, alumni and people with IT education coming to the capital from other Belarusian cities in search of higher salaries. For example, the Belarusian outsourcing industry's revenue was \$90 million in 2004 (for a comparison, in 2003 exported IT services totaled \$22 million in Poland, \$20 million in Hungary and \$26 million in Czech Republic) (Radkevitch, 2005). Every year, about 2,000 qualified IT specialists come to the market (Minevich and Richter, 2005).

This infrastructure has resulted in a high concentration of people in Minsk, whose main hobby and interests were structured around the computer and who were able to participate in software and hardware creation and development (and thus would potentially be very interested in having affordable Internet-access). In general, there existed a special 'computer culture'. For example, even before home LANs were created, a significant number of professional and amateur computer users were looking for ways to make their computers and related devices more adjusted to their needs. Thus, the FIDO² movement and regular meetings of system administrators in the center of the city were particularly popular in Minsk in the end of the 80s to the beginning of the 90s, before home LAN creation. Other examples incorporate taking a hard disc out from the computer processing unit and using it as a 'USB key' to exchange files; bringing a PC to a friend's place to play games together, etc.

² FIDO is a worldwide point-to-point and store-and-forward email WAN that uses modems on the direct-dial telephone network. It was popular and widespread worldwide in the 1980s and the first half of 1990s, before the appearance of the broadband connection. The technology and its users still exist today though not as numerous as earlier. Further details can be found at the official website of the FIDO organization (<http://www.fidonet.org/>)

At the same time, the context of individual Internet access was highly contradictory to the existence of the special computer culture and interests in computers and IT among the population. Thus, until 2006, the government Internet provider Beltelecom supported only low quality (dial-up) and extremely expensive residential Internet access while also keeping the monopoly of the Internet channel. Thus, private providers were obliged to buy a stream of the Internet channel only from Beltelecom and at high prices. As a result, they could only offer access for a high price and therefore sold the Internet mainly to organizations and enterprises with a large majority of citizens not being able to afford to use the Internet on a daily basis.

The 16-year process of home LAN development went through a variety and dynamics of institutional conditions. These included:

- 1) Conditions of institutional voids (i.e. no or only bad quality Internet infrastructure affordable to individual users);
- 2) Successful home LAN cooperation with private providers and municipal services; and
- 3) Hostile environment and pressure from the government and private providers.

Further details on the home LAN creation and development in Minsk are provided in the three research papers (Chapters 2, 3 and 4). The 16-year chronology of home LAN creation and development in Minsk is shown in Figure 1. 6.

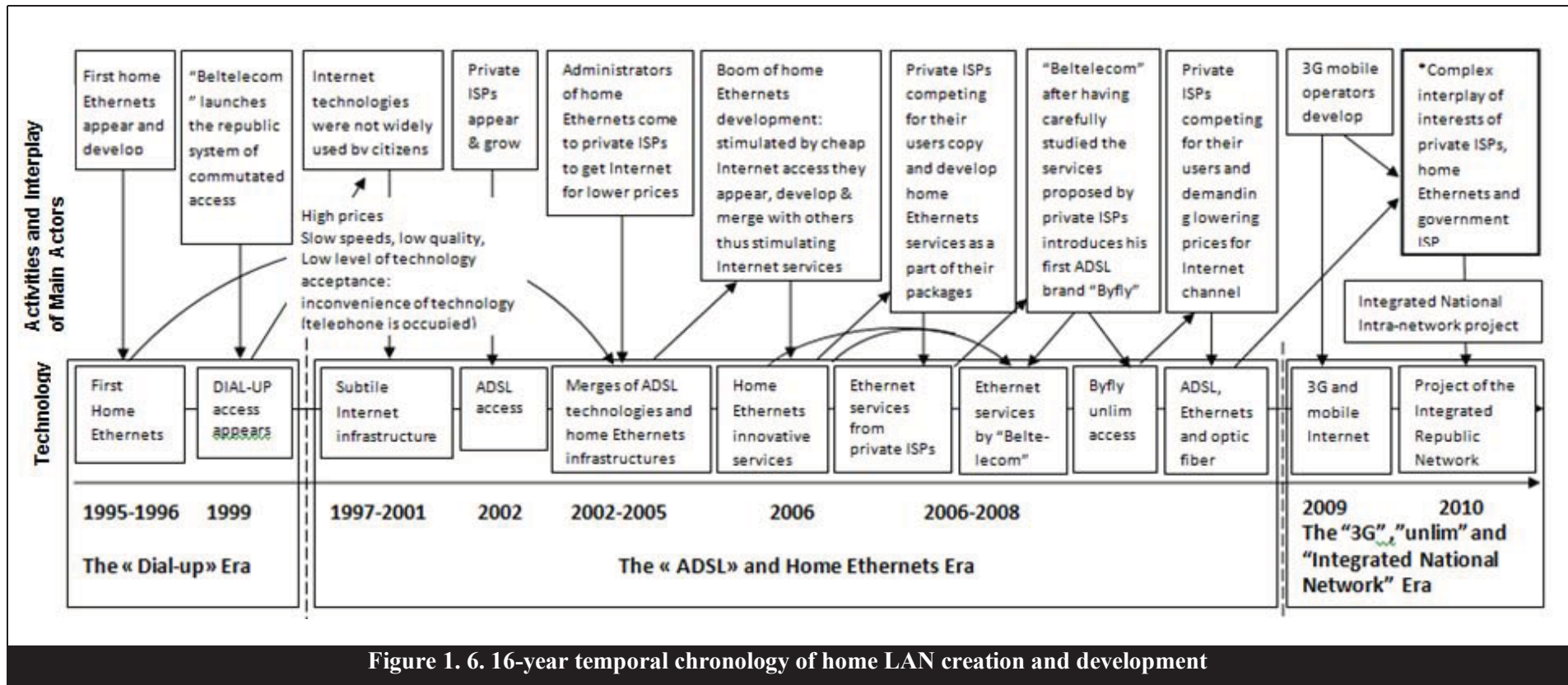


Figure 1. 6. 16-year temporal chronology of home LAN creation and development

1. 2. RESEARCH QUESTIONS UNDER STUDY IN THE DISSERTATION

This dissertation is based on the following underlining inquiry:

How do ICT and social media technologies become a background for end-user innovation and citizen bottom-up mobilizations and how might these bottom-up developments change and create alternatives to the existing infrastructures, institutions and actors?

When answering this inquiry, the dissertation aims at answering the following research sub-questions:

- *How is the meaning and the structure of technology enacted by end-users over time and how might the enactments lead to technology transformation, innovation and broader industry-wide transformative effects?*
- *How are the processes and results of foreground patterns of routines and technologies within organizations embedded in larger extra-organizational entanglements, such as field structures and institutional dynamics?*
- *How can organizations lacking significant financial and managerial resources and operating in complex, uncertain and unfavorable environments manage to create and develop innovations successfully over a long period of time and even compete with organizations with wider access to resources and higher legitimacy?*

These research questions are addressed in three research papers. The conclusive section of this introductory chapter (section 1.5) and Chapter 5 of this dissertation draw on the findings to these research questions from the papers and summarize their theoretical and practical contributions.

1. 3. THEORETICAL BACKGROUND OF THE DISSERTATION

This dissertation aims at understanding the processes of end-user innovation and technology co-creation as embedded in the context of multiple interrelated agents and environmental complexities. For these reasons, the three research papers of the dissertation investigate the phenomenon from different perspectives and at different levels of analysis.

Paper I: operates at the within-organizational level of the phenomenon. It investigates how an alternative million-user Internet infrastructure was developed by

citizens themselves as a result of the mutual co-evolution of the IT artifact and the interplay between its pragmatic and symbolic meanings. We show how this co-evolution was dynamically (re)shaped depending on the dynamics of the community of users and the interplay of external actors of the Internet infrastructure. In the attempt to understand this, we combine the insights from activity theory, theory of symbolic interaction and theory of user–technology enactment, each having a specific contribution to understand the processes of user-technology enactments and transformation. Activity theory looks at the process of end-user technology enactments as a tool of reaching specific inquiry (Leontiev, 1978; Rabardel, 1995). Its main strengths are that it provides detailed accounts into the role of users, i.e. the community of inquiry, and enables treating them as a collective actor (Dewey, 1938; Lorino, 2006; Peirce, 1955). The theory of technology enactment proposed by Orlikowski (1992) emphasizes the structure of the technology in the process of user–enactment. In particular, it argues that the structure of technology is not inherently prescribed and is dynamically enacted in the process of technology use. Finally, the theory of symbolic interaction provides valuable insights on the meaning of the technological artifact in the process of enactment. In particular, it argues that the meaning of technology cannot be prescribed a priori in the technology structure. Rather, it is dynamically evolving when interacting with the technology in practice.

Building on these three theories (activity theory, the theory of technology enactment and the theory of symbolic action), we look at how the three elements – users, technology structure and technology meaning are dynamically co-constructed in practice and lead to technology innovation and co-creation in home LANs.

Paper II: focuses on the dynamics and interplay between the extra-organizational and within–organizational levels of the phenomenon of home LANs and builds on sociomateriality and institutional theories. The paper investigates how home LAN sociomaterial imbrications and the foreground patterns in home LAN technologies and routines are formed when being entangled with the institutional dynamics, field characteristics and complexities.

Sociomateriality is a recent ontological perspective assuming ontological inseparability of matter and meaning, material and human, technical and social (Barad, 2003; Barad, 2007; Orlikowski and Scott, 2008). It argues that both human and material agencies do not possess any pre-established qualities, form and boundaries by themselves a priori but acquire these only in practice when continuously co-entangling with each

other into sociomaterial assemblage. As a result, both human and non-human entities have the agency and are equal in their ‘capacity to make a difference’ (Latour, 2005) and the possibility of drawing multiple boundaries between the human and material in the same sociomaterial assemblage (Barad, 2007). The sociomateriality provides a promising lens to study organizational processes, change in technology and routines, and the contemporary nature of technology. However, despite the rare exceptions (Scott and Orlikowski, 2009) the studies on sociomateriality focus at the within-organizational level of analysis and tend to neglect the extra-organizational dynamics, such as institutional embeddedness of organizational processes. For these reasons, we propose to bring together the sociomateriality and institutional perspectives.

Institutional theory argues that organizational behavior (including change or stability in organizational technologies and routines) are tightly coupled with the dynamics of extra-organizational re-salient social structures (i.e. ‘institutions’) (Berger and Luckmann, 1967; Greenwood, Raynard, Kodeih, Micelotta, and Lounsbury, 2011; Meyer and Rowan, 1991; Powell and DiMaggio, 1991; Scott, 2008). Acting through the established schemas, norms and rules, institutions make organizations complying with the dominant institutional logics in the field become established as authoritative guidelines and provide organizations with a specific set of organizing principles (Friedland and Alford, 1991; Scott and Meyer, 1994). Institutions thus both constrain and enable organizational behavior (Scott, 2008). However, institutional theory is criticized for undermining the role of materiality in the process of institutional change and the role of technology in the institutional change (Arjaliès, 2011; Knorr-Cetina, 1997; Miller, 2008; Spee and Jarzabkowski, 2009), as well as for tending to separate the materiality of technology from the core institutional dynamics (Orlikowski, 2009; Scott and Orlikowski, 2009). Few research studies show how institutions might influence the design, development and effects of technology and (broadly) materiality in organizations (Scott and Orlikowski, 2009). The paper argues that combining both theories provides valuable insights into the processes of formation of stability and change in technology and routines.

Paper III: focuses on the organizational process of home LAN innovation creation and development. In particular, the paper aims at understanding how organizations might innovate and develop successfully in highly restrictive and resource-

lacking environments. The paper builds on the theories of organizational innovation, improvisation, and experiential learning.

Thus, despite the fact that innovation had been one of the most intensively studied topics in the fields of Organization and Management studies, and Information Systems, its phenomenon still remains the ‘black box’ (Fagerberg, Movwery and Nelson, 2004). Analysis of the literature on innovation reveals three main triggers of successful innovation creation: organizational environment, improvisation, and organizational learning.

Whether the research on innovation and ICT creation argues that its success requires special favorable conditions (Ein-Dor, Myers, and Raman, 1997; Heavin, Fitzgerald, and Trauth, 2003; Trauth, 2000) or emphasizes the importance of its particular historical and social path dependencies (Avgerou, 2003; Hobday, 2000), it does agree on the fact that organizational context and environment play a crucial role in the process. Thus, organizational environment acts both as a dynamic background and enabler of organizational innovations. First, it provides a source of information and resources necessary for the organizational innovative recombinatory activity as well as exploration (Cohen and Levinthal, 1990; Cook and Yanow, 1995; Fagerberg, Movwery and Nelson, 2004; Schumpeter, 1950). Second, it acts as an impulse and feedback mechanism in the process of organizational learning, a process crucial for successful innovation to happen (Kolb, 1984).

Organizational improvisation is regarded to be an important part of the innovation process (Cunha, Cunha, and Kamoche, 1999; Eisenhardt and Tabrizi, 1995; Moorman and Miner, 1998). Improvisation has the potential of increasing successful organizational innovation as it addresses the number of challenges of innovation creation: a lack of expected and planned circumstances (Ciborra, 1996; Crossan and Sorrenti, 1996; Moorman and Miner, 1995; Weick, 1993, 1998). Improvisation is about efficiently generating a new combination of resources, routines and structures; the exploitation of tacit knowledge (Yanow, 2001); and enables fast responses in changing and turbulent environment (Cunha, Cunha, and Correia, 2001).

An experiential learning perspective provides a valuable lens to study the processes of organizational innovation and improvisation and understanding how these were dynamically shaped. In particular, experiential learning emphasizes the process of learning and knowledge creation as opposed to the more traditional theories of learning

(based on cognitive and behavioral models); emphasizing its outcome (Kolb, 1984). In this light, the experiential learning perspective is valuable as it provides insights not only to innovative solutions but to the processes of their creation. Furthermore, it emphasizes the role of the context providing impulses for organizational learning and innovation and argues on the mutually transformative nature of learner–environment entanglements that act as impulses for further organizational learning (Dewey, 1938; Kolb, 1984). The latter is in line with the main idea of this study – co-evolution and co-creation – and resonates with the lenses and findings of the other two papers.

We use the insights from the above perspectives to conduct an inductive multi-case study aiming at understanding how home LANs managed to innovate and develop successfully through a long period and when lacking significant managerial and technical knowledge, financial and operational resources, and legitimacy.

1. 4. RESEARCH PROCESS AND METHODOLOGY

1. 4. 1. Focus and Epistemological Position

The importance of the context and the focus on the process of home LAN creation described above create prerequisites that might be best addressed with case study research (Pettigrew, Woodman, and Cameron, 2001; Yin, 2009) and process data methodologies (Langley, 1999).

Case study research is a useful approach to investigate complex contemporary phenomenon within a real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2009). Process data methodology (Langley, 1999; 2007) enables us to consider phenomena dynamically – in terms of movement, activity, events, change and temporal evolution. In contrast to the ‘variance’ theories process theories:

provide the temporally embedded accounts that enable us to understand how [the systemic patterns of relationships surrounding organizational phenomena] come to be (Langley, 2007, p.4).

Thus, both case study research and process data methodologies have the potential to provide valuable accounts for understanding the phenomenon of home LAN creation and development as well as addressing the research questions of this dissertation.

The research in this dissertation is a qualitative inquiry investigating the processes and results of end-user grassroots innovations. Thus, following Yin (2009), when research is based on data which cannot be readily converted to numerical values and is presented in categorical, perceptual and attitudinal dimensions describing real-time events, a qualitative study should be used. Furthermore, the underlying logics of qualitative inquiry coincide with the logics of the process methodology described above. In particular, the research questions of the dissertation (i.e. the ‘how’ questions) as well as the need for nuances and interpretations, and the novelty of the phenomenon studied justify a qualitative approach. The qualitative approach allows the researcher to discover nuances, details, meanings, sense making and complex relationships between the concepts. The research in this dissertation is based on the understanding, meanings and attitudes of work practices, the concepts of sociomaterial imbrications and assemblages, etc. which cannot be measured or used to make predictions but is valuable in producing insights into the process and patterns of relationships surrounding the phenomenon of home LANs.

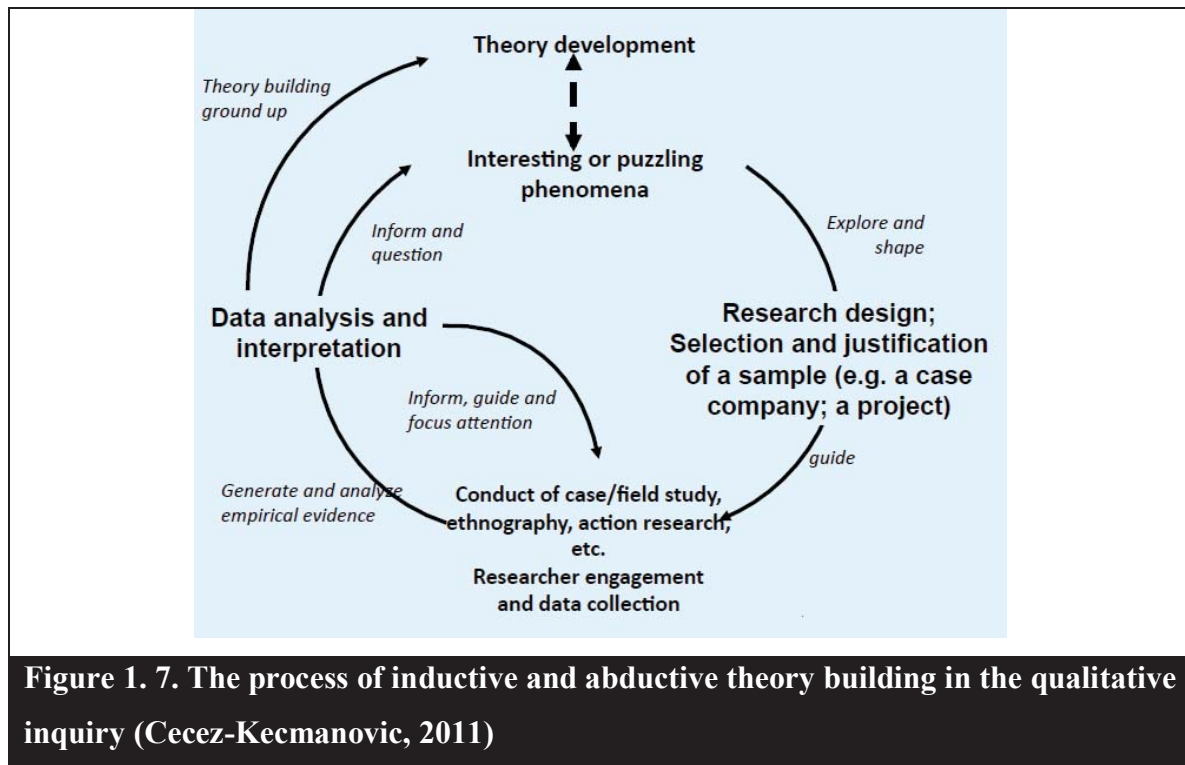
This dissertation is based on abductive and inductive logical reasoning. Thus, abductive reasoning informed the research logics of Papers I and II. Abductive reasoning is the process by which useful explanations of new phenomenon are developed by simultaneously studying facts and devising theory to explain them (Kelle, 1995; Peirce, 1955; Richardson and Kramer, 2006). As Kelle (1995, p.34) argues, abduction aims

to explain new and surprising empirical data through the elaboration, modification, or combination of pre-existing concepts [cited in (Richardson and Kramer, 2006)]

Inductive reasoning informed the logics of Paper III. Inductive reasoning (Peirce, 1955; Richardson and Kramer, 2006) is oriented at finding generalizations through the observation of a number of cases.

Abductive and inductive reasoning imply the use of a non-linear research process (see Figure 1.7) which means that the processes of research design, data collection, data analysis and theory development might be organized in a repetitive and parallel manner (Cecez-Kecmanovic, 2011) .

This research is based on social constructivism (interpretivism, Papers I and III) and on the agential realism approach (sociomaterial assemblage, Paper II).



Finally, investigating the 16-year process of the phenomenon of home LAN Internet technology and infrastructure co-creation from the grassroots, this dissertation represents a study that is mainly retrospective. Studies of retrospective processes are well established in the management disciplines. As Ann Langley (2009, p.11) explains:

As long as accurate temporal chronologies can be reconstructed from archival data and extensive interviewing, retrospective studies can be an efficient and effective approach. Indeed, some particularly interesting process analyses of change have emerged from studies that were largely retrospective.

In this dissertation, the 16-year temporal chronology of the home LAN creation and development is presented as Figure 6. The following subsection provides details on the data sources and data collection processes enacted for this dissertation.

1. 4. 2. Data Sources and Data Collection Procedures

Before the main circle of data collection started in July 2010, a pilot study was conducted from December 2009 to January 2010. The aim of the pilot study was to find relevant research questions and to help the author in developing an appropriate research design, interview protocols, etc. For the main study, data collection started in July 2010 and finished in April 2011. Within this period, data were collected from interviews,

documents, archival data and field observations. Details on each of these as well as the data collection procedures are provided below. The author herself was also a user of one of the biggest home LANs in Minsk for three years.

1) Interviews from the field

In total, 72 interviews were made. These included 56 interviews with home LAN representatives (33 interviews with administrators and 23 interviews with users) and 16 interviews with private and state Internet providers. All interviews were semi-structured and open-ended to ensure that maximum information about the home LAN phenomenon was obtained from the participants. The majority of interviews (about 80%) were tape-recorded if the interviewees agreed to this. Each interview lasted about 40 minutes on average with variations from half an hour to 2 hours per interview. Interviews were guided first by the structured questions developed in advance in the questionnaires according to the type of the informant (i.e. administrator of home LAN; user of home LAN; private Internet provider; and state Internet provider), then additional questions were asked based on the informant's relevant experience and profile. Questionnaires for the structured part of the interviews are presented in the Appendix.

All the informants had at least one year's experience dealing with home LANs and the majority of the informants had more than 5 years of such experience (some home LAN administrators had 15-16 years of experience). All interviews were private. Among the 56 interviews with home LAN administrators and users, 51 interviews were conducted face-to-face, 3 interviews were conducted by phone, and 2 informants (home LAN administrators) contacted me by email, sending me the stories of their experience of home LAN creation and development written in a very detailed and reflexive manner and supported by photos and documents from the field (following this, I exchanged several emails with each clarifying the aspects of the story that I found particularly useful). Among the interviews with private and state Internet providers, 13 interviews were conducted face-to-face, 2 interviews were conducted by phone and one informant sent his responses to the questionnaire by e-mail (with a possibility to clarify the answers and ask further questions). All the interviews were conducted in Russian and then translated into English.

Interviews with representatives of home LANs and Internet providers had different data collection strategies. Below, I discuss the details on these.

- *Interviews with home LAN administrators and users.* Sampling strategy for the interviews with home LAN representatives was based on a selective snowballing technique. The technique was used to ensure trust and access to the data collection materials. Ensuring trust was particularly important in the interviews with home LAN representatives for the following two reasons. First, according to the law, since July 1st 2010, just the month when the data collection started, home LANs were announced as illegal organizations. Second, the trust issue was particularly important because home LANs were situated in residential apartments and a significant number of interviews and field observations took place there. Initially, I used a classic snowballing approach, asking my informants to provide further contacts (this approach also helped me to deal with the trust issues). I started with the contacts that I myself had as a past user of one of the biggest home LANs in Minsk as well as with similar contacts of my friends – users of home LANs in other networks. Additionally, I published notices about this research in several websites: homenet.tut.by (the main website of home LANs in Belarus) and dancesport.by (a website with forums popular with many young people - the main contingent of home LAN users - in Minsk and Belarus more generally). Furthermore, being a graduate from BSUIR³, the leading national university in computer science and computer engineering, I had a number of relevant contacts myself. This is how the initial data sample was created. Eventually, as I collected more and more contacts from my interviews, I distinguished them based on the following criteria: 1) home LAN administrators and users; 2) the time of home LAN creation and existence; 3) number of users; and 4) the city area (to ensure that all Minsk districts were covered). I controlled data sampling and the data collection process so as to ensure that the whole variety of home LANs was represented according to the above criteria.
- *Interviews with private and state providers.* Sampling strategy for the interviews with Internet providers was based on the following steps. First, I sent an email to all the providers in Minsk with a notice about this research and a request for an interview. Because the response rate from the request was low, I used the internal contacts (emails and phone numbers) that I received from some home LAN administrators as many of them worked and/or continued working with private

³ Belarusian State University of Informatics and Radio Electronics

providers (or had friends who did so). Second, I attended the annual international specialized exhibition on TIBO⁴ where all Belarusian providers usually have their senior managers and staff represented. I conducted interviews with representatives of Internet providers (usually managers) there. However, the problem of non-response with the state Beltelecom provider still existed. At TIBO, the company Marketing Director answered only to several general questions while stating that all the details on the company strategy and communication that were not indicated in their website were ‘closed information’. Thus, I had to look for internal sources of data collection. My friends in the sphere of journalism and telecommunication helped to organize several important unofficial interviews with Beltelecom managers. These included the managers responsible for the company ‘Byfly’ development (an important ADSL Internet service for individual users that the company launched in 2006) and working in the company for more than 10 years.

The data collection from interviews was terminated when a level of theoretical saturation was reached, i.e. when I could gradually start to predict the responses of interviewees.

2) Documents

Documents included web pages and intranets of home LANs; the interactive maps of their internal infrastructures; and internal documents of home LANs. The latter includes home LAN statutes and caudexes (documents developed by users collectively and describing the main goal and organization of the network, rights and responsibilities of home LAN users, the procedures of users’ inclusion and exclusion, etc.).

3) Archival data

Archival data included documented and video-recorded opinions of experts in home LANs in the press; articles in newspapers and journals; more than 30 pages of the national non-profit IT portals publishing news on a daily basis (<http://it.tut.by>, <http://www.interminsk.com> and <http://providers.by> and <http://techlabs.by> and homenet.tut.by); government laws concerning national Internet and telecommunication services development; and related discussions on websites; and analysis of the materials from the national home LAN website, homenet.tut.by.

⁴ International forum on telecommunications and banking and office technologies (TIBO) is an annual showroom of the latest domestic and international achievements in information and telecommunications technologies, software and hardware development, banking technologies and consumer electronics. TIBO comprises five major components – Exhibition, Congress, Internet Award of the Year Ceremony, Graphic Design Competition and Belarus’ Open Computer Sports Tournament.

4) Direct observations

Field notes were developed from direct observations of how users interact with their home LAN technologies and services while showing me and describing ‘how it works’. These observations usually took place in the apartments of users where they link up to their home LANs.

1.5. OVERVIEW OF RESEARCH PAPERS

This study provides an overview of the three research papers introduced in outline in Section 1.1. First, it presents the synopsis of the study and summary table of research papers. This is followed by a brief overview of each paper. The synopsis of the study is presented at Figure 1. 8.

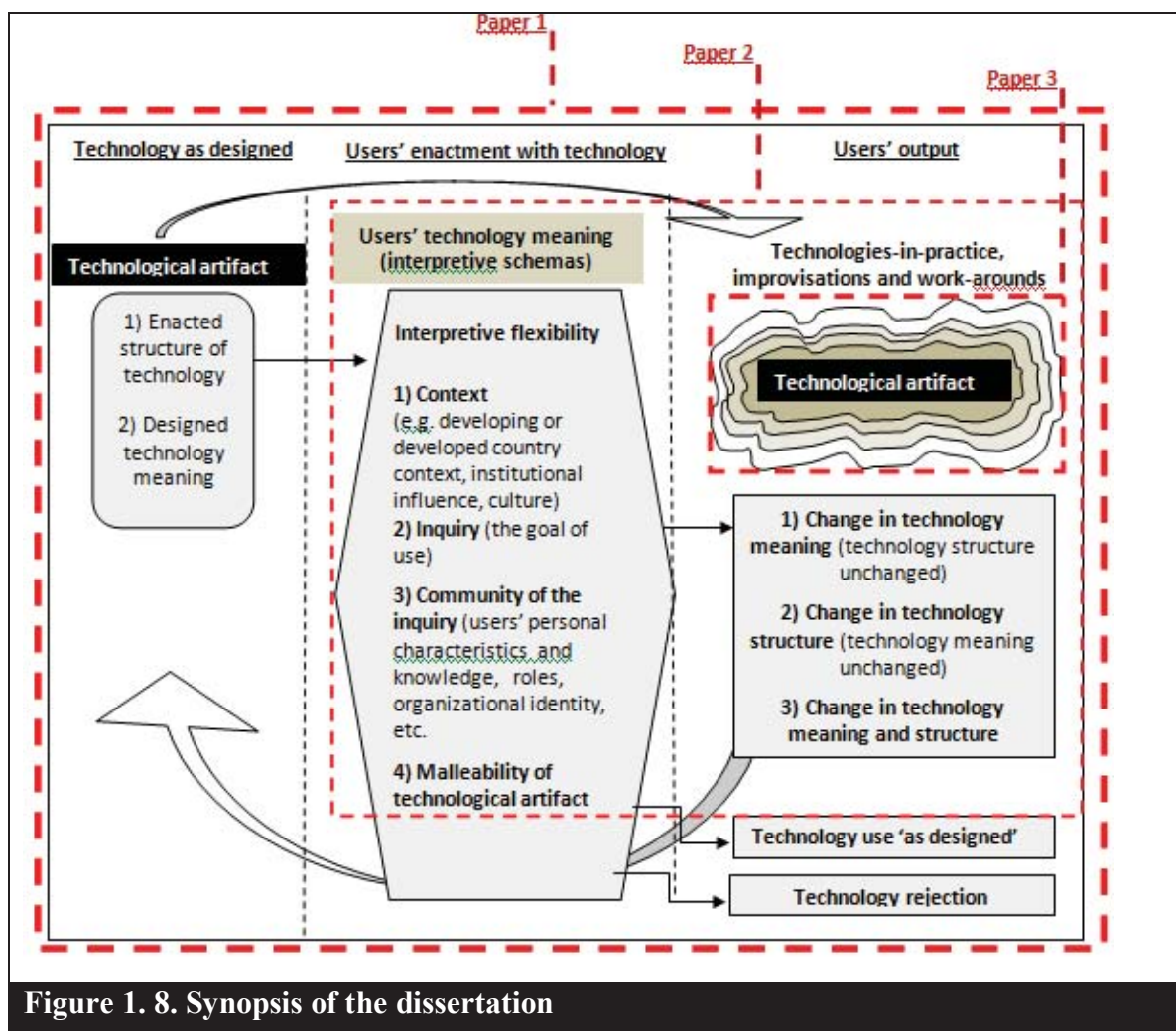


Figure 1. 8. Synopsis of the dissertation

Table 1.1 summarizes the three research papers in terms of their research question, data and theories-in-use.

Table 1. 1. Overview of the research papers

Paper	Research Question	Theories – in-use	Methodology and Data	Unit of analysis
Co-Creating from the Bottom Up: End-User Transformative Technology Enactment and its Meaning in the Community-based Organizations	How is the meaning and the structure of technology enacted by end-users over time and how do the enactments relate to the technology transformations, innovation and broader industry-wide transformative effects?	- Activity theory - Technology enactment theory - Symbolic interaction theory - Process data methodology - Contextual analysis of change	In-depth single case-study with multiple levels of analysis - 54 semi-structured interviews - Documents - Archival data - Field observation	User enactments of technology structure and meaning
How Sociomateriality and Institutions Entangle: A Case Study of End-User Communities and Internet Infrastructure Development	How are the processes and results of socio-material imbrications of routines and technologies within organizations embedded in larger extra-organizational entanglements, such as field structures and institutional dynamics?	- Sociomateriality theory - Institutional theory - Process data analysis - Contextual analysis of change	In-depth single case-study with multiple levels of analysis - 72 semi-structured interviews; - Documents; - Archival data;	Sociomaterial entanglements of technologies and routines and the foreground patterns of change in human and material agencies
Successful Innovation with Scarce Resources: Improvisational Practices and Experiential Learning in the Community-Based User-Created Organizations	How can organizations lacking significant financial and managerial resources and operating in complex, uncertain and unfavorable environments manage to create and develop innovations successfully over a long period of time?	- Improvisation theories - Experiential learning - Studies of contextual factors influencing innovation and ICT development	In-depth single case-study with multiple levels of analysis - Semi-structured interviews - Documents	Micro-processes of organizational learning and practices of organizational innovation and improvisations

The following subsections provide an overview and details on each of the three research papers.

Paper I. Co-Creating from the Bottom Up: End-User Transformative Technology Enactment and its Meaning in the Community-based Organizations

Overview

The paper opens the study of home LAN technologies and practices in this dissertation by presenting the phenomenon of end-user technology co-creation. It looks at

how the meaning and the structure of technology are enacted and co-created by end-users over time and how the processes of these enactments are embedded in the technology meaning. We argue that these processes are deeply embedded in the technology meaning (and particularly, in the interplay between its pragmatic meaning, enabling the performance of organizational routines and practices, and its symbolic meaning as capturing broader contextual and social interplay).

The paper begins with the discussion on theoretical accounts of end-user technology enactment. It starts with the analysis of theories on technology adoption and use and evidence that they tend to focus mainly at the adoption phase and largely overlook the post-adoption periods of technology use. Then, end-users as co-designers of technology are theorized by: 1) providing evidence from the studies of ICTs and end-user enactments leading to the innovative developments in the technology structure and meaning; and 2) developing a framework of end-user technology enactment and change and discussing how these enactments might lead to broader organizational innovations. Following the description of the research methodology, the paper provides a detailed analysis of how end-users co-create the alternative Internet infrastructure technologies and innovations through the co-evolution of technology structures and its pragmatic and symbolic meanings.

The paper argues that these processes were deeply embedded into the social meaning of technology and, in particular, in the interplay between the pragmatic and symbolic meanings (with the latter being an important theme of the process and grounded in the contextual interplay of other actors related to the Internet infrastructure).

Theoretical question

The paper explores the following research question:

- How is the meaning and the structure of technology enacted by end-users over time and how do the enactments relate to the technology transformations, innovation and broader industry-wide transformative effects?

Unit of analysis

User enactments of technology structure and meaning as embedded in the organizational practice (pragmatic meaning) and broader contextual and social interplay (symbolic meaning)

Contribution

The paper has several contributions. First, it provides detailed accounts on how the meaning and the structure of technology are enacted by users over time and how these enactments lead to broader organizational transformations and collective innovation creation. Second, it proposes a framework for end-user enactment and change. Third, the paper shows that the symbolic and pragmatic meaning of technology play important roles in the evolution of user technology enactments and innovation from the grassroots. The paper thus provides contributions to the study of grassroots developments, the theories of technology enactment, design and use, network collaborative organizations, and developments of new organizational forms.

Paper II - How Sociomateriality and Institutions Entangle: A Case Study of End-User Communities and Internet Infrastructure Development

Overview

The paper considers how the foreground patterns of change in home LAN technologies and routines are formed and (re)configured as being embedded into the contextual dynamics of institutional logics, field characteristics and the interplay of different actors. In doing so, the research uses sociomateriality and institutional theories and illustrates how extra-organizational and within-organizational processes intertwine to form sociomaterial imbrications of technologies and routines. Through the 16-year process of home LAN development, we illustrate how different institutional field characteristics influence the processes of sociomaterial imbrications of routines and technologies within home LANs. Our findings indicate that institutional field dynamics and complexities play important roles in the processes of organizational sociomaterial entanglements as formed by the foreground patterns of human and material agencies.

The paper brings together institutional and sociomateriality theories. Our findings indicate that in the institutional fields where multiple and conflicting logics co-exist and impose both conflicts over means and over goals on organizations, sociomaterial assemblages of organizational routines and technologies are mainly (re)enacted by human-agencies (as opposed to the enactments of both human and non-human agencies in the fields with other characteristics).

The paper begins with an introduction to the sociomaterial perspective, followed by a detailed discussion on our current knowledge on the processes of sociomaterial imbrications (entanglements) of human and material agencies in organizations. We acknowledge that while the sociomateriality perspective provides a promising new way to theorize organizational technologies and practices, it neglects the extra-organizational entanglements of matter and meaning that might influence the processes of organizational sociomaterial imbrications. The paper then provides the analysis of institutional theory and the mechanisms by which the institutional field dynamics and complexities are translated to organizational behavior and practices. Based on the analysis we then develop an analytical framework of the processes of sociomaterial imbrications of routines and technologies as embedded in larger extra-organizational dynamics. This is followed by the analysis of the processes of home LAN technologies and routines during the 16 years, as well as a discussion of the findings and conclusion.

Theoretical question

- How are the processes and results of foreground patterns of routines and technologies within organizations embedded in larger extra-organizational entanglements, such as field structures and institutional dynamics?

Unit of analysis

Sociomaterial entanglements of technologies and routines and the foreground patterns of change in human and material agencies as embedded in institutional dynamics and field structure characteristics

Contribution

The paper provides contributions to sociomateriality studies by developing insights into how the processes and the foreground patterns of sociomaterial imbrications are embedded in larger institutional dynamics and complexities and providing a rare case of sociomateriality in the developing countries. It also contributes to studies of institutional theory by highlighting the role of objects, such as technology, in the process of institutional change (Arjaliès, 2011; Knorr-Cetina, 1997; Spee and Jarzabkowski, 2009) and providing an understanding on how technologies and technology-related practices are embedded and shaped by broader institutional influences (Avgerou, 2008;

Lamb and Kling, 2003; Orlikowski and Barley, 2001). In particular, the paper evidences that in the fields where conflicting demands exist over both means and goals, organizational sociomaterial imbrications will change by enactment of human agency (as compared to the enactment of both human and material agencies in a field with conflicting logics over means only). Further, the paper is one of the few cases of research into sociomateriality of organizational technologies and routines in a developing country.

Paper III - Successful Innovation with Scarce Resources: Improvisation and Experiential Learning in the Community-Based User-Created Organizations

Overview

The paper investigates how improvisation activities and experiential learning might enable the creation of successful innovation in environments with restricted and limited resources. The research builds on the theories of innovation, improvisation and experiential learning. Our findings indicate that home LANs managed to be successful and sustainable in the restrictive conditions based on: a) improvisational and emergent rather than planned practices; and b) on experiential learning that happened in tight co-entanglement with the organizational environment.

Theoretical question

- How can organizations lacking significant financial and managerial resources and operating in complex, uncertain and unfavorable environments manage to create and develop innovations successfully over a long period of time?

Unit of analysis

The processes of successful improvisation and innovation creation in the restrictive environments imposing ‘managerial challenges’, ‘resource-based and financial challenges’, ‘organizational challenges’, and ‘political and legitimate challenges’.

Contribution

We illustrate how citizen bottom-up organizations created successful innovations and developed its unique value when using an experiential learning approach and improvisational techniques in their practices. In particular, using the lenses of

organizational improvisation and experiential learning, the research provides insights to understanding *the processes* of successful innovation creation and development in the conditions of complex, uncertain and restricted environments. The main contributions of the study lie in the areas of innovation development and implementation, organizational improvisation, experiential learning as well as the emerging research on the user-driven innovation and community-based technology activism (Powell, 2008; Powell and Meinrath, 2008).

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Chapter 2:
**CO-CREATING FROM THE BOTTOM UP: END-USER TRANSFORMATIVE
TECHNOLOGY ENACTMENT AND ITS MEANING IN THE COMMUNITIES
OF ICT-ENABLED ORGANIZATIONS**

Earlier versions of this paper were presented at:

- the European Conference on Information Systems (ECIS), June 9-11, 2011, Helsinki (Finland) (Zorina and Avison, 2011a).
- the International Workshop on Practice Theory organized by the special interested group in pragmatic research (SIGPrag) and hosted at the Aalto University, June 8th, 2011, Helsinki (Finland) (Zorina and Avison, 2011b).
- the SIGPrag Workshop on the MISQ Special Issue “Symbolic Action and Information Systems - Social Media and Beyond’ at the International Conference on Information Systems (ICIS), December 3rd, 2011, Shanghai (China).
- the International Workshop on Grounded Theory at the International Conference on Information Systems (ICIS), December 7th, 2011, Shanghai (China).
- the DPhil research seminar at the Oxford Internet Institute, January 30th, Oxford (United Kingdom).

I am grateful for comments and questions on these occasions that have helped shaped this version.

ABSTRACT

In this paper we look at end-user technology transformative enactment, i.e. the enactment of end-users with technology which leads to a major transformation of its structure or meaning as compared to that originally developed. Evidence from theory and practice provide illustrations of end-users playing an increasingly important role in the way that technological artifacts are developed and enacted. Moreover, even though there is increasing evidence that these enactments might lead to important end-user developments, innovations and even large-scale industry transformations, our understanding of these practices and structures is limited. Based on more than 50 interviews and intensive document and archival data we study the 16-year process of mutual evolution of technologies and their meaning with the boundaries of the communities of users of home local area networks (LANs) and their organizational structure in Minsk, Belarus. We combine a qualitative interpretive single case study with generic strategies of process data analysis (such as grounded theory, temporal bracketing and visual mapping) to understand the meaning of technology within and between different episodes of home LAN development. We demonstrate how home LAN technologies and their symbolic and social meaning evolved as the organizational structure of home LANs progressed from associations of a few individuals linking their home computers for multi-party activities to community-based organizations incorporating thousands of users and technologies. These were such an important part of the country's Internet infrastructure and services that they later became a prototype for national Ethernet standards. We also demonstrate how the symbolic and social meaning of these home LAN technologies and their services changed when these not-for-profit many-user grassroots communities went through a process of change and/or decline that eventually led to commercialized forms.

Key words: user innovation, technology enactment, technology co-creation, symbolic meaning, pragmatic meaning, activity theory, developing countries, case study

2. 1. INTRODUCTION

Studies increasingly show how in practice technological artifacts might rarely be used as originally designed because of the end-users acting as co-creators of technology structure and meaning (Castells, 2002; Ciborra, 2004; Heeks, 2010; Green, 2001; Gopal and Prasad, 2000; Morawczynski, 2008; Orlikowski, 2000; Orlikowski, 1992). Practical illustrations of this phenomenon incorporate the history of well-established ICTs (the Internet and telephone, for example) as well as recent developments (Kenya mobile banking); the recent emergence of ‘social software’ (Facebook and YouTube); etc. Opportunities for users’ contributions increase as technology becomes more advanced (DeSanctis and Poole, 1994), flexible (Leonardi, 2011), ubiquitous (Attewell and Savill-Smith, 1992), symbolic (Aakhus and Jackson, 2005; Ågerfalk, 2010) and used across different cultures (Leidner and Kayworth, 2006; Silva and Westrup, 2009) and development contexts (Avgerou, 2003; Walsham and Sahay, 2006). Both research (Castells 2002; Ciborra 2004; Dutton 2008) and practitioners (IESE. 2011) has acknowledged that technology end-users might possess particularly valuable expertise crucial to business-effective innovations.

However, our understanding is still limited with regard to the transformative processes and potential impacts of end-user enactments (Heeks, 2010; Morawczynski, 2008) and how practices alternative to those originally designed for technology happen (Orlikowski, 2000). This paper addresses the gap by posing the following research question:

How is the meaning and the structure of technology enacted by end-users over time and how might the enactments lead to technology transformation, innovation and broader industry-wide transformative effects?

In order to answer the research question this paper combines the perspectives of technology enactment theory (Orlikowski, 2000; Orlikowski, 1992); and the theory of management tools developed in activity theory (Cassirer, 1955; Vygotsky, 1983; Leontiev, 1978; Rabardel, 1995) with the studies on the symbolic meaning of technology (Aakhus and Jackson, 2005; Ågerfalk, 2010; Arnould and Thompson, 2005; Beynon-Davies, 2010; Prasad, 1993; Gopal and Prasad, 2000; Lee and Nickerson, 2010). Based on these perspectives and using examples of end-user enactment of technology change from the fields of information systems and organization studies, we develop a framework

of end-user technology enactment and change. Further, we build on this framework to develop a detailed understanding of how end-users develop the meaning of technology and its structure over time as their inquiry, community characteristics and contextual factors evolve. We illustrate and explain how the IT artifact and its meaning become a background for end-user innovation, collective self-identification and ICT-enabled organization processes. Based on a detailed analysis of the 16-year period of Internet technology enactment and development in end-user communities, our study reveals how symbolic meaning of technology is constituted in the process.

Based on more than 50 interviews and intensive data sources, we look at the 16-year period of end-user technology enactment and development. Our research site concerns the community-type organizations of home local area networks (LANs) in Minsk, Belarus. Contrasting with organization-based LANs and wide-area networks (WANs) which are built to facilitate professional data sharing and communication between employees, home LANs refer to associations of private individuals developed by citizens themselves linking their home computers in order to share resources, play multi-party games and reduce the price of Internet access. We show how home LAN technologies and their meaning evolved as the organizational structure progressed from associations of a few individuals to community-based organizations incorporating thousands of users and technologies. These formed an important part of Internet infrastructure and services that later became a prototype of national Ethernet standards. Further, we demonstrate how home LAN technologies and their symbolic and social meaning changed when these many-user communities went through the process of development through to commercialization.

Initially started as friend-to-friend technology developments, these organizations eventually proceeded through a variety of organizational forms, technology structures and meanings and contextual dynamics. This environment enables us to investigate the phenomenon of end-user technology enactment across the diversity of end-user and contextual characteristics and broader organizational results.

We design this research as a single qualitative case study (Markus, 1983; Myers and Avison, 2002; Walsham, 1995; Yin, 2009) and combine this method with generic strategies of process data analysis (Langley, 1999; Newman and Zhao, 2008; Pettigrew, 1990; Van de Ven and Poole, 1995). In particular, we use the visual mapping and the temporal bracketing approaches (Eisenhardt, 1989; Langley, 1999) to order the sequence

of events, activities, and choices of home LAN users and administrators and identify main episodes of home LAN development. Further, we used the grounded theory approach (Strauss and Corbin, 1998; Mason, 2002) to generate insights on the symbolic meaning of home LAN technology and compare the results within the identified episodes.

The main contribution of this paper is to provide detailed accounts on how the meaning and the structure of technology are enacted by end-users over time and how this enactment leads to technology innovation and broader organizational transformations. We argue that this process is deeply embedded into the social meaning of the technology (and particularly, in the interplay between the pragmatic and the symbolic meanings). The paper has several contributions to the theories of technology adoption, the theory of technology enactment, activity theory, design theory and developments of new organizational forms.

The paper is structured as follows. First, we provide a theoretical account of the process and results of end-user technology enactment. Then we describe our research methodology including data sources, data collection and data analysis procedures. This is followed by presentation of the research context and data analysis. The discussion section summarizes our findings and discusses theoretical and practical contributions of the study as well as its limitations.

2. 2. END-USER CO-CREATION OF THE TECHNOLOGICAL ARTIFACT

The process of end-user technology adoption and use is crucial for deriving value of information technology in organizations (Davenport 1998; Jasperson et al. 2005; Karahanna et al. 1999; Thong et al. 2006). Previous research has argued that end-user adoption has several stages and includes the pre-adoption, adoption, and post-adoption activities (Rogers 1995) as well as that it may be driven by different behavior attitudes through different stages (Agarwal and Karahanna 2000; Karahanna et al. 1999; Jasperson et al. 2005). Thus, while the adoption stage is argued to be mostly influenced by attitudinal and normative considerations (perceptions of usefulness, ease-of-use, result demonstrability, top management strategies), the post-adoption usage is argued to be determined by attitudinal (perceptions of usefulness) and social factors (prior use, habit, enhanced image, and social norms) (Jasperson et al. 2005; Karahanna et al. 1999). However, the potential of post-adoption user behavior has not been fully developed as the majority of research tends to focus on the adoption stage (Jasperson et al. 2005; Tong et

al. 2006). In particular, our understanding is still limited with regard to the processes and potential impacts of end-user enactments (Heeks 2010; Morawczynski 2008); significant variations in individual post-adoption behaviors (Jasperson et al. 2005); how practices alternative to those originally designed for technology develop (Orlikowski 2000), as well as how end-users might turn into innovators (Nambinsanet et al., 1999), and co-creators of information technologies and applications (Amoroso and Cheney 1992; Barki and Hartwick 1994).

This section theorizes the process of innovative end-user technology enactment through the following two steps. First, we provide evidence from the studies of ICTs and end-user enactments leading to the innovative development in the technology structure and meaning and show that these enactments provide an important background to understand how ICTs are used. Second, based on the theoretical analysis of how end-users enact technology in process we propose a framework of end-user technology enactment and change and discuss how these enactments might lead to broader organizational innovations.

2. 2. 1. End-users as Co-creators of Technology

Recent discussions in the literature suggest that end-users play an increasingly important role in the way technological artifacts are developed and used in practice. These include the notions of end-user improvisations and work-arounds (Ciborra 1994, 1996, 2000; Elbanna 2006; Orlikowski 2000; 1992) as well as end-user appropriation of the technology to such an extent that they start improvising on it (Heeks 2010). Similarly, research in the area of communication and social media technologies suggests that end-users might act as IT innovators and key co-producers of ICT technologies. As Castells (2002, p. 28) argues:

users often act as the key producers of the technology, by adapting it to their use and values, and ultimately transforming the technology itself.

Moreover, research has argued that these transformations might be rooted in the innovative enactment of meaning of the technology artifact by end-users: as technology becomes increasingly complex and knowledge intensive, its meaning cannot be transmitted through contexts and thus should be discovered ‘de novo’ by end-users

(Attewell, Savill-Smith, 1992; Nambinsan et al., 1999). Green (2001, p. 43) proposes that when the technology is ‘domesticated’ by users it implies that

... the technology has been harnessed to the needs of the people or household groups who sustain it – who keep it out of the rain, keep it fuelled, serviced and mended.

Thus, studies show that one of the first widely-used social media, the telephone, was initially invented by Alexander Graham Bell as a medium for broadcasting music, news and drama in the business and public spheres. However, this was a user-driven innovation which saw the telephone as a medium for social communication and residential activities that defined the technology’s consequent architectural evolution and meaning (Fischer 1992; Kraut et al. 1999). Similarly, the general history of another revolutionary social media technology, the Internet, shows that the improvisations of early computer hackers were extremely important for developing further the Internet-technology initially developed by ARPA, and for establishing the form that is now accepted worldwide (Castells 2002; Dutton 1999; 2008).

Similarly, in the contemporary and well-researched M-PESA example of mobile banking in a developing country, the innovative meaning developed by its end-users played a crucial role in the way that technology was used. Thus, despite the fact that the project was initially created by the bank and its partner agencies to provide a system facilitating microcredits, end-users developed “multiple uses for M-PESA that are not related to the ones initially designed” (Hayes and Westrup 2010). The innovations included sending money from immigrant workers to their families, using the account to keep money safe especially on journeys (Camner and Sjöblom 2009; Hayes and Westrup 2010; Morawczynski 2008). Similarly, in the Philippines millions of citizens use their cell phones as virtual wallets. Press et al. (2006) describes how citizens in Cuba deploy settop boxes and small parabolic antennas to intercept the signal from the U.S. satellite TV. Some of these observations resulted in the proposition of a notion of ICT-enabled grassroots innovative organizations, i.e. organizations developed by the end-users where they act as technological or organizational innovators (Heeks 2010).

The proposed notion is similar to the phenomenon of grassroots communities of wireless networking (Powell and Meinrath 2008) and user-generated wireless broadband infrastructures in digital cities (Farkas 2008). These are developed by the residential Internet users in Canada, South and North America, and worldwide and incorporate

building and maintaining information infrastructures and a variety of innovative services and technologies. The aim is to provide an alternative to traditional top-down infrastructures in order to create new opportunities for participation in civic life, addressing the digital divide, providing economic solutions for freelance workers and creating ‘public good’ (Powell and Meinrath 2008; Powell 2006).

The bottom-up end-user technology enactment has been argued to have a potential to create radical business innovations (Castells 2002; Ciborra 1994, 1996, 2000; Dutton 2008; Nambinsan et al., 1999) when also simultaneously sustaining necessary conditions for the innovation to be accepted (Dutton 2008). Thus, Dutton (2008) provides an example of personal computers (PC) that originally were developed by “home brewing” do-it-yourself technical entrepreneurs” (p.501). However, early top-down government and industry attempts to implement PC technologies at the workplace initially failed because of end-user resistance. Implementation of PCs at the workplace succeeded only when end-user experience with home-based PCs was developed and this led to the “groundswell of grassroots demand” for the innovation (Dutton 2008).

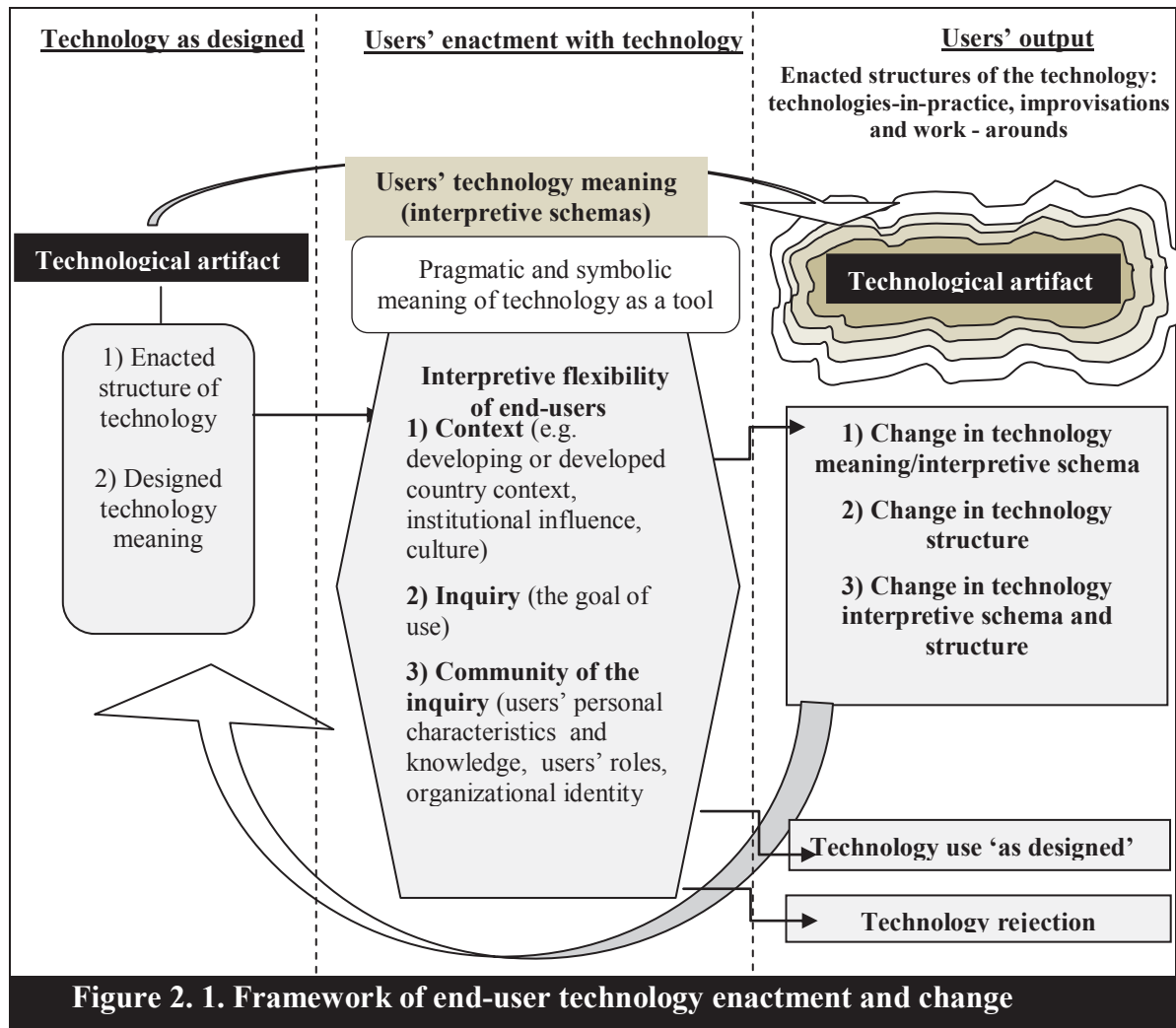
Ågerfalk et al. (2009) argue that open and social technologies (OSTs) such as open source software, web 2.0 and peer-to-peer computing has a fundamental impact on contemporary organizations. Even though these technologies do not participate in the organizational core business processes directly, they act in a manner similar to disruptive innovations by altering and changing the way end-users communicate and interact internally and externally, fostering the introduction of new ways of working and new sets of norms and social structures. This, in turn, leads to infrastructural (Ågerfalk et al. 2009; Lyytinen and Rose, 2003) innovation, “the introduction of computer and network-mediation into talk” (Aakhus and Jackson 2005, p.411) and broader organizational innovations “blurring and reconstitution of boundaries among organizational stakeholders within organizations and between organizations” (Ågerfalk et al. 2009, p.2). However, as Ågerfalk et al. (2009) argue, the scope and the effect of OSTs depend on the increasing number of users rather than on specific technology features. Similarly, Powell and Meinrath (2008) argue that success of grassroots community wireless networks is defined by their ability to incorporate the community social goals into the technical structures. The importance of social aspects in the communication technologies described above complies with the Goldkuhl and Lyytinen (1982) definition of ICTs as “social systems only being technically implemented”. In this light, understanding how end-users enact

information and communication technologies as well as how they construct social structures and meaning for their enactments is crucial. However, the examples described above illustrate that further understanding of the interplay of technology and its meaning and end-user enactments is necessary. The following subsection conceptualizes how technology structure and its meaning are enacted and changed in the process of use.

2. 2. 2. Technology Structure and its Meaning in the Process of End-User Enactment

In this section, we develop a framework to understand end-user technology enactment and change. In order to do so, we combine perspectives from activity theory (Cassirer 1955; Vygotsky 1978, 1983; Leontiev 1978; Rabardel 1995), the theory of technology enactment (Orlikowski 2000; 1992) and the theory of symbolic interaction (Gopal and Prasad 2000; Prasad, 1993; Mead and Blumer 1980). The three theories converge on the grounds of their perception of technology as: 1) both the product and the medium of human activity; and 2) having no inherent meaning and even structure except for those that people assign to technology when they use it.

Furthermore, the choice of these theories was made on the basis that they comply with the so-called users' view (i.e., a social construction of the technology in-use as defined collectively by a specific user community) (Jasperson et al. 2005), and their mutual complementarity. Thus, activity theory (Cassirer 1955; Vygotsky 1978, 1983; Leontiev 1978; Rabardel 1995) provides detailed accounts of end-users' enactment with technology as a tool of reaching specific inquiry. This view is complemented by the insights from the theory of technology enactment (Orlikowski 2000; 1993) on the constructed structure of technological artifacts and the insights from the theory of symbolic interaction on the development of social meaning of technology (Gopal and Prasad 2000; Prasad, 1993; Mead and Blumer 1980). Based on our analysis of these theories, we develop a conceptual framework of end-user technology enactment and change which we illustrate in Figure 2.1.



As Figure 2.1 shows, the proposed framework represents the process of end-user technology enactment through the following three 'pillars'. The first pillar, 'Technology as designed', represents technology as the structure (technological artifact) and meaning attached to it by the technology designers. In this paper, we do not investigate the processes of innovation by technology designers though we do acknowledge that it might also be significantly influence by user-driven innovation (von Hippel, 2005, 2009). The second pillar, 'Users' enactment with technology', incorporates the factors described in the literature as important in the process of end-user technology enactment (the context, users' inquiry and community of inquiry, and malleability of technological artifact) as well as the concept of end-user technology meaning (interpretive schemas and end-user interpretive flexibility). Finally, the third pillar of the framework, 'Users' output', describes the possible outcomes of end-user enactment and incorporates technology use strictly 'as designed', technology transformations (change in technology structure, the

interpretive schema of its use, or both of these) and technology rejection. Factors influencing technology enactment by end-users are the following: 1) Context (developing or developed country context, institutional influence, culture); 2) Inquiry, that is the goal of technology use; 3) Community of the inquiry (users' personal characteristics and knowledge, users' roles, organizational identity, etc.). We now elaborate on how each of the three theories addresses the above grounds and discuss how these are relevant for understanding the process of end-user technology enactment and change in the proposed framework (Figure 2.1).

Thus, activity theory considers that human activity is always mediated by the 'mediating tooling', such as technology and artifacts as well as the knowledge, and the cultural and historic background that those individuals possess. This consideration is based on the assumption that human life and the variety of its activities may be conceived as a system of needs (inquiries) and the means to their satisfaction. However, in contrast to animal needs that are mostly biological and use direct means from nature to be satisfied, most human needs are socially constructed, indirect and require special mediating tools for their satisfaction (Leontiev 1978; Vygotsky 1983, 1978).

Furthermore, technological artifacts acting as mediating tools acquire their meaning and enacted structural characteristics only through the process of use by human agency (Cassirer 1955; Vygotsky 1923; Leontiev 1978; Rabardel 1995). The materiality of technology itself is not sufficient for a technology, or any other material object, to become a tool. These are the interpretive schema of how artifacts should or could be used that transforms technology into a tool mediating the accomplishing activity. The structure of a tool or instrument engaged in the activity thus consists of the material objects/artifacts and the interpretive schemas (Figure 2.2).

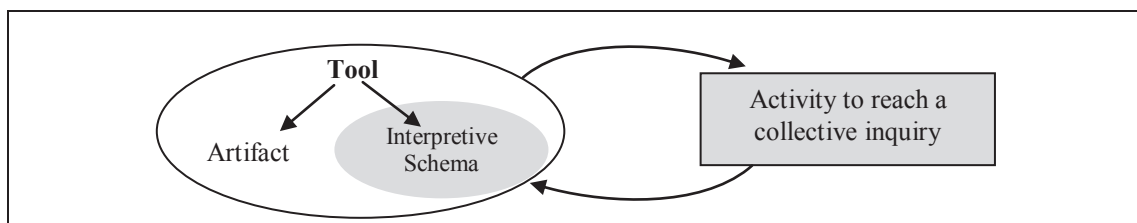


Figure 2. 2. The meaning of technological artifact and its use as a tool in collective enquiry (developed from Rabardel (1995) and Kern (2008))

Thus, the material structures of technology are not tools by themselves but they become so in the process of internalization and appropriation of human activity, i.e. when key figures are supplemented by interpretive schemas of users (Rabardel, 1995).

Following the activity theory and pragmatist views, the activity often represents an inquiry, or a need, that a group of individuals has. The subject of the activity is often represented not by an individual inquiry but rather by a group of inquirers, also called the collective inquiry. When several people engage in a collective activity they form a ‘community of inquirers’ (Peirce, 1931; Dewey, 1938) and start sharing a ‘collective inquiry’ (Dewey, 1938; Lorino 2006; Lorino, Tricard, and Clot, 2011; Peirce 1931). A collective inquiry can be defined as the investigation process by which actors make sense of an uncertain situation and cooperate to collectively accomplish the purpose of their group. The notion of the ‘community of inquirers’ is important because it directly influences the ‘semiotically mediated’ nature of the activities that a community is able to conduct. Moreover, when members of the community of inquiry communicate between themselves, they create rules and norms that also influence the system of activities conducted to satisfy the inquiry. This is so because every member of the community of inquiry possesses certain knowledge, abilities, resources and semiotic meanings and values which he or she brings to the whole community. Importantly, if the boundaries of the ‘community of inquirers’ are changed, i.e. when some members enter or leave it, the nature of the activity and even the nature of the tool may also change. By changing the interpretive schema one can change technology as a tool even when leaving its structure the same (Kern 2008; Lorino 2006). In particular, because the inquiry is both mediated and mediating (Lorino, Tricard, and Clot, 2011), members of the community of inquiry might continuously transform their discourses, texts and figures (such as technology, for example) as their mediators in the process of use.

However, despite the fact that the activity theory provides a presentation of the general process of end-user–technology (tool) enactment, and describes end-users as collective actors (i.e. a community of inquiry), it does not provide detailed accounts on the nature of interpretive schemas and technology meaning and how those meanings become crystallized at different levels of collective activity, i.e. the functional and pragmatic level and the social level inscribing the variety of social practices and broader organizational context. The theory of technology enactment (Orlikowski 2000; 1992) and

the theory of symbolic interaction (Gopal and Prasad 2000; Prasad, 1993; Mead and Blumer 1980) provide important contributions.

The theory of technology enactment proposed by Orlikowski (1992) draws on Giddens' structuration theory (1984) and argues that both the structure and the meaning of the technology cannot be inscribed externally. Despite the fact that designers inscribe certain cultural, symbolic and material properties to the structure of technology, the structure and meaning of technology are only initiated in practice by end-users (Chisalita 2006; Orlikowski 2000; 1992). When using technology in practice, end-users never use the designed structures as given but enact the designed properties differently, work - around and improvise, i.e. the so-called 'technologies-in-practice'. As a result, the structure of technology is not totally defined by designers but contains a significant part contributed by end-users. Related to this, research argues that successful technology of a new medium design is not the one that captures the objects themselves, but the variety of social practices that draw on ever-changing social understanding emerging around the material properties of artifacts (Brown and Digid 2000; Winograd 1988). As a result, in order to understand technology enacted by end-users, one should look at the enactment process between the technology-in-practice and the human agency as well as account for the users' 'interpretive flexibility', which refers to "the degree to which the users of technology are engaged in its constitution (physically or socially) during the development process" (Orlikowski 2000, p.20). According to Orlikowski (2000), interpretive flexibility depends on the material characteristics of the technology, characteristics of human agency (knowledge, motivations, etc.) and characteristics of the context. For these reasons, technology design should rather shape the 'work that people do in organizations' (Winograd 1988; 1986) and rely on the shared meaning of technology users developed through the common context (Winograd 2001).

The theory of symbolic interaction (Gopal and Prasad 2000; Prasad, 1993; Mead and Blumer 1980) studies how human meanings evolve and develop. It contends that objects and events do not have intrinsic meaning separate from the meaning that people assign to them when interacting with them in practice. Thus the theory argues that both the meaning and the (inter)action of humans with objects and events should be taken into account in understanding the process of technological change in organizations. According to the theory, when interacting with objects (technologies) and events, individuals filter the interactions dependently of 'self-images' (i.e. symbols). Being enacted by individuals,

symbols influence the way those objects and events are interpreted by individuals and, through them, the process and the results of their social interactions with symbols. Thus this enactment shapes everyday organizational practices and outcomes as symbols are dynamic and constantly reproduced by individuals. As Prasad (1993, p. 1405) argues:

Symbolic interaction... offers a perspective from which a researcher can look at multiple local meanings of technological change and proceed to understand how those meanings become crystallized and subsequently influence organization-level action.

Gopal and Prasad (2000) go beyond the design paradigm as enacted by one group of people. Through their study of IT used by teachers in Canadian schools they demonstrate that technologies are constructed symbolically by multiple agents including users, facilitators and designers. Building on theories of social construction and pragmatist philosophy (Dewey 1981; Mead and Blum 1980) they argue that “the meanings of various social and nonsocial objects or symbols are derived through the interaction process”.

In this paper we thus distinguish between *the pragmatic meaning of technology* – incorporating the functional and pragmatic qualities of technology as tools that are able to satisfy the collective inquiry, and *the symbolic meaning of technology* – incorporating the social dimensions of technology, i.e. as a tool inscribing a socially-constructed representation of the meaning and goal of the whole activity system and its relevance in the broader organizational context.

The next section presents the research design and methodology of this study.

2. 3. RESEARCH METHODOLOGY

2. 3. 1. Research Design

This research is designed as a single qualitative case study. The novelty of the phenomenon, the importance of the context and process, and the need for nuances and interpretations imply that this research could be appropriate to a qualitative approach. Following the recommendations of Yin (2009) concerning when a case study can appropriately be a form of social inquiry, we designed this research as a case study because the context and circumstances are crucial to understanding how home LAN technologies and their meanings co-evolved in time with the development of home LAN communities. As general guides to the research design we use Myers and Avison (2002),

Denzin and Lincoln (2000) and Silverman (2000) as well as suggestions of Walsham (1995) on how to manage interpretive research in information systems. We position this research as a single case study because it presents an intensive study of a single case (Markus, 1983) of the phenomenon of home LAN development in Minsk built on multiple levels of analysis within the case. However, because similar phenomena existed in Russia, Ukraine and some other countries such as Canada (Powell and Meinrath, 2008), this case is exemplar as it represents something not studied before but not unique (Yin, 2009). The research therefore does not require multiple sites. Further research, however, can contribute to our knowledge of home LAN technologies and their meaning by making a comparative case study of Belarus with Russia, Ukraine or elsewhere, or by comparing our study with other studies on the evolution of symbolic meaning and use of technology over time.

2. 3. 2. Data Sources and Data Collection Procedures

This research is based on multiple sources of evidence which is an important part of case study methodology (Creswell, 2007; Yin, 2009). Data collection involved a variety of techniques including exploratory study, semi-structured interviews, archival data and documents, direct observations and follow-up interviews. Table 2.1 provides a description of the process of data collection and the aims of each step.

Table 2. 1. The Process of Data Collection

Steps of Organizing for Data Collection	Description and Purposes
Step 1. Conducting Exploratory Study	Eight unstructured interviews lasting from 20 minutes to 1 hour each were conducted in order to identify the initial dimensions of the inquiry.
Step 2. Designing and Conducting Interviews in the Field (steps 2 and 3 were done in parallel)	Semi-structured interviews were designed. Findings from the pilot study as well as the 5-year experience of the author being a user of one of the biggest city home LANs were used as the main sources to design interviews. Different interview protocols were developed for the following main types of actors: - Home LAN administrators; - Home LAN users.
Step 3. Collecting Archival Data and Documents	Diverse archival data and documents described in Table 2 were collected in order to create an analytical chronology of the detailed history, events and causal links of home LAN creation and development as well as to enrich the insights and findings from the interviews.
Step 4. Conducting Direct Observations of Practices of Home LAN Users	Direct observations of users operating in their home LANs were conducted in order to clarify the relationship between home LAN users and technologies (hardware and software, home LAN structures and services, etc.) and to enhance our understanding of the meaning behind the user-technology practices. Observations lasted about 30 minutes each.
Step 5. Getting Feedback From Interviewees	Feedback from interviewees (home LAN administrators and active users) was received in order to clarify the findings and insights developed in level 2 and 3 case write-ups (Table 3)

Data collection was made from January 2010 to mid-April 2011. As a result, four diverse data sources were obtained. We present a summary on the data sources in Table 2.2 (see also (Zorina and Avison, 2012). Further details, including interview protocols, can be provided by the authors on request).

Table 2. 2. Data Sources**1. Semi-structured Interviews From the Field (Myers and Newman, 2007):**

Preceded by an explanatory study (Jan 2010-March 2010), interviews with administrators and users of home LANs lasting from 30 minutes to 2 hours each, with the majority of interviews being about 40-50 minutes long;

54 Interviews with administrators and users of home LANs: more than 40 home LANs in total

(Access was gained through personal contacts, notices on websites, and snowball techniques)

2. Documents:

Official websites of Beltelecom and private providers for investigating their mission, strategy, news, technology, and services (<http://www.ipitel.by>, <http://www.aichyna.com>, <http://www.telecom.by>, <http://www.ADSL.by>, <http://www.beltelecom.by>, <http://www.byfly.by>, <http://www.anitex.by>, <http://www.solo.by>, <http://www.bn.by>);

More than 30 pages of non-commercial IT portals providing news and discussions on Internet development in Belarus on a daily basis (<http://homenet.tut.by/>, <http://it.tut.by>, <http://www.interminsk.com/>), <http://providers.by/>, <http://techlabs.by/>);

Websites of some home LANs with news and blogs about their practices, development, and services (<http://dom15.narod.ru/>, <http://slepianka.at.tut.by/help.html>);

Example documents of home LAN financial and Internet-channel accounting and control; Home LAN maps created by their users; Home LAN statutes and regulating documents;

Photos and videos of home LANs creation, renovations, regular offline events, improvisation technologies, technical support practices made by administrators and users over the process of home LAN development and use.

3. Archival Data: These include documented and recorded opinions of experts and politicians on grassroots creation and development, and articles in newspapers and journals, and related government laws of Internet-access regulation.

40 minutes video recorded interview with administrator and specialist in home LANs Konstantyn Scherban by the Belarusian News Portal 'Tut.By';

40 minutes video recorded Interview with lawyer Dmitri Matveev providing his opinion on home Ethernets by the Belarusian News Portal 'Tut.By';

80 minutes video recorded and transcribed debates with representatives; Articles in newspapers related to home LANs news and stories (<http://dom15.narod.ru/images/article.jpg>)

4. Field Notes From Direct Observations:

Field notes and photos from the field observation of users interacting with their home LAN technologies and services while showing and describing 'how it works' (these took place in user apartments where they link up to their home LANs)

We terminated our data collection once reaching the point of theoretical saturation (Miles and Huberman, 1994; Glaser and Strauss, 1967; Glaser, 1992), i.e. when a deep understanding was developed that enabled us to gradually predict the responses of the main actors to certain issues. Simultaneously with steps 2, 3 and 4 of our data collection, we initiated data analysis as in interpretive research data collection and its analysis go hand in hand with no clear demarcation existing between the two (Myers and Avison, 2002). This interaction is important to build deep investigation and understanding of the phenomenon. We provide details on our data analysis procedures in the following subsection.

2. 3. 3. Data Analysis Procedures

In this research we use guidelines on how to deal with the process data in order to understand how home LAN technology and its meaning co-evolved with changes in the boundary of the community of users. In contrast to the variance data providing explanations in terms of dependent-independent variables, process data aims to provide understanding of how things evolve over time and why they evolve in this way (Langley, 1999; Van de Ven and Huber 1990). Thus, the process data consists of events, activities, and actors' choices ordered over time to explain the process and the outcome of change. For these reasons, process data theories of data analysis were successfully used in studies aiming at understanding how change unfolds over time (Langley, 1999; Pettigrew, 1990; Van de Ven and Poole, 1995) including the studies on IT-related organizational change (Barley, 1986; Cho and Mathiassen, 2008; Lychnell, 2011; Newman and Zhao, 2008; Newman and Robey, 1992). Our research case fits well with the process data theories approach. In particular, we look at events, activities, and choices of actors ordered over the 16-year period to explain how the symbolic meaning of home LAN technology co-evolved with change in the boundary of the communities of users and why these happened in a particular way.

Langley (1999) proposed a range of generic approaches that might be used when organizing and analyzing process data (narrative, quantification, alternate templates, grounded theory, visual mapping, temporal bracketing, and synthetic strategy), the choice or the combination of which depends on the particular research aims. In our research we combined the strategies of temporal bracketing and visual mapping and some elements of the grounded theory approach. Below we briefly describe the three and provide reasoning for our choice.

The temporal bracketing strategy (also known as the 'encounter-episode' approach) is used when we need to understand the mechanisms of how change happens. Following this approach, the whole sequence of data is divided into 'episodes' by the 'events'. These are clear breakpoints creating 'certain discontinuities at the frontiers' of the episodes (Langley, 1999, p. 703). The identified episodes become units of analysis that are then compared and analyzed in order to produce an understanding of the change mechanisms.

The visual mapping strategy serves as an important supplement to the temporal bracketing approach as it provides an understanding of the sequence of events and episodes over time and presents them in the form of a visual map. Understanding patterns

in events is the key to developing ‘process’ theory. The grounded theory approach aims at producing understanding about the ‘meaning’ and their ‘patterns’ (Langley, 1999).

The combination of the above-mentioned strategies is particularly helpful to understand in detail how the process of the mutual co-evolution of home LAN technologies, their meaning and change in home LAN communities unfolded over time. In particular, the process of our data analysis was based on the following four steps:

- i) using the visual mapping approach we identified the sequence of events, activities, and choices of home LAN users and administrators and ordered these over time and in the time line;
- ii) using the temporal bracketing approach we identified the main episodes in the continuities of home LAN development divided by important events break-pointing them;
- iii) using the grounded theory approach we generated insights on the symbolic meaning of home LAN technologies within the identified episodes;
- iv) we compared the attained results across the episodes to get a more general understanding of how the symbolic meaning of home LAN technology co-evolved with change in the boundary of the communities of users over the 16-year period.

Such a comparison is important for the constitution of comparative units of analysis for the exploration and replication of theoretical ideas by further research.

The combination of the temporal bracketing and the visual mapping strategies has been successfully used by a number of researchers studying IT-related change. In our research we use this combination as the main generative strategy for our process data analysis. However, we also used some suggestions from the grounded theory approach to make sense of the symbolic meaning of home LAN technologies within the episodes by structuring the meaning identified from our data into categories.

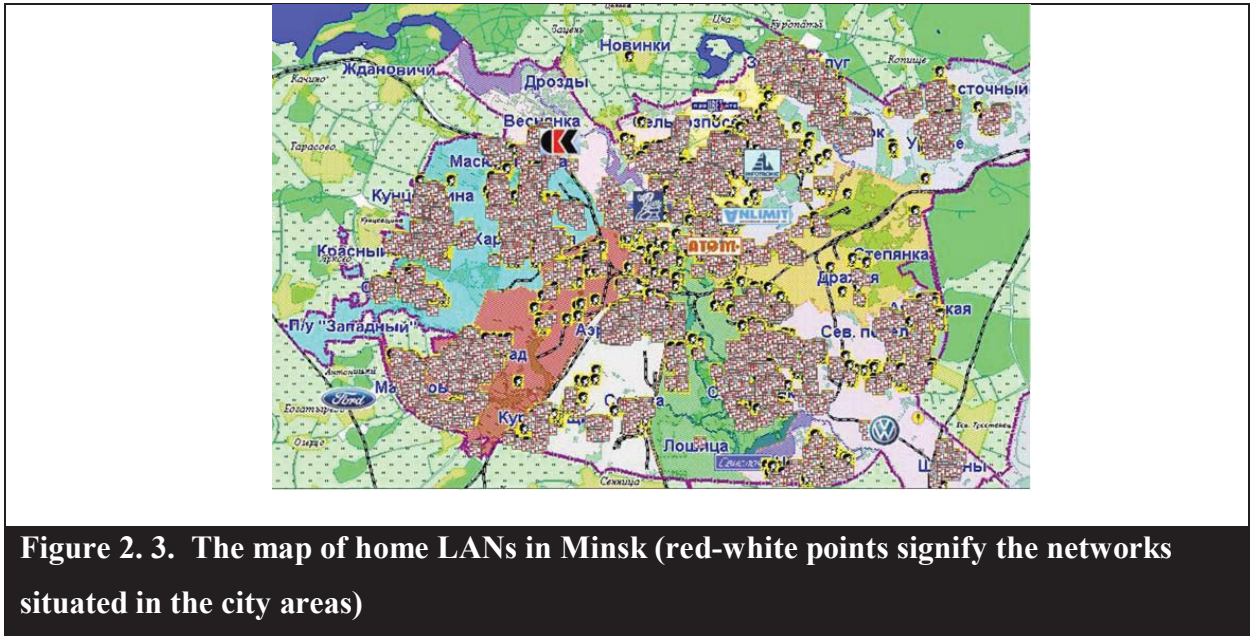
The data analysis procedures were preceded by the stage of pre-analysis where the interviews were transcribed and translated as text for further detailed analysis and we triangulated all data evidence (Eisenhardt, 1989). Coding schemas and categories were developed in line with recommendations of Strauss and Corbin (1998) and Mason (2002). A summary of the main phases of data analysis is presented in Table 2.3.

Table 2. 3. Data Analysis Phases

Phases	Guiding strategy	Application to the Case	Developed Concepts
Pre-Analysis Procedures	(Myers and Newman, 2007)	Long detailed description of the history of home LANs and its development across the concepts initially developed through data collection such as: - Technology and its characteristics; - Number of home LAN users and their description; - Practices around technology and their meanings; - Organizational form; - Environmental factors;	Technology (key figure); Schemas of use; Practices of technology use; Collective activities through technologies; Organizational form; Symbolic meaning of technology
Level 1. Visual Mapping Approach	(Langley, 1999); (Eisenhardt, 1989)	Triangulating the data we identified: the sequence of events, activities, and actors' choices ordered over time for home LANs in a 16-year period and many-thousand phenomena.	Time line of the sequence of events, and activities and a causal map of their interactions
Level 2. Temporal Bracketing Approach	(Langley, 1999); (Eisenhardt 1989)	We identified main episodes in the continuities of activities divided by important breakpointing events	Episodes divided by important breakpoints
Level 3. Grounded Theory Approach	(Langley, 1999); (Strauss and Corbin, 1998); Mason (2002); Eisenhardt (1989)	We generated insights on the symbolic meaning of home LAN technology within the identified episodes and concepts developed at the pre-analysis phase.	Symbolic meaning of home LAN technology
Level 4. Interpretive Qualitative Case Study	(Langley, 1999); (Yin, 2009); (Strauss and Corbin, 1998); (Mason, 2002); (Walsham, 1995); (Markus, 1983)	We compared the symbolic meaning of home LAN technology in the episodes to get an understanding of how the symbolic meaning of home LAN technology co-evolved with change in the boundary of the communities of users.	Comparative units of analysis: symbolic meaning of home LAN technology through different episodes

2. 4. DATA ANALYSIS

The research setting of this study is represented by the end-users of home computers that developed grassroots innovative organizations as a result of technology enactments. These organizations, called home local area networks (LANs) (and most often referred to by their participants as 'networks') appeared in Minsk within communities of citizens. Home LANs were the main form of Internet access and resources sharing for 16 years in Minsk. They included thousands of members and covered all the city areas, giving their users cheap Internet access, network resources sharing, online and real social communication opportunities. Figure 2.3 presents the map of home LANs.



Data analysis identified six main episodes in the development of communities of users which also correspond to the change in the way technology structure and meaning were enacted by end-users. Within the episodes, we looked at the factors influencing end-user interpretive flexibility (i.e. the context, the community of inquiry and the malleability of technology, see figure 1); at the technology structure, the meaning that end-users put in it and the processes of technology enactment. While detailed accounts on the contextual influence are not possible due to the limited amount of space, an event map of contextual dynamics important for home LAN development is presented in Table 2.4. In order to fully understand the dynamics of end-user technology enactment, we start our analysis with ‘Episode 0’ describing the initial use of technology, the home computer, by its citizens in Minsk.

Table 2. 4. Summary Table of All Episodes

Episode 0. Home computer as passion and main hobby of individual users (mid 1990s)					
Interpretations (interpretive flexibility through episodes)		Technological artifact	Meaning	Symbolic meaning	End-user output; technology enactment and change
		Home computer	Device for single- user activities (offline games)	Computer as passion and main hobby (i.e. to “discover what was inside and what we can do about it”)	Technology-in-practice Change in the original meaning (not only as device for the designed single–user activities but as a subject of special interest) Altering the structure in order to overcome the designed limits (i.e. coming to a friend to share files with your own hard disc.
Context:	Multiple conflicting logics in the field represented by the interests of government monopolist and private providers; no Internet-access affordable for end-users;				
Inquiry	Multi-task inquiries for individual activities with home computers				
Community of inquiry: Boundary: Description: Roles: Identity:	Single user Mostly young people and older people with engineering background; - -				
Malleability of technology:		Malleable technology			
Episode 1. Home LAN as substitute for the lack of Internet-access (1995- 1998)					
Interpretations (interpretive flexibility through episodes)		Technological artifact	Meaning	Symbolic meaning	End-user output; technology enactment and change
		Home computers; cables; net cards; hubs, switches	Device to play multi-party games and share files with other users	Technology as a substitute for the lack of Internet services and undeveloped infrastructure undeveloped by government and private Internet service providers	Technology-in-practice, Improvisational workarounds End-user contribution and innovation Change in technology meaning (home LAN as a means to play multi-party games and share files within communities and thus substitute for the lack of Internet access) Change in technology structure (developing the structure to link home computer with other computers in the network; network technologies)
Context:	Multiple conflicting logics in the field represented by the interests of government monopolist and private providers, and the civil logics of home LANs; no Internet-access affordable to end-users;				
Inquiry	To have a means to play multi-party games and share resources between friends				
Community of inquiry: Boundary: Description: Roles: Identity:	- Small groups (usually less than 10 people) - Young users (from 15 to 25 years of age on average); with some technical background or knowledge; - All users are equal (shared responsibilities, and costs); - Communities of friends, non-commercial and non-profit activities				
Malleability of technology:	Malleable technology				

Episode 2. Home LAN as a symbol of belonging to a special culture (1999-2003)					
Interpretations (interpretive flexibility through episodes)		Technological artifact	Meaning	Symbolic meaning	End-user output; technology enactment and change
Context:	Multiple conflicting logics in the field represented by the interests of government monopolist and private providers, and the civil logics of home LANs; no Internet-access affordable for end-users;	Home LANs: Home computers; cables; Net cards; hubs; switches; routers, specialized software; bricolage and improvisation-made hardware and software	Device to play multi-party games, share files with others and participate in a variety of social network services developed within home LAN communities	Technology as a substitute for lacking Internet services and infrastructure undeveloped by government and private Internet service providers Technology as symbol of belonging to a community with a special culture	Technology-in-practice, Improvisational work - arounds End-user contribution and innovation Change in meaning (symbol of belonging to a community with a special culture; activities such as ‘network football’, ‘network beer’) Co-existing meaning: substitute for the lack of Internet-access Change in technology structure: (development of a variety of end-user developed network services: prototypes of social networks, network radio, ‘media gallery’ with photos, file search programs, etc.)
Inquiry	To have a means to play multi-party games and share resources between larger groups of people				
Community of inquiry: Boundary: Description:	- Groups of 10-30 people; Diversified users (mostly young people but also people in their 40s, families, and some retired people); -Administrators, and (mainly) active users; -Associations of individuals; mostly non-commercial and non-profit;				
Roles: Identity:					
Malleability of technology:	Malleable technology				
Episode 3. Home LAN as an enabler of cheap and quality Internet access (2003-2006)					
Interpretations (interpretive flexibility through episodes)		Technological artifact	Meaning	Symbolic meaning	End-user output; technology enactment and change
Context:	Multiple conflicting logics in the field Internet access	Home computers; cables; net cards; hubs; switches; routers, modems; specialized software; bricolage and professional hardware and software; fiber optics;	Device to play multi-party games, share files and participate in a variety of social network services developed within home LAN communities, and for Internet access	Technology as a means to get cheaper Internet-access and a significant supplement to it (access to services and resources of home LANs and of some providers) Technology as symbol of belonging to a community with a special culture	Technology-in-practice, Improvisational workarounds End-user contribution and innovation Change in meaning (technology as a means to get cheaper Internet-access and a significant supplement to it) Change in technology structure (change to link home LAN and Internet providers’ infrastructures; change in home LAN topologies, technologies and software to incorporate large numbers of users)
Inquiry	Using home LANs to receive a cheaper Internet access from private ISPs				
Community of inquiry: Boundary: Description:	- Groups of 50 to several thousands of users; - Diversified users (mostly young people but also people in their 40s, families, and retired people) ; - Administrators, active users, and users (large majority); - Social entrepreneurship organizations; elements of commercial and profit activities;				
Roles: Identity:					
Malleability of technology:	Malleable technology				

Episode 4. Home LAN as an important supplement to cheap and quality Internet access (2006-2007)					
Interpretations (interpretive flexibility through episodes)		<i>Technological artifact</i>	<i>Meaning</i>	<i>Symbolic meaning</i>	<i>End-user output; technology enactment and change</i>
<u>Context:</u>	Multiple conflicting logics in the field Internet access				
<u>Inquiry:</u>	Providing home LAN users with valuable services supplementing the existing affordable Internet access				
<u>Community of inquiry:</u>	- Groups of 50 to several thousands of users; - Diversified users (mostly young people but also people in their 40s, families, and retired people) ; - Administrators, active users, and users (large majority); - Commercialized (A) or underground organizations (B);				
<i>Boundary:</i>					
<i>Description:</i>					
<i>Roles:</i>					
<i>Identity:</i>					
<u>Malleability of technology:</u>	Malleable technology				
Episode 5. Home LAN as a symbol of an identity choice (2008-2010)					
Interpretations (interpretive flexibility through episodes)		<i>Technological artifact</i>	<i>Meaning</i>	<i>Symbolic meaning</i>	<i>End-user output; technology enactment and change</i>
<u>Context:</u>	Multiple conflicting logics in the field Internet access				
<u>Inquiry</u>	Answering the external challenge				
<u>Community of inquiry:</u>	- Reduced number of users (the scope of reduction depended on the developed organizational form and identity); - Diversified users (mostly young people but also people in their 40s, families, and retired people) ; - Administrators, active users, and users (large majority); - Commercialized (A) or underground organizations (B);				
<i>Boundary:</i>					
<i>Description:</i>					
<i>Roles:</i>					
<i>Identity:</i>					
<u>Malleability of technology:</u>	Malleable technology				

2. 4. 1. Episode 0. Home computer as passion and main hobby of individual users (mid 1990s)

We start our analysis in the mid-1990s, the time when home computers first appeared in a significantly large number of households in Minsk. Besides the global computerization affecting households worldwide, there existed other important institutional factors influencing the process of home computer adoption in Minsk. Historically being designed in one of the main centers of electronic and computer engineering in the former USSR, Belarus inherited a developed infrastructure of manufacturing enterprises and huge universities specialized in the area of computer science and engineering. The latter resulted in many thousands of people with an engineering background who were fascinated by computer technology. As a result, during this period the communities of the inquiry consisted mostly of young people with some technical background or knowledge as well as older computer and IT engineers educated during the Soviet Union times. Data analysis shows that even during this initial period the meaning that end-users associated with home computers was broader and more special than just a ‘device for multiple personal activities’. As two founders of home LANs put it:

Computers were our lifestyle, main interest and the main topic of conversations. We wanted to know what was inside and what we could do with them ...Every generation has its own fashion, and ours was structured around the computer and related activities.

The symbolic meaning of home computer as ‘lifestyle’ and ‘main interest’ co-evolved with such end-user technology enactments as work-arounds and improvisations. As a result, the technology structure was often altered and changed in a way to overcome its limitations:

Before the network was created, sharing files in the network was so inconvenient. Floppy discs had little memory, CD discs were expensive and, besides, not everyone had a CD-writer. The most usual way of sharing a file was taking out the hard disc and coming to a friend’s place with it. [End-user of home LAN]

The context of the country’s Internet-access infrastructure development of the 1990s could be characterized as extremely slow and unfavorable. In particular, the government Internet server provider (ISP) Beltelecom offered only slow (dial-up) and extremely expensive Internet access for individual users until 2006 whilst also keeping the monopoly and high prices for the country’s Internet-channel. Thus private ISPs had to buy the Internet channel from Beltelecom and though

offering individual Internet access through better facilities (ADSL) they could only sell it at a high price. As a result, individual Internet-access in Belarus was significantly limited (see Figure 2.4).

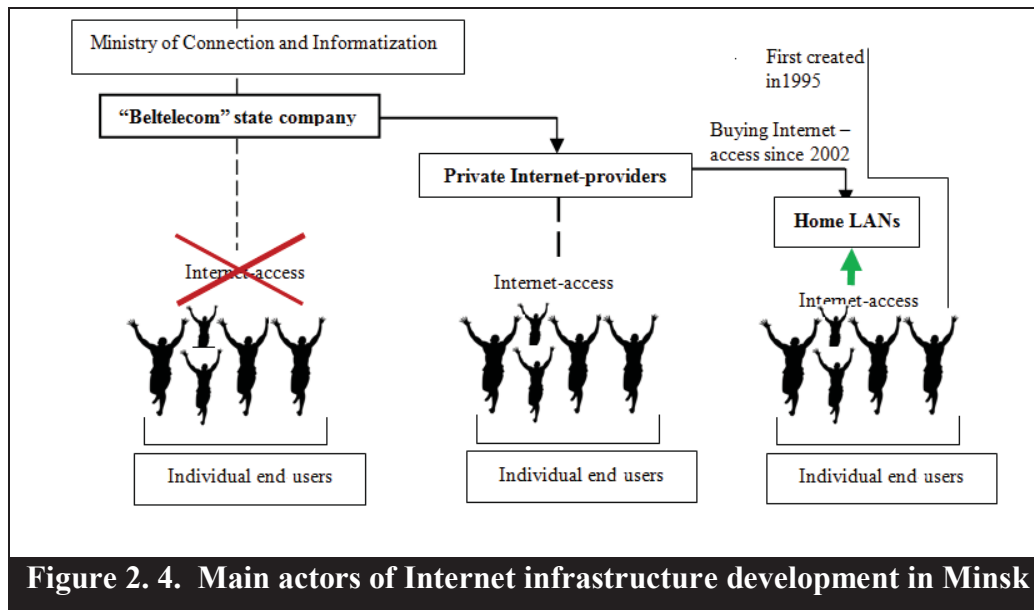


Figure 2. 4. Main actors of Internet infrastructure development in Minsk

As we show later, home LANs developed on the basis of home computer technologies served to a large extent as a substitute for collective practices usually enabled by Internet access in other countries. The above institutional factors relating to home computer adoption and use in Minsk played an important role in later episodes of home LAN development which became a million-user phenomenon. Detailed accounts on the institutional influence on the patterns of change in home LAN technologies and routines may be found in (Zorina and Avison, 2012).

2. 4. 2. Episode 1. Home LAN as substitute for lacking Internet access (1995-1998)

The first home LANs in Minsk appeared in 1994-1995. By linking their computers in home LANs, users created a shift from offline, that is, not being connected (individual) to online (collective) practices of home computer use, typical of which was multi-party game playing and resource sharing. As one early adopter suggests:

It all started when we came up with the idea of playing games together. We did not know how computer networks worked but decided to sort it out. So we shared some cable, some money and constructed ‘something’. It worked because we lived close to each other. Of course, this was cool! We started to boast of this to our friends so other friends came to join us.

We found that the ‘pragmatic’ meaning of home LAN technology developed to provide a means to play multi-party games and share resources intertwined with the ‘symbolic’/virtual presence of Internet technology as a phenomena and a great desire of end-users to have a substitute for lacking Internet-enabled opportunities. As two end-users put it:

We knew that the Internet existed somewhere, in other countries, but this was just too far away from our reality ... We thought: Internet is a network of computers. We also have computers so why don’t we build a network for ourselves?... We did not have the Internet available so we decided to build our own.

The development of home LAN technologies, therefore, had an important symbolic meaning of being a substitute for the lack of Internet access and services provided by it. The main inquiry underlying the process of home LAN development was to find a means to share files and play multi-party games with friends. The community of the inquiry consisted of young people (from 15 to 25 years of age on average) usually with some technical background or knowledge. Home LANs of this period consisted of small groups (usually less than 10 people). The collaboration between individual users was based on pre-existing ties such as friendship and common interests and was facilitated by their close geographical positions in typical multi-storied buildings.

In the beginning, we only linked up with friends and peers. Explaining this to an outside person would be too complicated and, besides, we could not explain how it was working then; we could only explain what we did to make it work [a home LAN user].

As a result, the identity of home LANs during this period was represented by the identity of the ‘Communities of friends’ sharing the same inquiry and interests as well as equal responsibilities and costs:

Everything was based on equal and mutual peer-to-peer relationships, no money stimulus existed in the network. Everybody was contributing according to his will and knowledge [a home LAN user].

We also found that the process of enactment and development of technology structures was very sensitive to the identity of end-user communities, the established roles and relationships between users as well as to the pragmatic and symbolic meanings of technology. As the ‘community of friends’ was identified where each member had equal rights and responsibilities, the process was underlined by the inquiry to develop a device with a pragmatic meaning to share

files and play multi-party games with friends and a symbolic meaning to act as a substitute for the lack of Internet access. A user illustrates this:

We learned through practice about the technologies we needed. First, me and my neighbor bought a piece of cable and two net cards and linked our computers. Then a 3rd neighbor wanted to join us. Thus, we discovered that cable and net cards were not enough anymore and that at least a simple router technology was needed. This is how our first hub appeared in the network [administrator of a home LAN].

The process of this mutual evolution was highly dynamic and based on improvisation:

Everything was first done with resources at hand, and we made plenty of mistakes and nothing worked well. With time, we improved things [administrator of a home LAN].

Thus, during this episode the technological artifact evolved from home computer to the level of a home LAN: an improvised information system consisting of home computers, cables, hubs, switches and net cards; the practices around technology evolved from individual offline to collective online activities. Similarly, the meaning behind the technology transformed from technology for individuals to technology-enabled collective activities. The initial symbolic meaning of home LAN technology as a substitute for Internet technology also appeared at this stage. Below we provide an illustration of an air cable connection between two multi-storied buildings (Figure 2.5a) and home LAN equipment (switch) situated in an attic (Figure 2.5b).



Figure 2. 5a. Home LAN cable connecting two multi-storied buildings



Figure 2. 5b. Home LAN switch situated at attic of a multi-storied building

2. 4. 3. Episode 2. Home LAN as a symbol of belonging to a special culture (1999-2003)

During this period, the context of home LAN development (i.e. the lack of Internet access, the providers' policy, etc.) remained the same. However, the characteristics of the community of inquiry changed significantly. First, it grew in number, up to 30 users on average. Second, despite the fact that the community of inquiry still consisted mostly of young people, it now incorporated not only the 'community of friends' but also 'friends of friends'. The growth was also initiated because some particularly interested home LAN users put a notice about them on the doors of the multistoried buildings where they lived. As a result, the inquiry driving the enactment and development of home LAN technologies now changed to the desire of having a means to play multi-party games and share resources between *larger groups of people* and thus to increase the 'fun' by attracting new members. Eventually, this development also led to the change in the pragmatic meaning associated with the enacted and home LAN technologies and their developments. This now incorporated 'the means enabling multi-party games playing, sharing resources and 'having fun' with a larger group of people'. Simultaneously, the identity of home LAN organizations changed from the 'communities of friends' to the 'associations of individuals' developing their own unique culture for which we provide details below.

The changes described above in home LAN boundaries, inquiry and identity influenced the way home LAN technologies were enacted and developed by end-users. In particular, these led to the development of technological and software innovations that could satisfy the new inquiry for a larger group of people. Thus, home LAN technologies now incorporated the hardware as home computers, air and underground cable linking, switches, routers, servers, bricolage-made technologies as lightning rods and boxes for hardware, and services such as media gallery, game portals, chats, maps of network resources, and lists of participants with their photos, network news, etc. (prototypes of contemporary social media like Facebook and Twitter). As with the previous episode, these innovations were often made based on improvisation, work - around and bricolage technologies. Below, we show a picture of the process of home LAN technology development, the construction of a home LAN server from an old workstation (Figure 2.6).

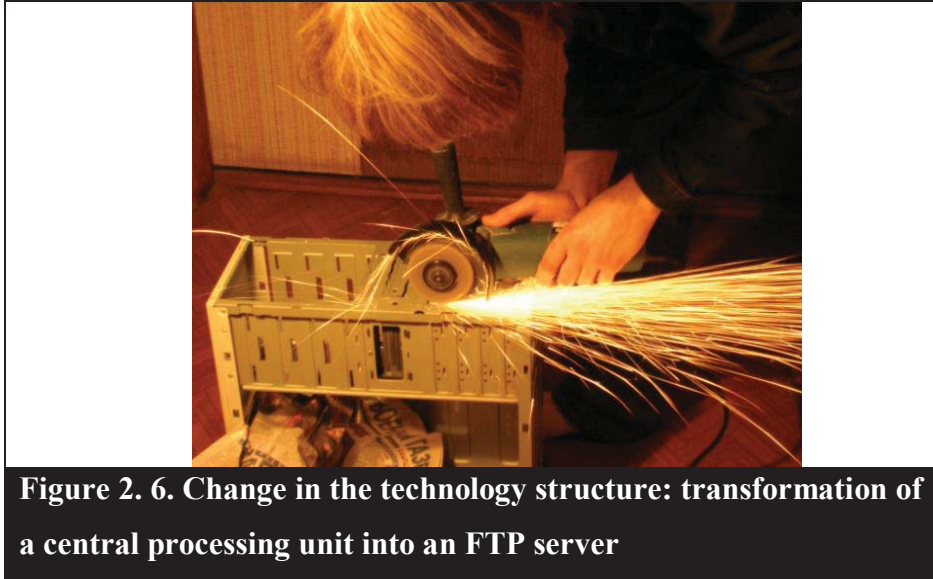


Figure 2. 6. Change in the technology structure: transformation of a central processing unit into an FTP server

Another important difference from the previous two episodes was that users of home LANs created a strong and unique organizational culture. This created an additional symbolic meaning for home LAN technology enactment. End-users of home LANs saw themselves as a separate significant phenomenon and developed their identity in terms of a not-for-profit ‘associations of individuals’. This included the development of home LAN codes and statutes as legislative documents developed by end-users and confirmed at their regular meetings; regular offline network meetings devoted to the discussion of home LAN development; budgets (at this stage a small monthly fee for development and repairs was introduced); and vote-based decision-making systems. Thus, the texts of statutes represent an interesting summary of the meaning put in the home LAN technology structures and enactments by end-users. In particular, the statutes included a definition of home LAN organizations and their aims, description of the technologies they used, the behavior, the rights and responsibilities of end-users, and underlined the fact that all technologies and services used in networks are the *common* property of all users. Additionally, regular social meetings termed ‘network football’, ‘network beer’ ‘network tea’, ‘network snowballs’ started to be practiced by users. This is how three users of home LANs describe it:

Despite that I joined the network because of the resources, later its social aspects became the most important. If I were asked then about my main motivation to use the network, I would have immediately answered – social ties and activities... We shared not only online resources but also offline ones. For example, I was the only one who had a digital camera then so I usually served as a ‘network photographer’ for our offline meetings ... This was so fascinating: having regular tea or beer parties together, or sports competitions between the

neighboring networks, or just enjoying the first snow by playing snowballs with other ‘network citizens’... We felt that as we had something in common to share.

As illustrated by the above, the emerged culture of the home LANs created the additional important aspect of the symbolic meaning of home LAN technologies. As an illustration of this symbolic meaning, we provide a picture of a ‘network football’ match organized between two home LANs to find out ‘which network was better’ (Figure 2.7).



Simultaneously with the development of home LAN organizational culture, there was a diversification of users into two roles: administrators and end-users.

Administrators (those who created home LANs, linked up new users and provided technical support). These were the most knowledgeable users. The role of administrator was developed historically. Usually, the most active, reliable and knowledgeable users took these responsibilities. Importantly, the work of administrators was often evaluated at regular offline meetings of home LAN users. In some cases administrators were selected or changed by means of a vote. At this period, the work of administrators was usually not paid at all and relied on enthusiasm, personal motivation and youthful ambitions. On the other hand, the whole work for the network support, link up of new users and network development was usually done by administrators and some of the most active users. Here a home LAN administrator provides the explanation as to why they spent so much of their personal time and effort for the network:

It was similar to having a child. Some people have a daughter or a son and I had my network to bring up... It was a part of our youthful ambitions, you know, when you want to change the world, create something important for people and be a famous and respected person.

Home LANs materialized our dream of success: only yesterday, we were just students and now we became the Administrators of the local area network!

Users. This category incorporated all home LAN users except for the administrators. During the episode, the majority of users were actively involved in the network development: they helped administrators to create resources of home LANs and link up new users, build ‘air’ or underground cable links, etc. Some users also kept parts of home LAN equipment such as hubs/switches/routers, modems and sometimes even servers at their home and maintained their functionality. Active users and other users played an important role in the way that technologies of home LANs and their meaning developed. Thus, a lot of technological and service innovations in home LANs were developed and proposed by users from the bottom-up. These innovations included network radio, network interactive maps, websites, software applications development, file search services, media gallery, etc. A home LAN administrator explains:

Services were developed by users. As administrator I did not have time for this. People usually came to me during the offline meetings and proposed things and ideas. We then tested these services on the users’ computers and if everything was fine, integrated them into the network.

To sum up the main achievement of the episode, technologies of home LANs evolved to create numerous technical and service innovations. A strong organizational culture based on these technical and service innovations significantly added to the symbolic meaning of home LAN technologies. Additionally, they now represented belonging to a unique organizational culture of the ‘networked citizens’.

2. 4. 4. Episode 3. Home LAN as a means to get cheap and quality Internet access (2003-2006)

Episodes 3 and 4 are characterized by significant changes and dynamics in the context of home LAN technology enactment. Having realized themselves as a separate phenomenon, some networks contacted private providers and proposed to them a mutually profitable exchange: cheap Internet access for the large number of subscriber users. Some providers agreed to cooperate and this led to further expansion of the boundaries of home LAN technologies. Thus, providers offered home LANs free modems for each group of 5-10 users, as well as developed specialized

software, for example that enabling personalized online payment access for multiple users of the same modem. On their side, users of home LANs developed technologies multiplying the Internet-access channels in order to enable quality and cheap multi-user consumption from the same modem. This cooperation resulted in a significant change in the community of users from medium to large groups. Aiming to get high quality Internet access for an affordable price, citizens enthusiastically joined home networks. This eventually led to the situation when, according to the analysis of some experts, ‘about 90 percent of all home computers in Minsk’ (2 million population) were connected to home LANs (<http://news.tut.by/162645.html>). The exact number of users in each network was different and varied from around 50-100 users to 300-500 users with some home LANs having several thousands of users. The evolution in the number of users necessarily led to the great diversification. Now they incorporated not only young people, but also families, ‘grown-ups’ and older people such as businessmen, and even some retired people joining the network mainly to Skype their relatives abroad. However, the increase in the number of users also led to the deterioration of the unique home LAN organizational culture and its use. As two long-term home LAN users describe this:

As in many other good things, at some point some users appear that are not interested in the real sense of the phenomenon, they just want to consume services without creating something in return. This consumer culture killed the spirit of the network ... Networks with too many people were not the same as before.

Thus, the symbolic meaning of home LAN technologies was largely changed from the previous ‘symbol of belonging to a community with a special culture’ to a ‘means to get cheap and quality Internet access’. Simultaneously, the growth in the number of users also led to significant changes in the way home LANs were managed and in the ways technologies were enacted by end-users and network administrators. This is how one administrator describes this:

Many things working for a small group technically were not possible for larger groups that required the interconnection of many users. At least, network topology re-engineering and equipment reconstruction was necessary.

As these changes required funds and a significantly increased amount of work from administrators for re-building and user support, the majority of home LANs became commercialized with a monthly fee and control mechanisms:

Commercializing the network a bit was seen as a solution to create some regular funds. However, explaining to other people, especially to those far from the technical issues, why they needed to invest money for the reformation was complicated: they had their network working somehow so why should they pay for something that they did not pay for before? So we started looking for a solution in the form of diverse marketing and management technologies and devices [Administrator of a large home LAN].

This resulted in the development of specialized software applications and managerial systems for home LANs such as accounting systems and software development to control and personalize users' access to the network. As one network administrator puts it:

In order to stimulate the regularity of monthly fee payments, we installed control switches to personalize the network access and created special software applications that could impede the access of some users while not disturbing others.

Some administrators tried to combine the changes with social mechanisms:

I created an accounting documentation system and put it on the net server. This was available to all users and renewed on a regular basis. First, everybody could see who pays and who does not. Second, as all the costs and revenues were documented, people could see where the money was going. To make it even more transparent, I used to tape-record and photograph every problem or repair that I made and posted it on our website.

Typical documented expenditures include cables and hard discs for routers, power cords and wall outlets for switches, server updates, keys from basements and roofs, typical incomes includes a monthly fee per user and sales of old equipment, including switches and hubs.

2. 4. 5. Episode 4. Home LAN as an important supplement to cheap and quality Internet access (2006-2007)

This episode resulted in the development of home LAN service technologies as well as an additional symbolic meaning of home LANs as a supplement for cheap and quality Internet access. On average, the increased number of users led to the wave of end-user innovative services as game portals, media galleries, chats, network radio, etc. A specialized website devoted to the home LAN community development in Minsk (and in Belarus in general), *homenets.tut.by*, facilitated the transition of end-user innovations across networks. Additionally, many providers observed the innovations developed through networks and copied or introduced these onto their

own infrastructures thus developing their own Ethernets and additional competitive advantage by attracting new users. As a manager of a huge Internet-providing company in Minsk explained:

All our services came from home LANs.

Further, besides a variety of services, home LANs often cooperated with several providers simultaneously. Thus, they provided their end-users with an important possibility to switch between multiple providers and their Ethernets.

2. 4. 6. Episode 5. Home LAN as a symbol of an identity choice (2008-2010)

This episode is characterized by diversification in home LAN identities leading to different ways in which network technologies were enacted and developed. Several intense institutional pressures on home LANs by both government and private organizations were the underlying conditions of the diversification. First, the government monopolist Beltelecom previously indifferent to the individual Internet access of its users, joined the market of end-user provision in 2006. It launched ADSL Internet-access and progressively reduced the price for it (previously, only the dial-up Internet access at high prices was offered by the company). Following on from this, two successive government laws prohibiting home LANs were enacted. The first law appeared in 2007. It strongly recommended that all home LANs should legalize and register as private organizations (there was no possibility for them to register as associations in the sphere of telecommunications). The law did not find support among home LANs as it was contradictory to their free origins, non-profit activity and shared property by all members of the community. The second law appeared in 2010 which announced all home LANs as illegal and obliged them to be shut down. Simultaneously, administrative procedures for registering new private Internet-providers were significantly facilitated. The second institutional pressure came from private ISPs. As discussed in the previous section, private ISPs copied services developed in home LANs and developed their own Ethernets on this basis. They started intensive competition for end-users of home LANs using the law as a reason to legalize their relationships with home LANs and thus ‘help’ their users and administrators to escape these problems. Home LANs responded to the pressure differently: commercializing; integrating with private providers; or going underground. We find that in general home LANs with a big number of users and better developed managerial and technological resources to operationalize end-user resources tended to

commercialize. On the other hand, smaller home LANs with a more democratic structure tended to either go underground or merge with the infrastructure of private providers. We also find that the dynamics of the enacted meaning and structure of home LAN technologies followed the way that they developed their identities.

First, as an administrator of a home LAN that developed into a commercial private Internet provider explained:

The choice was either to do it professionally or to give it up. We decided that we had enough knowledge and experience not to give up everything we have created into the hands of others. We are now entrepreneurs risking our own money so we really work hard and develop many services that we think are important to people.

These home LANs changed the structure and enactment of their technologies so as to comply with national standards. For example, they followed all the procedures of registration, control, and network rebuilding ‘from scratch’ and according to the project affirmed by the Ministry of Communication. Thus, the symbolic meaning of their technologies was ‘*professional development*’.

However, second, a number of home LANs developed ‘false’ identities: some administrators registered as individual entrepreneurs while the network largely continued to function in the old way. These networks did not change the structures of their technologies but developed a symbolic meaning of ‘formal compliance’.

We registered as individual entrepreneurs to escape the law and continued working as we used to do.

Third, some home LANs complied with the pressure from private organizations and integrated into the infrastructure of private providers. Their symbolic meaning changed into ‘being a part of private provider/not any more being special’ while the way technologies were enacted depended on the rules of the main provider.

This has almost the same facilities as we had in our home LAN but we pay several times more and it is not as special as it used to be.

Alternatively, some home LANs went underground. Here, the structure of their technologies and their way of enactment stayed mainly unchanged (a risky strategy). However,

their symbolic meaning changed to ‘Technology as an alternative to government and private Internet services’:

Why should I pay money to a provider for the things that I have for free or almost for free in the home LAN that I myself constructed? The only thing that we did not have a right to do was air cable connection between the houses as we did not have special permission for this. Concerning the cable connection inside the building, this is our own business and we have full right as tenants to build as many cables and holes as we want

Finally, some home LANs died as a result of change in administrator interests, their moving to another place, etc. In this case, the structures of their technologies stayed unchanged with the symbolic meaning of ‘old-fashioned technologies’, something that ‘does not make sense any more’. As two users of these networks put it:

Cables continue to hang on the roofs and inside the houses. It is the ‘network’ itself that is dead ... The Internet and its facilities are now easily available so it just does not make sense...

2. 4. 7. General Pattern of End-user Transformative Technology Enactment

This subsection describes the general pattern of end-user transformative technology enactment.

1. Initially, among Minsk users of personal computers (let us call these actors A) there ‘existed a specific activity system U (*private and personal use of home computers*). This activity system was mediated by technology T (*personal computers*) and eventually altered with the change in the technology structure (i.e. *taking away hard discs*) in order to satisfy some specific additional inquiry Q0 (i.e. *sharing files*) entangled with the symbolic meaning of technology T, S0 (*home computers as passion and hobby*).
2. Some of the actors in the community of inquiry A generate a new activity system V by imagining that they could use technology T (*personal computers*) to reach new inquiry Q1 (i.e. *to play multi-party games together*). Thus, they transform the material structure of the mediating technology from T to L (i.e. *home LANs based on home computers connected with wires, hubs, etc.*) and endow this with the certain pragmatic meaning P1 (*device to share files and play multi-party games*) and symbolic meaning S1 (i.e. *substitute for*

lacking Internet-enabled services). As a result of these transformations, the new activity system Y is of interest for and enrolls a larger population of users, extending the community of inquiry to B having an identity I1 (i.e. *communities of friends*).

3. The new community of inquiry B generates a new activity system W as it has a broader variety of practical needs and changed inquiry Q2 (i.e. *to have a means to play multi-party games and share resources between larger groups of people, friend of friends*). Thus, it transforms the material structure of the mediating technology from L to N (i.e. *adding to the existing home LAN technologies servers, new services, etc.*) and endow this with the certain pragmatic meaning P2 (*device to play multi-party games, share files and participate in a variety of social network services developed within home LAN communities*) and symbolic meaning S2 (i.e. *a symbol of a special culture of home LANs*). As a result, the community of inquiry changes to C having identity I2 (*associations of networked individuals*).
4. The new community of inquiry C generates a new activity system X addressing it with a new inquiry Q3 (i.e. *imagining that it can use home LAN technologies and users to receive cheaper Internet access from provide ISPs*). Thus, it transforms the material structure of the mediating technology from N to O (i.e. *adding to the existing home LAN technologies modems, Internet infrastructure of ISPs, etc.*) and endow this with a pragmatic meaning P3 (*device to share files, play multi-party games, etc.*) and symbolic meaning S3 (i.e. *a means to get a cheap Internet access*). As a result, the community of inquiry changes to D having identity I3 (*social entrepreneurship organizations*).
5. The new community of inquiry D generates a new activity system Y addressing it with a new inquiry Q4 (i.e. *providing home LAN users with valuable services supplementing the existing affordable Internet access*). Thus, it transforms the material structure of the mediating technology from O to R (i.e. *adding a variety of new innovative services*) and endow this with a pragmatic meaning P4 (*device to enable Internet access and a variety of social network services developed within home LAN communities*) and symbolic meaning S4 (i.e. *a supplement of the affordable Internet access*). As a result, the community of inquiry changes to E having identity I4 (*commercialized community-based organizations*).
6. Because of the institutional and political interplay (i.e. *involvement of a state-owned provider Beltelecom and a number of prohibiting government laws, etc.*), several different

types of community of inquiry are generated in an attempt to answer inquiry Q5 (*answering to the external challenge*):

- community of inquiry E (*home LANs transforming to private ISPs or organizations of individual entrepreneurship*) with a new activity system Z1 addressing inquiry Q5 and sharing identity I5 (i.e. *commercial organizations*). As a result, the material structure of the mediating technology was transformed from R to S (*change to update home LAN technologies to the standards and levels of other private Internet providers*) with a pragmatic meaning P5 (i.e. *a tool of Internet access and Ethernet services*) symbolic meaning S5 (*totally commercialized tool of Internet access and Ethernet services*);
- community of inquiry F (i.e. *home LANs going underground*) with the new activity system Z2 addressing inquiry Q5 and sharing identity I6 (i.e. *underground non-commercial organizations*). As a result, the material structure of the mediating technology was **not** transformed and remained R with a pragmatic meaning P6 (i.e. *a tool of Internet access and Ethernet services enabled by home LANs*) and symbolic meaning S6 (*an alternative to the Ethernet services of government and private Internet providers*).

The general pattern described above shows that the process of end-user transformative technology enactment is entangled with the community of inquiry and its identity, underlying inquiry, activity system, and symbolic meaning of technology. The following sections discuss the findings.

2. 5. DISCUSSION AND CONCLUSION

This paper provides detailed accounts on how the meaning and the structure of technology are enacted by end-users over the 16-year period and how this enactment leads to technology innovation and broader organizational transformations. Our main finding indicates that the process of end-user innovation is not restricted to the change in technology structure and/or the interpretive schema of its use (i.e. technology pragmatic meaning): this is significantly influenced by and influencing the change in user inquiry, broader activity system of reaching the inquiry, identity of the community of inquiry, and the symbolic meaning of technology (i.e. socially constructed representation of the meaning and goal of the whole activity system and its relevance in the broader organizational context). The phenomenon of end-user innovation should thus be

addressed as the co-evolving system of all the above mentioned elements. Furthermore, we argue that this process is deeply embedded into the social meaning of the technology (and particularly, in the interplay between the pragmatic and the symbolic meanings). The paper thus has several contributions to the theories of technology adoption, the theory of technology enactment, activity theory, design theory and developments of new organizational forms.

- 1) Our findings indicate that when end-users enact technology as a tool to reach their inquiry they tend to construct the meaning of technology (interpretive schemas) at different levels simultaneously: pragmatic and symbolic. These findings contribute to both activity theory and the theory of technology enactment (Orlikowski 2000; 1993) as previously the distinctions between the pragmatic and symbolic meanings of technology have not been explicitly addressed. As we illustrate in our data analysis, there exists an important distinction between the pragmatic and symbolic meaning though all the episodes of home LAN technology development. Furthermore, we found that the symbolic meaning of technology played a significant role in the way home LANs were enacted and developed. Thus, in the data analyzed above, the symbolic meaning of home LAN technologies as substitute for the lack of Internet access, then as symbol of belonging to a community with a special culture, enabler of affordable Internet, and, finally, as underground technology, substantially influenced the ways that home LAN technologies were enacted by end-users. We thus argue that the process of end-user co-creative technology enactment is significantly influenced by the symbolic meaning of technology for end-users.
- 2) We show that the symbolic and pragmatic meaning of technology often co-evolve ‘hand-in-hand’ and provide a mutually constitutive background for each other as well as the way technology structure is enacted by end-users. Furthermore, at some stages of end-user technology development the symbolic meaning of technology might play the key role. For example, despite significant similarities between episodes 1 and 2 in terms of contextual factors (multiple conflicting logics in the field represented by the interests of government monopolist and private providers, and the civil logics of home LANs; no Internet access affordable to end-users), inquiry (to have a means to play multi-party games and share resources between friends), and the pragmatic meaning of technology (device to play multi-party games and share files), the change in the symbolic meaning of home LAN technologies during the episode 3 (as a symbol of belonging to a community with a special

culture) led to significant changes in the technology structure and the way it was enacted (new organizational practices as regular offline meetings of users, ‘network tea’, ‘network football’, stratification of users into administrators and users, etc.). Further research, especially that based on the quantitative comparative case-study analysis, might investigate whether the above findings hold true through different contexts and technology types;

- 3) Our findings on the importance of symbolic meaning of technology enriches the research on technology adoption. In this sense, our findings do not support those of previous researchers arguing that the process of technology adoption is mainly influenced by the perceived usefulness and ease of use (Agarwal and Karahanna 2000). However, we find support for the findings that the adaptation process of technology enactment is significantly influenced by social dynamics (Aakhus and Jackson 2005; Ågerfalk et al. 2009; Jaspersen et al. 2005; Karahanna et al. 1999; Powell and Meinrath 2008).
- 4) In contrast to previous studies acknowledging that individuals might be involved in the technology feature extension behaviors only after gaining substantial experience in the technology use (Cooper and Zmud 1990; Goodhue and Thompson 1995; Kwon and Zmud 1987; Morrison et al. 2000; Saga and Zmud 1994), our findings indicate that end-user co-creations might happen at the pre-adoption, adoption and post-adoption stages (Rogers 1995). As shown in our data analysis, end-user transformations of Internet technology structure and meaning took place before, in the process and after the Internet access technology adoption. In this light, this finding supports the arguments by (van Oost et al., 2009) arguing that users might act as the driving force in *all phases* of the innovation process. Furthermore, by investigating the processes of juxtaposition both technology design and appropriation, the paper sheds light on the way that dyschronies of technology-related processes within the same organization could be overcome (Alter, 2003; de Vaujany, 2006).
- 5) We find support for the findings arguing that: i) end-users might act as co-creators of technology structure and meaning in the process of technology enactment (Castells 2002; Ciborra 2007; Heeks 2010; Green 2001; Gopal and Prasad 2000; Morawczynski 2008; Orlikowski 2000; 1992); and ii) that this enactment might lead to important technological and organizational innovations (Castells 2002; Ciborra 1994, 1996, 2000; Dutton 2008;

Nambinsan et al., 1999). This finding contributes to design theory and challenges the conceptual separation of users and designers of technology. In our paper we illustrate how end-users of home computers dynamically (co-)created the meaning and structure of home computers in such a way that it led to the evolution of home LAN architectures. As a result, users developed numerous technological innovations (i.e. innovative services of home LAN chats, file search and share software, net radio, map of home LANs, bricolage-made servers, lightning rods, network topologies, etc.) and organizational innovations (i.e. groups of people to share resources and play multi-party games, associations of networked individuals, social entrepreneurs, underground organizations). Interestingly, these innovations were created and successfully developed so that they incorporated thousands of users within conditions lacking financial resources, technical and managerial knowledge and in a generally hostile institutional environment (in particular, within the episodes 0, 1, 2 and 5 when home LANs experienced ignorance or pressures from government and private organizations). Furthermore, this finding provides an important practical contribution for understanding how end-users come to create innovative technologies and improvise on the designed technologies.

- 6) The paper contributes to our understanding of creating, functioning and impacts of new ICT-enabled organizations referred to as grassroots developments (Castells 2002; Heeks 2010); collaborative network organizations (Dutton 2008; Dutton and Eynon 2009); and informal entrepreneurial organizations (Bureau and Fendt 2011). In particular, the contribution of the paper in this area is threefold: (i) our data reveals the co-evolution processes between the technology structure and meaning and a variety of grassroots organizational forms (peers collaboration, associations of networked individuals, social entrepreneurial organizations, private providers, and underground organizations); (ii) we illustrate how these co-evolution processes happened through the variety of contextual dynamics incorporating informal economy/institutional voids, cooperation with private providers, and significant institutional pressures. Further research could elaborate on the link between institution pressures and the co-evolution process inside these organizations.
- 7) The dynamics of organizational identity influenced the symbolic meaning of technology and the way the structure of technology was enacted by end-users. Our data analysis illustrates how the identity of home LANs co-evolved with the symbolic meaning of

technologies (see Table 4). Further research should elaborate more on how the structure of the technology artifact. Its meaning and organizational identity might be interrelated. We illustrate how home LANs undergoing the same contextual conditions enacted different technology structures as they developed different symbolic meanings and organizational identities. Thus episode 5 provides an illustration of home LANs experiencing similar pressures from government and private providers developing different organizational forms and identities (private providers, formally complying individual entrepreneurs, underground organizations, etc.) and different symbolic meanings (technology as a tool of Internet access and Ethernet services equal to the private Internet service providers versus technology as an alternative to the Ethernet services proposed by government and private Internet service providers which defined the way they enacted home LAN technologies (a change to update home LAN technologies to standard or bricolage enactment). We thus argue that organizational identity might serve as a filter of symbolic interactions between the meaning and the structure of technology in the process of end-user enactment. In this sense, the finding is complementary to the findings from institutional theory that organizational identity serves as a critical filter that shapes how organizations perceive and respond to the imposed institutional demands (Greenwood et al. 2011; Kraatz and Block 2008). Further research should elaborate more on the role of organizational identity as translator in the processes of intra- and extra- organizational dynamics related to the end-user technology enactments.

To conclude, this paper aims at a detailed understanding showing how the process of end-user co-creative enactment happens and how end-users become co-creators of the structure and meaning of technological artifacts. Building on our analysis and a variety of arguments for theory and practice, we provide a framework for end-user technology enactment and change. The framework provides a lens that further research investigating the process of user technology enactment might use. We therefore argue that the users' contribution to the structure and meaning of the technological artifact might lead to the disappearance of the traditional separation between end-users and designers.

This research, however, has several limitations. First, we present a potted history of home LAN development as a phenomenon that first started in 1994-1996 and declined or went underground in 2010. Following our research question we were mostly interested in the home

LANs that were created in the mid-1990s and went through all the episodes (individual to small groups to medium groups to large groups and then declining back to small groups). However, although our data analysis has shown significant commonalities through the diversity of home LANs, every network comprised its individual and unique story. For example, some home LANs were created in 1995 while others were created in 1998 or 2002; some home LANs developed to the size of several thousands of users while others stopped at 50 or 100 people to keep the personal approach; at the later stages of development some home LANs went through the process of commercialization and turned into private ISPs while others tried to keep their initial community-based and free origins and went underground. Given that the phenomenon of home LANs in Minsk incorporated thousands of users and lasted for more than 15 years, the aim of this paper was not therefore to describe the whole population and individualities of home LANs but to reveal important commonalities in the ways that technologies, their meaning and practices of use co-evolved in home LAN communities and structured themselves around the initial technology of home computers. As mentioned in the methodological section of this paper, we looked at more than 40 diverse home LANs and interviewed more than 50 administrators, active users and users of these networks while also supporting our findings with rich secondary data.

Because of the lack of clear historical and accounting descriptions, we did not consider merges between home LANs as a particular change event in the boundaries of the community of users. Instead, we looked at the change in the number of users without trying to explain its origins. However, merges were important and necessary events in the development of home LANs, especially those that incorporated hundreds and thousands of users.

Further, despite institutional factors playing an important role in all the episodes of home LANs we did not describe these processes in detail. The aim of this paper was to understand the internal process of how technologies and its meaning co-evolved within the dynamics of home LANs' boundaries. The role of the external environment, such as institutional factors and government and private ISPs, in the change of home LANs' routines and technologies is described in detail in (Zorina and Avison, 2012). Further research might investigate how the within – organizational dynamics of technology enactment might influence the dynamics of institutional fields and actors related to the communities of end-users.

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Chapter 3:
**HOW SOCIOMATERIALITY AND INSTITUTIONS ENTANGLE: A CASE STUDY OF
END-USER COMMUNITIES AND INTERNET INFRASTRUCTURE DEVELOPMENT**

Earlier versions of this paper were presented at:

- the International Conference on Information Systems (ICIS) 2011, December 4-7, Shanghai (China) (Putilina Zorina and Avison, 2011).
- the workshop ‘Networks and Relations in and between organizations’, jointly organized by the London School of Economics and the Paris Dauphine University, May 30th, Paris (France).
- the research seminar of the Social Informatics group at the University of Edinburgh, March 15th, Edinburgh (Scotland).
- the research seminar of the Science and Technology Studies Unit (SATSU) at the University of York, March 13th, York (UK).
- 2nd OAP Workshops ‘Materiality and Space in Management and Organizations Studies’, May 10-11, Paris (France).

I am grateful for comments and questions on these occasions that have helped shaped this version.

ABSTRACT

Our research focuses on the processes and patterns of change in technologies and practices of community-based organizations developing an alternative Internet infrastructure in Minsk, Belarus. Drawing on this particular scenario from the field, we investigate how sociomaterial entanglements of human and material agencies are (re)configured in the context of different institutional logics and other actors of infrastructure development. In doing so, the paper goes beyond the limits of analysis restricted to the within-organizational level of previous research and explicitly investigates the dynamics of the extra-organizational level, such as institutional field structure characteristics and complexities, the interplay of other actors on the processes of sociomaterial imbrications. Methodologically, the paper builds its analysis by combining the processes data methodology and contextual analysis of change. Based on our analysis, we identify three phases contrasting in the institutional field structure characteristics. Our findings indicate how these institutional characteristics are translated through organizational filters (identity, field position, etc.) to the processes of sociomaterial imbrications and to the foreground patterns of stability and change in the human and material agencies constituting them. In particular, our findings evidence that in the fields where conflicting demands exist, both over means and goals, organizational sociomaterial imbrications will change by enactment of human agency. This contrasts with the enactment of both human and material agencies in field with conflicting logics over means only. These findings only partly support the recent findings of Paul Leonardi about the patterns of sociomaterial imbrications discovered within organizational analysis. The research provides contributions to both sociomateriality and institutional theories as well as to the studies of sociomateriality and technology in developing countries. The analytical framework developed in this research provides guidelines for future research in the systematic analysis of the processes of sociomaterial imbrications of routines and technologies as embedded in larger extra-organizational dynamics.

Key words: sociomateriality, institutional logics, organizational change, developing countries, case study

3. 1. INTRODUCTION

Understanding how technologies and their related routines change in organizations has been one of the main concerns of the discipline of Information Systems (IS). Recent studies propose a new perspective aiming at understanding this interplay. This perspective suggests that humans and organizations and material artifacts do not possess inherent properties independently from each other but only acquire them in the process of their mutual entanglement, i.e. when forming *sociomaterial assemblages* (Orlikowski and Scott 2008; Pickering and Guzik 2008). Contrasting with the previous socio-technical perspective, the sociomateriality perspective underlines the capacity of both human and material agencies to make a difference and argues that both acquire their form, attributes and power only through the processes of their interpenetration (Orlikowski 2009; Barad 2007). Such an approach possesses potential for a better understanding of how humans and technologies interact and change, from unexpected ways that technologies are used in organizational routines (Boudreau and Robey, 2005; Schultze and Boland, 2000) to changes in material structure of technology realized by its users (Alavi and Leidner 2001; Majchrzak et al. 2000) as well as how new technologies-in-practice appear and develop (Orlikowski 2000). In particular, this perspective suggests that sociomaterial assemblage at within-organizational level could be treated as processes of *sociomaterial imbrications (entanglements)*, i.e. particular empirical sequences of human and material agencies (Rose, Jones, and Truex, 2005) established in organizations and influencing sustainability and change in technology-mediated practices (Leonardi 2011; Leonardi and Barley 2008). Empirical work has emphasized that the process of sociomaterial imbrications is complex (Chua and Yeow 2010), dialectical (Wagner et al. 2010) and depends on intra-organizational perceptions of affordances and constraints (Leonardi 2011). However, despite these valuable insights, previous research has mainly considered the intra-organizational level of human-technology imbrications while the role and the influence of the extra-organizational structures, such as the dynamics and influence of organizational field structures and institutional drivers have largely been omitted. We argue that such a view overlooks the understanding of larger contextual dynamics underlining the processes of sociomaterial imbrications within organizations and explanations of why the perception of affordances and constraints is structured in their particular way by human and material agency.

Yet, numerous theories show that the processes of change and stability in organizational routines and technologies might be significantly influenced by the dynamics of institutional logics and field structures. These include institutional theory research investigating the link between institutional complexities and organizational responses (Greenwood et al. 2011; Pache and Santos 2010; Scott 2001), some research on how institutions influence technology design and use in organizations (Avgerou 2000; Barrett and Walsham 1999), as well as research on the processes of organizational sense-making (Weick, Sutcliffe, and Obstfeld, 2005). Further, the above theories lack understanding in the predictability of the technology-context interplay (Avgerou 2003; 2008; Hayes and Westrup 2010; Walsham and Sahay 2006), the ways that organizations balance the macro and micro logics (Pache and Santos 2010) as well as the role of objects, such as technology, in the process of institutional change (Arjalies 2011; Spee, Jarzabkowski, 2009; Knorr-Cetina 1997). Consequently, we argue that in order to understand how changes at the micro and the macro levels proceed, linking the insights from sociomateriality and institutional theories is important. Therefore in this paper we address the following research question:

How are the processes and results of socio-material imbrications of routines and technologies within organizations embedded in larger extra-organizational entanglements, such as field structures and institutional dynamics?

In order to answer this question, we conduct a case study illustrating how the processes and patterns of sociomaterial imbrications of technology and organizing inside the communities of end-users were influenced by the dynamics and field structure of Internet-access in a developing country context. We collected extensive data to understand how the main actors of the field, government and private Internet service providers (ISPs), and the interplay of the national Internet field structure characteristics influenced the processes of sociomaterial imbrications inside the communities first leading to their success and, later, to their disorganization and disappearance. By synthesizing the literature on sociomateriality (Chua and Yeow 2010; Leonardi 2011; Orlikowski and Scott 2008; Pickering and Guzik 2008; Wagner et al. 2010), contextual studies on ICT (Avgerou, 2008; Walsham and Sahay 2006) and the literature on institutional theory (Greenwood et al. 2011; DiMaggio and Powell 1991; 1983; Oliver 1991; Pache and Santos 2010; Scott 2001) we develop an analytical framework which provides guidelines for future research in the systematic analysis of the processes of sociomaterial imbrications of routines and technologies as embedded in larger extra-organizational dynamics. As a part of this analysis, we take the

pattern of sociomaterial imbrications obtained by Leonardi (2011) at the within-organizational level of analysis and analyze whether this holds true as the extra-organizational complexities are taken into account. Based on this we develop a process model (Langley 1999) of sociomateriality patterns within end-user communities during the 16 year period of Internet infrastructure development.

The remainder of this paper is structured as follows. We start with explaining how sociomateriality studies propose to understand technology-enabled organizational change and what we are still lacking in the picture of how technologies and organizations dynamically interplay. We then discuss how institutional theory is valuable to understand how intra-organizational processes of sociomaterial imbrications are embedded into extra-organizational sociomaterial imbrications. After presenting the research method, we then present the results from the case study. This is followed by the analysis of the results and a summary process model of sociomaterial imbrications in the field structure dynamics and interplay. We conclude by discussing avenues for future research.

3. 2. ORGANIZATIONAL CHANGE IN TECHNOLOGIES AND ROUTINES:

SOCIOMATERIALITY AND INSTITUTIONAL THEORY PERSPECTIVES

We present the theoretical background of this paper in the following two subsections. First, we discuss current understanding of the technology-organization relationship as proposed in the sociomateriality perspective. As we show below, research in this area tends to focus mainly on the intra-organizational level of analysis leaving the notions of contextual and institutional (organizational field) interplay largely unaddressed. Second, we provide insights from institutional theory discussing the processes and mechanisms of institutional influence on change and sustainability within organizations and discuss how these could be valuable to understanding sociomaterial processes within organizations enacted in the dynamics of organizational field structures and multiple institutional logics.

3. 2. 1. Sociomateriality as a Lens to Study Technology-Enabled Organizational Change

The concept of ‘sociomateriality’ was proposed by Orlikowski and Scott (2008) as a new theoretical perspective questioning the conceptual separation of technology and organizations in

contemporary work practices. The sociomateriality perspective argues that humans and organizations and technologies cannot be understood if studied as separate phenomena as they necessarily entail and constitute each other in practice (Orlikowski and Scott 2008; Pickering 2001; Suchman 2007). As a result, inseparable sociomaterial entities are formed that are referred to by the diversity of concepts such as ‘composite and shifting assemblages’ (Orlikowski and Scott 2008), ‘entanglements’ (Barad et al. 2003), ‘imbrications’ (Leonardi 2011; Sassen 2006), ‘figurations’ (Latour 2005) or ‘the double dance of human and machine agencies’ (Rose, Jones, and Truex, 2005). The underlying differences between the concepts are discussed in Leonardi (2011), Orlikowski and Scott (2008) and Rose, Jones, and Truex (2005). In general, the concepts of ‘composite and shifting assemblages’ (Orlikowski and Scott 2008) and ‘entanglements’ (Barad et al. 2003) emphasize relational and bidirectional links between technology and organizations; the concepts ‘imbrications’ and ‘figurations’ underline pattern-based and temporal aspects while the concept of ‘double dance of human and machine agencies’ is about presenting analytical model (schema) of the human-machine agencies’ interplay. In particular, the sociomateriality perspective argues that the social and material entities do not possess specific properties (i.e. their form, attributes, and capabilities) by themselves but acquire these through the process of their interpenetration in practice. (Barad 2007; Orlikowski and Scott 2008; Zamutto et al. 2007). As Barad (2007, p. ix) explains:

To be entangled is not simply to be intertwined with another, as on the joining of separate entities, but to lack an independent self-contained existence... Existence is not an individual affair. Individuals do not pre-exist their interaction, rather, individuals emerge through and a spare of these entangled intra-relating.

Barad (2007) thus comes out with the notion of ‘intra-action’ (as opposed to the ‘interaction’) assuming that social and material continuously re-configure each other in such a way that it is not possible to distinguish “in any absolute sense between creation and renewal, beginning and returning, continuity and discontinuity, here and there, past and future”(Barad, 2007, p. ix). As a result, multiple boundaries between social and material might be drawn in the same sociomaterial entanglements.

Previous research has argued that the perspective of sociomateriality has a potential to provide valuable insights on the nature and processes constituting everyday working practices (Orlikowski and Scott 2008); insights on how and why organizational technologies and routines

change over time to produce infrastructures enabling getting work done (Leonardi 2011); better understanding on the process of technology-organization relations (Zamutto et al. 2007); as well as explanations of the unexpected ways that technologies are used in organizational routines or converge around standards (Boudreau and Robey 2005). Linked to this, an understanding of how sociomaterial entanglements and imbrications come into being, i.e. how social and material entangle, is important. We now discuss how current research on sociomateriality addresses these issues and then underline some important gaps in the literature.

3. 2. 2. Processes and Mechanisms of Sociomaterial Imbrications

Several researchers have proposed to address the processes of sociomaterial imbrications by theorizing on the concepts of human and material agencies and perceptions of affordances and constraints (Hutchby 2001; Leonardi 2011; Leonardi and Barley 2008; Rose, Jones, and Truex, 2005; Zammuto et al. 2007). These researches build on the concept of ‘agency’ defined by Giddens (1984) as a ‘capability to make a difference’ and argue that both human and material agencies possess a capacity to act on their own (Leonardi 2011; Rose, Jones, and Truex, 2005). Thus, ‘human agency’ is defined as an ‘ability to form and realize one’s goals’ (Leonardi 2011, p.147) and ‘material agency’ (i.e. ‘machine agencies’ in the language of Rose, Jones, and Truex, 2005) is defined as a “capacity for non-human entities to act on their own, apart from human intervention” (Leonardi 2011, p.148). Human and material agencies become important when they interweave with each other in contemporary working practices.

Research has shown that when interweaving, human and material agencies simultaneously enable and constrain each other. On the one hand, organizational routines and practices are always mediated by technological and material artifacts. The latter enable or constrain routines and practices with their material agency becoming apparent through its material properties (Rose, Jones, and Truex, 2005), performativity (Barad 2003, Pickering, 2001) and the increasing number of ‘flexible’ technologies, i.e. technologies with opportunities for user-enabled material changes (Leonardi 2011). In this way, material agency ‘performs’ (Barad 2003) its capacity apart from human intervention and control. On the other hand, the materiality of technologies is always shaped and reshaped by human agency (Leonardi and Barley 2008; Orlikowski and Scott 2008; Zamutto et al. 2007). Thus, the materiality of technologies is shaped by social rules and values

embedded in its structure and material properties in the process of design. For example, Chua and Yeow (2010) showed that the sociomateriality of a developing technology is a complex process influenced by the materiality of the developed artifacts and the affordances that emerge from the goals and desires of the developers. Swahn et al. (2009) show that the process of technology materialization needs a dialectical mangling between physical material, digital material and human agencies. Similarly, Wagner et al. (2010) show that turnaround processes are significantly important for any IS to become a working and useful artifact. Furthermore, the materiality of technology is also constantly reshaped by human agency as technological and material features are not deterministically perceived and enacted by human agency. This creates ‘interpretive flexibility’ (Rose, Jones, and Truex, 2005) and various ‘technologies-in-practice’, i.e. numerous ways in which the same technology is used (Orlikowski 2000).

Simultaneously the enabling and constraining nature of human and material agencies result in the increasingly perceived phenomenon of ‘flexible routines and flexible technologies’ (Leonardi 2011), i.e. the situation when people may decide whether they change routines or technologies. Research finds that the process of sociomaterial imbrications is ever-changing and perception-based as people continuously develop views on affordances and constraints of their practices. The latter are argued to be the definitive factor of how human and material agencies imbricate and thus enable or constrain change in technologies and routines (Hutchby 2001; Leonardi and Barley 2008; Zammuto et al. 2007). As Leonardi and Barley (2008, p. 166) put it:

...we might better predict the nature and extent of technologically occasional organizational change by developing a language for talking about classes of constraints and affordances.

The concepts of affordances and constraints signify the properties that emerge between the system (the environment) and the actor (human and organization) (Boudreau and Robey 2005; Hutchby 2001; Leonardi and Barley, 2008; Leonardi 2011; Zammuto et al. 2007). Thus, sociomaterial imbrications are understood as processes of interlocking patterns of human and material agencies enacted by the perception of affordances and constraints of human agency (Leonardi 2011; Rose, Jones, and Truex, 2005; Zamutto et al. 2007).

However, as Leonardi (2011) observes, the imbrication process of both human and material agencies may follow two different paths and result either in change in organizational routines or in change in organizational technologies:

Depending on whether they [people] perceive that a technology affords or constraints their goals, they make choices about how they will imbricate human and material agencies...

In particular, Leonardi (2011) finds that constraints lead to the change in technology while affordances lead to change in routines. This view underlines that the process of pattern-formulation in sociomaterial imbrications is based on both individual choices and prior infrastructures.

In the following subsection we explain why this picture is not enough to fully address and explain the processes and mechanisms of sociomaterial imbrications of technologies and routines within organizations.

3. 2. 3. Sociomaterial Imbrications and Institutional Dynamics: Unstudied Field of Research

With some important exclusions (Chua and Yeow 2010; Orlikowski 2009; Rose, Jones, and Truex, 2005) research tends to limit its analysis on the processes of sociomaterial entanglements to the within-organizational level. As a result, we lack an explanation of the role of the structure and dynamics of institutional actors (such as the field logics, cultural norms, taken-for-granted beliefs, historical facts, etc.) on the way that human and material agencies intertwine and sociomaterial entanglements come into being.

For example, while research on sociomateriality acknowledges that the same materiality of technology and organizing might enable the creation of various affordances and constraints, it does not explain how and why this diversity occurs. These do not provide us with the knowledge of why particular sense-making choices (i.e. the perception of affordance or a constraint) is made, or how the human and material agencies entangle in the context. Thus, Leonardi (2011) studied the processes of sociomaterial imbrications in the context of a R and D department of a large automobile firm where people may choose what to change: routines or technologies. In particular, based on an empirical study he finds a pattern that *the perception of constraint leads people to change their technologies (i.e. material agency), while the perception of affordance leads people to change their organizational routines (i.e. human agency)*. This general pattern lacks the insights on the embeddedness of organizational practices into the contextual dynamics and complexities. We agree that increasingly more organizations today operate in the context of ‘flexible’ routines and technologies’ where they may decide what to change (Leonardi 2011). However, organizational decisions to change their technologies or routines as well as the

perception of affordances and constraints are also significantly influenced by their institutional demands, taken-for-granted assumptions, beliefs, and cultural norms. This gap leaves a number of important questions unaddressed: What is the role of context and institutional actors in the process of sociomaterial imbrications of routines and technologies within organizations? Why are affordances and constraints perceived in the way that they are?

Current research on sociomateriality does not provide accounts of the latter. At the same time, a number of research argues that contemporary work practices cannot be understood without considering both technological changes and institutional contexts (i.e. Orlikowski and Barley 2001; Orlikowski 1992). Technology itself is considered to be an institutional actor, incorporating (at least partly) institutional logics, structure, etc. As Orlikowski (1992, p 411) puts it:

Technology is built and used within certain social and historical circumstances and its form and functioning will bear the imprint of those conditions.

Similarly, research on the processes of organizational change (Pettigrew 1990; Pettigrew, Woodman and Cameron, 2001) as well as a variety of research on technology creation and development in organizations (Avgerou 2008; Walsham and Sahay 2006; Wei and Crowston 2010) underline the particular importance of contextual and institutional factors. Research on organizational processes of sense-making (Weick, Sutcliffe, and Obstfeld, 2005) argues that both intra-organizational cognitive decisions of individual actors and taken-for-granted institutional logics are important. Research on developing countries has shown that the unexpected and numerous variations in technology use and acceptance are necessarily enabled by contextual, institutional and cultural differences (Avgerou 2003; 2008; Walsham and Sahay 2006). Thus, as Orlikowski and Barley (2001, p. 158) argue:

..we advocate for research that requires substantive expertise in both technology and the social dynamics of organizing and that embraces the importance of simultaneously understanding the role of human agency as embedded in institutional contexts as well as the constraints and affordances of technologies as material systems.

In summary, we lack a framework that would allow us to more systematically understand how the processes of sociomaterial imbrications of routines and technologies are embedded into larger extra-organizational dynamics and are influenced by them.

Below we discuss how institutional theory could be valuable in understanding the processes and underlying patterns of sociomaterial imbrications as embedded into the institutional dynamics. We have chosen institutional theory as a lens for a number of reasons. First, institutional theory is one of the dominant lens within organizational theory (Greenwood et al. 2011) focusing on how organizational processes are coupled with the variety of environmental dimensions such as history, culture, political process as well as more precise field structure characteristics of the particular field where the organization operates. Second, as we describe in our analysis below, we consider that the combination of the institutional and the sociomateriality theories provides mutually profitable insights and addresses important gaps as compared to when each of these theories is taken separately. Finally, the institutional theory perspective has developed a number of comprehensive models (Pache and Santos 2010; Greenwood et al. 2011) describing how the structure of institutional environments influence organizational processes.

3. 2. 4. Institutional Theory Perspective on Organizational Change and Stability

The institutional perspective studies the processes by which institutions, i.e. re-salient social structures, such as schemas, norms, rules and routines, become established as authoritative guidelines for organizational behavior and thus influence (and are influenced by) organizational structures, practices and strategies (DiMaggio and Powell 1991; Scott 2001; Scott and Meyer 1994; Scott 2008). The theory, as a result, challenges the rationality of organizations as independent actors and considers that organizational sense-making and interpretive schemas about whether and how to change or sustain everyday practices are institutionally embedded (Goffman 1959; Friedland and Alford 1991). Thus, institutions both constrain and enable organizational actions (Scott 1995) and the patterns of organizational behavior (Berger and Luckmann 1967; Scott 2001) by providing actors with specific sets of organizing principles (Friedland and Alford 1991; Scott and Meyer 1994).

In the perspective of institutional theory, organizational change in routines and technologies is treated as a part of a broader change in organizational structural triggers influenced by the dynamics of institutional logics and characteristics of the organizational field (Friedland 2009; Friedland and Alford 1991; Pache and Santos 2010; DiMaggio and Powell 1983). Conformity to institutional rules, norms and cultural-cognitive schemas brings legitimacy

to organizational actors and stability to their organizing structures (DiMaggio and Powell 1991; 1983; Meyer and Rowan 1991; Scott 2001). However, contemporary organizations are increasingly subjected to conflicting institutional logics which results in situations where complying with one demand may violate others (Pfeffer and Salancik 1978). These institutional contradictions challenge taken-for-granted organizational routines and lead to changes in organizational strategies and structures. This results in diverse organizational responses and adaptive strategies to cope with institutional complexity (Greenwood et al. 1996; Greenwood et al. 2011; Kraatz and Block 2008; Lounsbury 2002; Oliver 1991; Pache and Santos 2010).

Institutions influence the patterns of organizational behavior through institutional logics (Pache and Santos 2010; Greenwood et al. 2011). Institutional logic refers to a set of assumptions, practices, beliefs and rules that organizations accept and use to make sense of their reality (Friedland 2009; Friedland and Alford 1991; Pache and Santos 2010; DiMaggio and Powell 1983). As organizations are located within specific organizational fields they continuously translate and encode the specific set of intertwining institutional logics into their day-to-day practices, rituals and behavior (Greenwood et al. 2011).

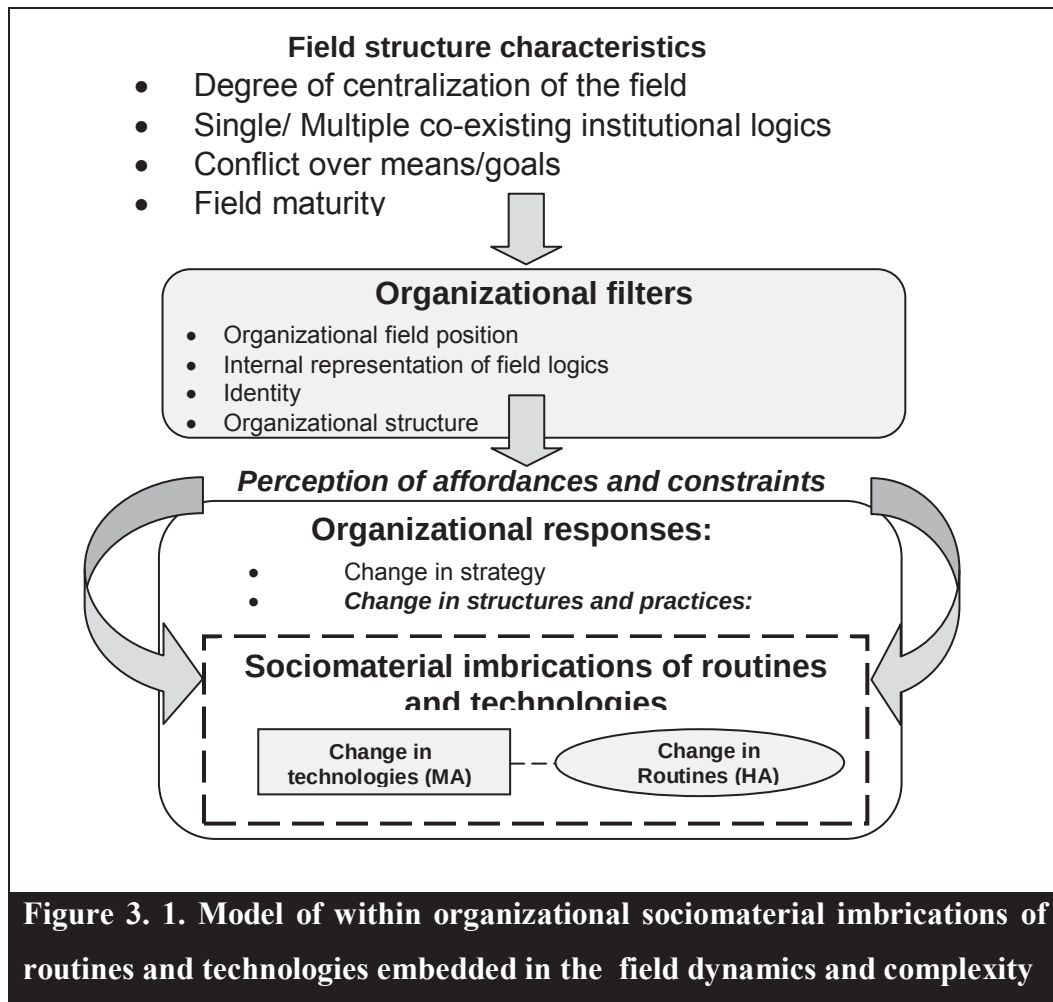
However, despite research in the institutional perspective providing valuable insights on the variety of organizational strategic responses to the dynamics of institutional logics, a deeper understanding is necessary for the dynamics of the macro and micro links and processes (Pache and Santos 2010; Greenwood et al. 2011). In particular, an understanding of how these are translated into organizational change in routines and technologies is still lacking. Thus, despite research having acknowledged that technologies have a potential to transform existing institutions (Castells 2002; Jones 1995; Orlikowski and Barley 2001) the role of technological artifacts in the process of institutional change has been under theorized (Arjalies 2011; Spee, Jarzabkowski, 2009; Knorr-Cetina 1997; Miller 2008;). For example, Castells (2002) discusses how Internet-technology development is coupled with institutional change and fosters more democratic institutions and organizations. Further, as contemporary technologies become increasingly more flexible (Leonardi 2011) it is interesting to investigate how organizations will respond to a variety of institutional demands when they have a possibility to choose between the change in organizational routines and facilitated change in technologies. Consequently, linking the institutional and sociomateriality perspectives provides fruitful avenues for further research contributing to both areas.

Institutional theory has been argued to be an important and useful lens to study technology in organizations (Orlikowski and Barley 2001). Because technologies are both social and physical artifacts (Leonardi and Barley 2008; Orlikowski 2000; Orlikowski and Scott 2008), institutional logics are necessarily embedded in both the materiality of technological artifact and technology-related practices (Barley 1986; Orlikowski and Barley 2001, p. 149):

Some [technologies] are the result of physical considerations, others reflect the designers' assumptions and images of users, still others reflect traditions of the design community, and yet others reflect taken-for-granted understandings of how the world is organized.

Similarly, Lamb and Kling (2003) argue that ICT-related change cannot be explained entirely with the agent-directed perspective but rather is channeled through local and global institutional environments. However, despite IS research having used institutional theory to study information technology and related practices (Barret and Walsham 1999) there are acknowledgements that deeper insights are necessary in order to provide understanding on how technologies and technology-related practices are embedded and shaped by broader institutional influences (Avgerou 2008; Lamb and Kling 2003; Orlikowski and Barley 2001).

In order to ensure comprehensive and detailed insights on the mechanisms of how the dynamics of institutional characteristics influence within-organizational processes of sociomaterial imbrications, we combined the relevant models developed by Pache and Santos (2010) and Greenwood et al. (2011). Their recent overview of works giving the institutional theory perspective has made important connections between the field and societal structures and the dynamics of institutional logics on the one side and the diversity of organizational response on the other side. They show that organizations *filter* institutional dynamics and complexity by 'various attributes of the organization itself' (Greenwood et al. 2011, p. 22) and discuss how the interplay between institutions and organizations leads to various organizational responses in terms of strategy, structures, and practices. In this paper we build on these findings and extend them to the sociomateriality perspective so as to understand how the processes of sociomaterial imbrications of routines and technologies are embedded in larger extra-organizational field dynamics and complexity. We demonstrate our analytical framework in Figure 3.1 and provide details below.



In general, institutional logic is imposed on organizational structures and practices both externally and internally (Pache and Santos 2010; Oliver 1991). The external mechanisms include field structure characteristics (such as the degree of field centralization, the number of institutional logics simultaneously co-existing in the field, field maturity and organizational position within the field). The internal mechanisms of institutional influence refer to the intra-organizational levels of analysis and prescribe how institutional logics are supported or rejected by organizational members and encoded in organizational identities. We will look at each of these in turn.

3. 2. 5. Field Structure Characteristics Influencing Sociomaterial Imbrications

Research in the institutional perspective provides the following list of institutional forces influencing organizational processes (and being influenced by them in reverse): institutional

logics, degree of centralization of the field, field maturity and the existence of the conflict over the means or and organizational goals.

Institutional logics: Institutional field logics (Friedland and Alford 1991; Friedland 2009; Thornton and Ocasio 1999) can be *single* or *multiple*. However, because of the globalization processes, control from international authorities and competing environmental demands from institutional environments, contemporary organizations increasingly become a subject of *multiple* and often competing and incompatible institutional logics (Brunson 2002; Djelic and Quack 2003; Meyer and Rowan 1991; Scott 1991). Some researchers argue that modern society is composed of a variety of interdependent but contradictory institutional logics (Friedland and Alford 1991) which leads to situations when diverse systems of meaning are built into rituals and organizational practices and provide diverse organizational responses on similar institutional pressures (Greenwood et al. 2011; Pache and Santos 2010).

The notion of multiple and often contradictory demands imposed on organizational technology acceptance and use has been raised by research on ICT in developing countries (Avgerou 2003; 2008; Hayes and Westrup 2010; Walsham and Sahay, 2006). These include the combination of globalization processes with local, cultural and historical logics; limited resources and skills available; IT diffusion from developed countries; the necessity to construct new techno-organizational structures within a given local social context; social and digital exclusion and extending connectivity; controversial government policies of liberalization and filtering internet information; and the dynamics of power redistribution linked to the emerging IS fields and ICT-use (Avgerou 2003; 2008). Moreover, the variety of multiple demands often co-exists with institutional voids (Mair and Marti 2009), i.e. situations where regulating and normative mechanisms are undeveloped which leads to community-based entrepreneurship (Leadbeater 1997; Mair and Marti 2009) and grassroots organizations (Castells 2002; Heeks 2010), the technology-enabled phenomena are evidenced and described both in the organization and IS literature but not yet well understood (Heeks 2010; Mair and Marti 2009).

Field fragmentation and centralization: *Field fragmentation* refers to the number of uncoordinated institutional logics imposed by powerful actors upon which individual organizations depend on legitimacy and material resources. Consequently, organizations in highly fragmented fields should comply with several institutional logics and demands. Related to the field fragmentation is *field centralization* characterizing the hierarchical power structure of the

field (Greenwood et al. 2011). It describes situations whether a dominant actor exists in the field that is able, by coercive, resource property or normative means, to re-enforce the acceptance of certain institutional logics by other actors (Pache and Santos 2010; Scott 1991). Field centralization and fragmentation influence the degree to which organizational forms and practices are standardized within the field (Greenwood et al. 2011). Thus, *in (highly) centralized* (lowly fragmented) fields dominant actors will reinsure that their logics are recognized and accepted by other organizations and formalized in their behavior and practices. Similarly, in *decentralized* fields organizations are not subjects of any particular environmental pressures and particular structures (Pache and Santos 2010).

Further, when multiple and potent competing institutional logics co-exist in the field, its power structure becomes *moderately centralized*. This situation is argued to be the most complicated for organizations as they have to make sense and respond to multiple and often incompatible institutional pressures enacted by several powerful actors. Thus, Pache and Santos (2010) propose that organizations experiencing conflicting institutional demands will tend to largely accept the strategies of incomppliance (such as avoidance, defiance and manipulation) as their organizational responses.

Conflict over means and goals: Conflict over means and goals happen at the field level between the field institutional demands and internal organizational logics and characterizes the nature of institutional prescriptions and how organizations experience them (Pache and Santos 2010; Oliver 1991). Thus, *conflict over goals* describes ideological disputes about the underlying reasons and mission of organizational existences and practices while *conflict over means* describes institutional pressures on resources and the courses of actions. In particular, Pache and Santos (2011) acknowledge that conflicts over means are rather easily solvable, whereas conflicts over goals, especially those enacted in the context of highly centralized fields, might lead to organizational paralysis and breakup. In a more general sense, organizational relationships with important institutional actors provides channels through which organizations are linked to important resources, legitimacy and normative and regulative pillars (Scott 2001) which influences organizational responses (Greenwood et al. 2011). Conflict over means, as a result, might influence the course of actions and resources by which the processes of sociomaterial imbrications are realized while the conflict over goals might influence how organizations make sense of sociomaterial imbrications.

Field maturity: Field maturity influences the relative stability of the institutional environment and whether inter-organizational relations are regulated and formalized. In general, more mature fields are argued to be more stable and have less institutional pressures and less conflicting (as well as multiple) institutional logics because they had more time to resolve them at the field level (Greenwood et al. 2011; DiMaggio and Powell, 1991).

3. 2. 6. Organizational filters

Organizations experience and respond to similar institutional environments differently as they *filter* them according to their organizational structures, their local logics, field position, identity, etc. Thus, organizations “... are places where people and groups make sense of, interpret and enact institutional prescriptions” (Greenwood et al. 2011, p. 29). We discuss relevant organizational attributes and processes below.

Organizational field position: Organizational field position, i.e. whether the organization is situated in the ‘center’ or ‘periphery’ of the field structure might influence the extent to which organizational practices comply with the dominant institutional logics (Battilana et al. 2009; Greenwood et al. 2011). Thus, “*organizations located at the ‘periphery’ are more motivated to deviate from established practices because they are less caught by institutional relationships and expectations*” (Greenwood et al. 2011, p. 22).

Internal representation of field logic(s): Institutional field logic(s) is differently represented by within organizations as organizations are composed by diverse members that might belong to various societal groups and adhere to various cultural and societal backgrounds as well normative and cognitive templates (Friedland and Alford 1991; Greenwood and Hinings 1996; Lounsbury 2002; Pache and Santos 2010). As a result, organizational members promote some logic(s) and reject others as they have been “socialized or trained into specific institutional logic” (Pache and Santos 2010, p. 16). For example, Greenwood et al. (2011) and Lounsbury (2002) discuss how government and private organizations react differently to similar institutional changes. This is the reason why the same institutional demands imposed on different organizations may be perceived either as *affordances* or *constraints*. The following three extents of internal representation of field logics are distinguished (Pache and Santos 2010): absence (when institutional demands are represented by external actors only), single and multiple (internal

commitment to single and multiple institutional logics correspondently). Furthermore, the interplay between within organizational and institutional logics, and especially contradictions between internal organizational logic and external institutional demands are argued to be an important reason for organizational change (Thornton, Jones, and Kury, 2005).

Organizational identity: Organizational identity is argued to be one of the most critical filters that shapes how organizations perceive and respond to the imposed institutional demands (Kraatz and Block 2008). Organizations use their identities in their sense-making processes including prioritizing or neglecting certain institutional demands, Furthermore, as identity becomes taken-for-granted by organizational members in an established institutional category (i.e. ‘bank’, ‘university’, ‘entrepreneur’, etc.), it shapes the patterns and processes of organizational working practices as appropriate to the specific identity (Greenwood et al. 2011; Kraatz and Block 2008; Lok 2010; Rao et al. 2003). Thus Rao et al. (2003) argue that change in organizational identity leads to change in the accepted institutional logics.

Organizational structure. Organizational units composing organizational structures are argued to have different sensitivity to the institutional demands (Greenwood et al. 2011; Jones 1999). This is so because members of diverse organizational units tend to have different strengths with other field-level actors (i.e. different degrees and natures of local internal representations of field logics). Thus, organizational technical units are expected to have a narrower range of logics compared to the boundary spanning units such as marketing and customer relations (Greenwood et al. 2011). However, organizations with less traditional structures, i.e. having less distinctive or mixed organizational units, remain under theorized.

Organizations respond to the interplay of field structure characteristics and organizational filters by changing their strategies and structures (Greenwood et al. 2011; Pache and Santos 2010). However, institutional factors and intra-organizational dynamics of filtering and resolving conflicts are important in *the process* as they may reinforce or weaken each other in their interplay (Pache and Santos 2010). We illustrate our theoretical discussion in the empirical study below where we capture both *the process* and interplay *dynamics* of organizational field structure and organizational filters.

3.3. METHODOLOGY

The case study looks at the process of Internet infrastructure developments over a 16 year period by organizations of end-user communities of social computing, called home local area networks (LANs), in the developing country, Belarus, and more precisely in its capital, Minsk. We designed this research as a detailed interpretive single case study (Myers and Avison 2002; Yin 2009; Walsham 1995). Our data analysis envelops a period from 1995 when home LANs first appeared until 2010 when a government law inhibiting this form of computer networking in Belarus was applied. Multiple data sources (Creswell 2009; Romano and Fjermestad, 2003) and a process theory approach (Langley 2007; 1999; Pettigrew 1990) were used to investigate how the processes of organizational sociomaterial imbrications of routines and technologies within home LANs were embedded in the dynamics of the institutional field of Internet development. We describe our research methodology as follows: first, we provide reasoning for our case selection; second, we describe our data sources and data collection procedures; finally, we discuss our data analysis procedures and explain how these were helpful in answering our research question.

3. 3. 1. Case Selection

There are a number of reasons why we select the development of IS-mediated practices in Minsk, Belarus, home LANs as our case for studying sociomateriality in the inter-organizational context. First, Internet infrastructure development by home LANs presents a clear and prominent case on sociomateriality of IS and organizing, i.e. where humans and organizations and technology artifacts acquire inherent properties and meanings in the processes of their mutual entanglement (Leonardi 2011; Orlikowski and Scott 2008). Second, a developing country context exemplifies a large variety of extra-organizational conditions (even as compared to a developed country context) where the co-existence of multiple, complex and contradicting logics is argued to be typical (Avgerou 2003; 2008; Hayes and Westrup 2010; Walsham and Sahay 2006). Third, the 16-year period and extensive multiple data sources provide us with an opportunity to study the nuances and varieties of the processes (Langley 1999; Pettigrew 1990) of human and material imbrications within organizations in the context of multiple dynamics of institutional logics. Finally, this case also represents one of the few research contributions on sociomateriality in a developing country context. Taken together, the above reasons provide us with an extreme (Yin

2009) and multi-level (Markus 1983) empirical illustration of within-organizational sociomaterial assemblages embedded in the complexity dynamics of their field structure.

3.3.2. Data Sources

This research is based on multiple sources of data (Creswell 2009) shown in Table 3.1. Data collection was made from January 2010 to mid-April 2011.

Interviews. We carried out a series of semi-structured interviews aimed at building a picture of how the interviewees think about home LAN technologies and practices related to their creation, use and development. The interviewees were administrators and users of home LANs. Before the data collection process started, an exploratory study was conducted from January to March 2010. Findings from the study as well as one of the authors' previous experience of being a user of one of the most developed home LANs, were useful in determining the initial protocols and the initial sample of actors to be interviewed. The guidelines of Myers and Newman (2007) were used to help us structure the interviews. Then, diverse sampling strategies were enacted to ensure appropriate data collection. These included publishing a notice about our research, finding administrators' contacts on relevant websites, and use of a snowball technique. We published a notice about this research at the major website of the Minsk home LANs communities ([http: and and homenet.tut.by](http://and.homenet.tut.by)) where we also looked for the contacts of home LAN administrators and users. The website contains the contacts of the majority of administrators and the possibility (supported by a specialized software application and database) of discovering whether any home network existed at a particular address. We then used a selective snowballing technique to develop our research site to ensure that the whole diversity of home LANs in terms of their size, age, and responses to institutional demands was represented. Given that the phenomenon of home LANs in Minsk incorporated thousands of users and lasted for more than 15 years, the aim of this study was not to describe the whole population and individualities of home LANs but to reveal important regularities in the ways that technologies, their meaning and practices of use co-evolved in home LAN communities. For these reasons and also to ensure trust (home LANs were announced as illegal organizations according to the law from July, 2010) a snowballing technique was used. Overall, we looked at more than 40 diverse home LANs and interviewed more than 50 administrators, active users and users of these networks while also supporting our findings with

rich secondary data. Different interview protocols were developed for home LAN administrators and home LAN users.

Table 3. 1. Data Sources

1. Interviews from the field

72 interviews from the field: interviews with administrators and users of home LANs and lasting from 20 minutes to 1.5 hour each, with the majority of interviews being about 40-50 minutes long; interviews with Internet providers lasted from 10 to 50 minutes each, with the majority being about 20 minutes each

- **56 Interviews with administrators and users of home LANs:** more than 40 home LANs in total (34 interviews with administrators of home LANs; 22 Interviews with users of home LANs)
- **16 Interviews with government and private providers:** along with documents and archival data we interviewed providers in Minsk selected to represent the population diversity: government provider (Beltelecom); big private providers operating in the market for a long time ('Atlant Telecom', 'Delovaya Set', 'IP TelCom', 'Solo'); providers that emerged from home LANs ('Deep Net', 'LifeNet', 'Netberry').

2. Documents

- Official websites of Beltelecom and private providers for investigating their mission, strategy, news, technology, and services (<http://www.iptel.by>, <http://www.aichyna.com>, <http://www.telecom.by>, <http://www.ADSL.by>, <http://www.beltelecom.by>, <http://www.byfly.by>, <http://www.anitex.by>, <http://www.solo.by>, <http://www.bn.by>)
- More than 30 pages of noncommercial IT portals providing news and discussions on Internet development in Belarus on daily basis (<http://homenet.tut.by>, <http://it.tut.by>, <http://www.interminsk.com>, <http://providers.by>, <http://techlabs.by>)
- Websites of some home LANs with their news and blogs about their practices, development, and services (<http://dom15.narod.ru>, <http://slepianka.at.tut.by/help.html>)
- Example documents of home LANs financial and Internet-channel accounting and control
- Home LANs maps created by their users
- Home LANs statutes and regulating documents
- Photos and videos of home LANs creation, renovations, regular offline events, improvisation technologies, technical support practices

3. Archival data

- *Video-recorded interviews with specialists on home LANs and Internet development* (40 minutes video recorded interview with administrator and specialist Konstantyn Scherban in home Ethernets by the Belarusian News Portal 'Tut.By'; 40 minutes video recorded Interview with lawyer Dmitri Matveev providing his opinion on home Ethernets by the Belarusian News Portal 'Tut.By'; 80 minutes video recorded and transcribed debates with representatives)
- Articles in newspapers related to home LANs news and stories (<http://dom15.narod.ru%images%article.jpg>)
- Government laws of Internet-access regulation in the Republic of Belarus

Documents. These include websites of home LANs, and related discussions of home LANs in various forums; more than 30 pages of noncommercial IT portals providing news and discussions on Internet development in Belarus on a daily basis; example documents of home LANs' financial and Internet-channel accounting and control; home LAN maps created by their users; home LAN statutes and regulating documents; photos and videos of home LAN creation,

renovations, regular offline events, improvisation technologies, technical support practices made by administrators and users over the process of home LAN development and use.

Archival records. These include documented and recorded opinions of experts and politicians on grassroots creation and development, and articles in newspapers and journals, and related government laws of Internet-access regulation.

Sampling strategy for documents and archival data included searches on initial data categories as home LANs, Internet providers in Minsk, and government laws and policy of Internet, Acts on telecommunication and informatization in Belarus, etc. Documents and archival data were collected in order to create an analytical chronology of the detailed history, events and causal links of home LAN creation and development as well as to enrich findings from the interviews.

We terminated our data collection once reaching the point of theoretical saturation (Miles and Huberman 1994; Glaser and Strauss 1967), i.e. when a deep understanding was developed that enabled us to gradually predict the responses of the main actors to certain issues.

3. 3. 3. Data Analysis Procedures

As a guideline for our data analysis procedures we combined the approaches of process theory (Langley 1999; 2007; Van de Ven and Poole 1995) focusing on the evolving process and mechanism of organizational change with the contextual analysis of change (Pettigrew 1990) emphasizing the importance of interconnected levels (such as the relationship between the context and organizational processes) and historical analysis. The aim of this combination was twofold. First, this provided us with a comprehensive understanding of how the ongoing intra-organizational process and the organizational field structure mutually constituted and reproduced each other, thus revealing the processes of sociomaterial entanglements at both intra- and extra-organizational levels. Second, the process theory approach is appropriate to study sociomateriality (as compared to the ‘variable’ and ‘evidence-based’ approaches) as it addresses the evolution of human and material, form and meaning, in the complexities of the human world. This combination provided us with a relevant tool to study the interplay of macro and micro levels which comply with the arguments that mixing levels of analysis is valuable in research on information technology enabled organizational change (Marcus and Robey 1988). Table 3.2

provides a summary of our data analysis approach and explains how the selected strategies relate to our research.

Table 3. 2. Data Analysis Procedures

Strategies	Description	Application to this research
Process research strategy (Langley 1999; 2007):	The ‘visual mapping’ strategy generates process of understanding about organizational change. The ‘temporal bracketing’ strategy addresses dynamic questions about temporally evolving phenomena and generates comparative units of analysis over time periods	Enables understanding of how processes of sociomaterial entanglements of routines and technologies unfolded over time; Emphasizes the intra-organizational level of analysis. Provides general understanding about the evolution of home LAN phenomenon in Minsk over the 16-year period (1995-2010) Provides understanding of the patterns of socio-material entanglements over diverse phases and a possibility to compare them
Contextual analysis of change (Pettigrew 1990).	The analysis addresses multiple levels (i.e. intra- and extra-organizational links) and historical background	Enables the understanding of how home LANs were embedded in the dynamics of their organizational context and historical background
Combination of strategies	The combination examines the evolving phenomena: as a whole and through comparison of different phases; in the embeddedness into the dynamics of organizational context	Enables understanding of how processes of sociomaterial entanglements of routines and technologies in home LANs unfolded over time being embedded in the dynamics of the organizational field and context.

The data analysis was based on the principle of triangulating and coded into categories according to the concepts identified in the theoretical background of this study, such as *the perception of affordances and constraints; change in routines and technologies; organizational field structure; conflict over means; conflict over goals; multiple and single logics*, etc. Using these categories we identified key processes and events of sociomaterial imbrications that happened within home LANs and major characteristics and the dynamics of their organizational field structure. Finally, we visualized our findings into the three distinct time-phases (Langley 1999). These were distinguished in the extent of home LAN interactions with other organizations in the field (field fragmentation): home LAN creation (no interactions with other actors (Phase I)); home LANs interacting with private internet service providers (Phase II); and home LANs interacting with government and private internet service providers (Phase III).

We consider home LANs to be sociomaterial entities because of the tight interplay between the human and material agencies in their organizational technologies, structure and

practices. In particular, we look at how the foreground patterns of sociomaterial imbrications of routines and technologies in home LANs were developed through the 16-year period, 1995 – 2010, and investigate how these processes entangled with the institutional forces such as historical, cultural and political dimensions and field structure characteristics through three phases. As we illustrate below, the phenomenon of home LAN creation and development can only be understood if the interplay of the whole variety of human and material agencies with the institutional and environmental agencies is taken into account.

3.4. DATA ANALYSIS

Below we describe how the institutional field structure dynamics influenced the dynamics of the intra-organizational socio-material imbrications of routines and technologies and their patterns in home LANs. During the three identified phases of their development. Figure 3.2 illustrates the sociomaterial assemblages in the field of individual Internet infrastructure and within home LANs through the phases.

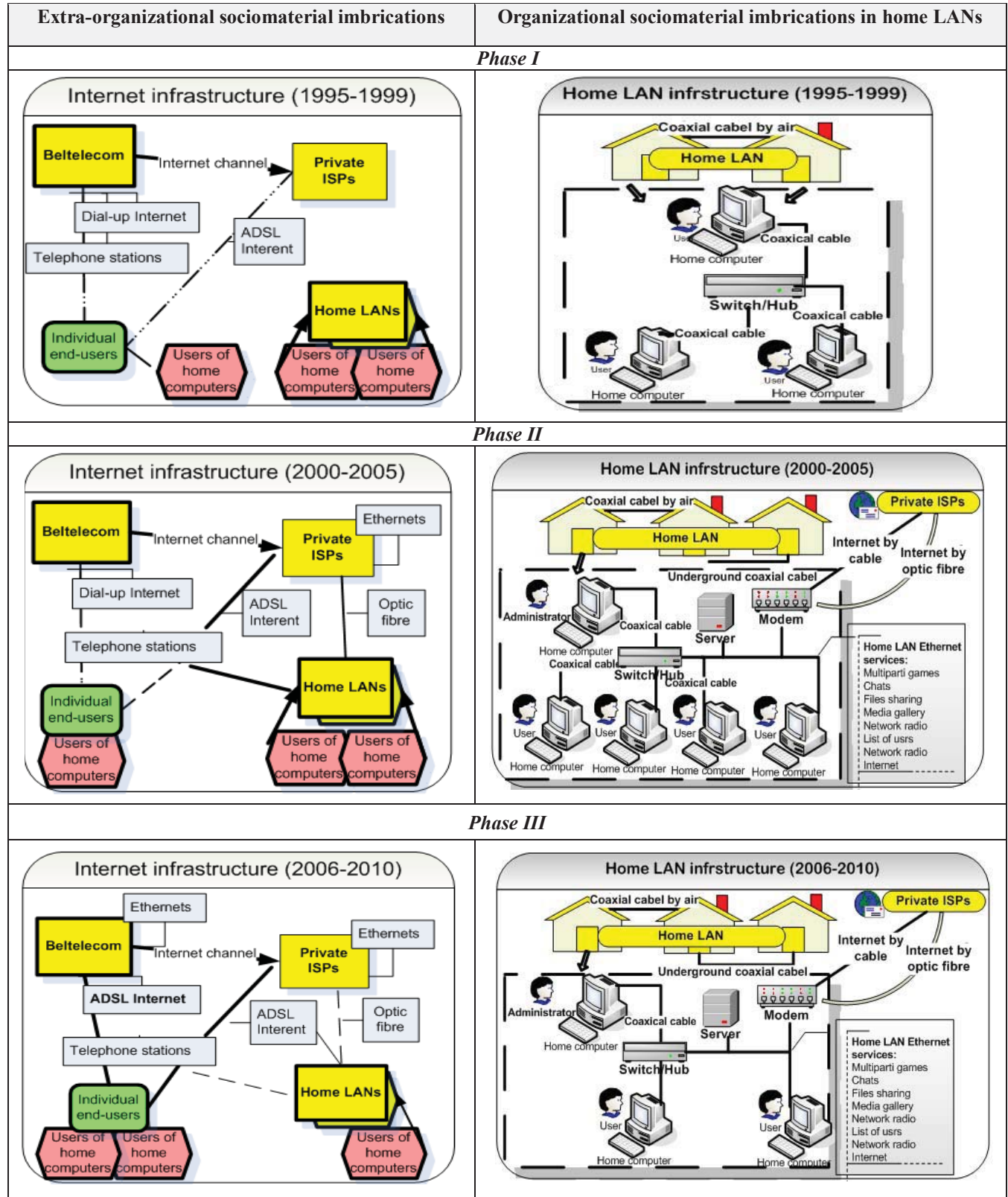


Figure 3. 2. Sociomaterial assemblages of routines and technologies in the Internet infrastructure at the organizational and field levels

3. 4. 1. Phase I: Home LANs not interacting with other Internet actors directly (1995-1999)

The first home LANs appeared in 1994-1995. They were created by young people linking their home computers with their friends living in the same neighborhoods. A home LAN consists of a computer belonging to administrator(s), a person(s) responsible for organizing and support of the home LAN, and user computers. The computers were linked with special technological devices, such as hubs and switches, repeaters, coaxial cables and (later) optical fiber connecting users through different flats and multistoried buildings. The arrangement of network structures, including their nodes and connecting wires, was based on the residential address of home LAN users. Thus, users living in the same buildings connected with each other by building communication wires between their apartments while users from different neighboring buildings connected with wires linked by air or underground. To build a home LAN its administrators and users combined professional networking devices that they afforded by pooling money with hand-made devices such as boxes for hardware storing in attics, lightning rods and others. For example, Figure 3.3 illustrates the structure of a typical home LAN node – hub connecting several personal computers into a common network. As the figure shows, each cable corresponds to a home LAN user and has a label inscribing his or her network nickname, and residential address.



Figure 3. 3. Home LAN hub with each cable corresponding to an individual user and inscribing his details

The label shown has an inscription “3 fr. door, 5 floor, 45 app., JUL” [*translated from Russian*] corresponding to a user with a network nickname Jul living at the apartment number 45 at the 5th floor and 3rd front door in a multistoried residence. The hub thus provides an example of sociomateriality in home LANs.

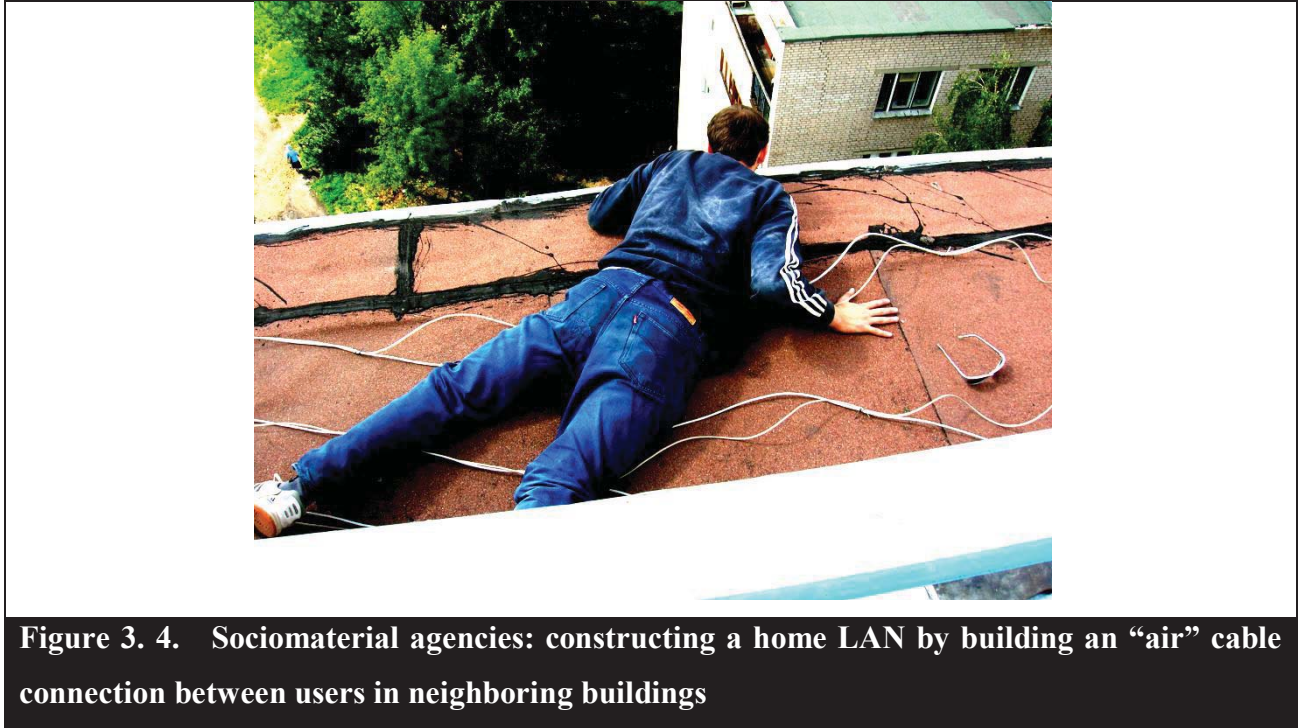


Figure 3. 4. Sociomaterial agencies: constructing a home LAN by building an “air” cable connection between users in neighboring buildings

Figure 3.4 shows the construction of a home LAN ‘air’ cable connection between users in neighboring buildings. Here, material agency is represented by the cables, the architecture and the roofs of multistoried buildings, and [invisibly at this figure] the materiality of PCs belonging to the residential users and a lack of affordable Internet infrastructure. Human agency is represented by a residential citizen lacking an affordable Internet trying to build an ‘air’ wired connection despite not being a specialist, without special equipment, and relevant professional knowledge how to do this (sun glasses and jeans, lack of professional uniform and equipment indicate the latter).

Both figures illustrate that home LAN technologies, structure and organizational practices can be best understood when regarded as sociomaterial entanglements with tightly intertwining human and material agencies. Moreover, human and material agencies shape each other when intertwining and emerge through and a spare of their mutual entanglements in such a way that their existence would not be possible otherwise. For example, the material agency at Figure 3

(cables, the architecture and the roofs of multistoried buildings, and personal computers) would not be enacted in the way in the way they were (for a construction of a handmade ‘air connection’) without intertwining with the human agency (i.e. residential citizen lacking affordable Internet access, etc.).

We now look at how the processes of sociomaterial imbrications of home LAN routines and technologies and their foreground patterns were embedded into the broader institutional interplay and dynamics.

3. 4. 1. 1. Sociomaterial Entanglements in the Institutional Context

Home LANs were created by people inspired and strongly interested in personal computers (PCs) and sharing a strong ‘computer culture’. A wish to play multi-party computer games and the need for resource sharing were important motives behind the home LANs creation. However, the Internet access for individual users was not affordable. This was so because the government Internet provider, the state telecommunications company Beltelecom, started offering a service of Internet access for residential citizens only in 1999. However, even since then the service was of a low quality (based on dial-up technology) and highly expensive - thus being unaffordable for the majority of Minsk citizens. The following citations from home LAN users illustrate the role of agency such as Internet and the policy of a state-owned provider in the process of home LAN creation:

Internet was very expensive and hard to buy. Our government is a monopolist and, I think, earns 100% profit on it. Me and my friend wanted to play multi-party games and share files so we decided to build our own network. [administrator of a home LAN created in 1996]

How did all these start? It was 1998, a 9-storied home building, no Internet yet. And there were we, 15-16 year old friends playing computer games. At some moment we decided not to go to a computer club any more but to play from our own chairs and home apartments. Thus we realized that what we needed was a sort of network.

[administrator of a home LAN created in 1998]

Moreover, as Beltelecom possessed a monopoly for selling the Internet channel private providers had to buy it from the company at high prices, and so they could only afford selling the Internet for high prices to their users.

As a result, some citizens in Minsk, being users of PCs, overcame the obstacle by creating their own means to play multiparty games and share resources and mobilizing from the bottom-up. As founders of home LANs describe it:

Me and two of my friends had computers and we wanted to share files and to play games together... So we built a network to link the three of us. Later, people from other stairwells joined so we became more than 10. In a year, we merged with another network in the neighboring house that was bigger than ours and had about 100 computers already.
[administrator of a home LAN created in 1995]

Thus, a *constraint* that no existing means available to satisfy the need of the home computer users, led to the development of home LAN sociomaterial structures through the creation of improvisation-based technology linking home computers of residential citizens.

Similarly, cultural and historical forces played an important role in the processes of sociomaterial imbrications of home LAN routines and technologies. Belarus (and Minsk in particular) was one of the main Soviet centers of electronics IT-engineering and computer science. The country's still high IT-educational level acted as an affordance to address the above described challenge of lacking Internet access and a means to play multi-party games and share resources successfully. For example, Minsk has huge universities with thousands of students specializing in computer science, IT and engineering. Every year, about 2,000 qualified IT specialists come to the market (Global Outsourcing Report, 2005: 46). Several huge universities in Minsk, such as the Belarusian State University of Informatics and Radio Electronics (BSUIR) and the Belarusian National Technical University (BNTU) have about 35000 computer science and engineering students. These cultural and historical forces resulted in the generations of engineers and people with professional ambitions and life hobbies related to computer science and IT, a great number of people who shared the so called 'computer culture' and not only needed a means to share files and play multi-party games but were able to build it by themselves. As home LAN creators explain:

The idea was natural: computers were my main toys, I grew up in a family of FIDOMen and all my friends were doing ITs.

Initially, my father who worked in the telecommunication area was our main consultant of how to extend cables, understand technical documentation, etc. Our friends already studying or working in BSUIR helped a lot with software setups and understanding things a bit more complicated than TCP and IP protocols, like the NetBIOS for example.

Another significant cultural factor motivating the development of home LANs and influencing their material agency was the architecture of multistory buildings. A great number of buildings in Minsk, especially the ones situated in the so called ‘bedrooms districts’, are built as multistoried buildings that may have from 60 up to 500 apartments each. This favored the physical development of home LANs. Thus, the historical and cultural environment of home LANs created an important background for the successful development and growth of home LANs.

The affordance described above led to the change in routines in the use of home computers: the latter started to be used for community-based activities of home LANs and resulted in the development of special services of home LANs. Typical services of home LANs included games, file sharing, chats and offline meetings, file search engines, network radio, description of user profiles, etc.

3. 4. 1. 2. Field structure characteristics and the foreground pattern of sociomaterial imbrications

Table 3.3 summarizes the details on the institutional field structure characteristics and home LAN organizational filters during Phase I.

Thus, during this phase, the field of Internet infrastructure in Minsk was *centralized* because of the centralized power of Beltelecom as government monopolist of the Internet channel.

Table 3. 3. Field Structure Characteristics and home LAN Filters in Phase I (1995-1999)	
<u>Field Structure:</u>	
Single and Multiple institutional logics	Multiple: government monopolist logics and civil society (home LANs) logics
Field centralization and fragmentation	Centralized field: Beltelecom’s monopoly on Internet channel is not questioned; neither Beltelecom no private providers are interested in individual Internet end-users
Conflict over means and goals	Conflict over means: Internet as an available means to share resources and play multi-party games
Field maturity	Immature
<u>Organizational Filters:</u>	
Field position	Peripheral
Internal representation of field logics	Single internal representation: civil society logics represented in home LANs
Identity	Identity: associations of friends, non-profit communities
Structure (units)	Technical units are boundary spanning

Multiple logics co-existed in the field: the logic of the monopolistic national telecommunication provider, Beltelecom and the civil society logic of home LANs. For example, a Beltelecom representative described the reason why individual Internet access was introduced as a service by a company only in 1999 (without irony) as the following:

We keep up with the times. We did not see a need to introduce it earlier.

Similarly, private Internet providers complied with the logics of Beltelecom and did not see reasons to invest money in the construction of the Internet infrastructure for individual users:

We cooperated with organizations and not users. Seriously, nobody even thought about individual users as a potentially profitable sector at those times. [a private ISP manager]

The civil society logic of home LANs was based on the historical and cultural context described above. Furthermore, the field structure was characterized by the *single internal representation* as home LANs were created and developed following the civil society logics and did not interact with government and private ISPs during this phase.

The conflict over means influenced home LAN technologies and routines as they developed other resources and practices for services usually offered by the Internet. Thus, home LANs accepted a strategy of *avoidance* by buffering the dominant logic of Beltelecom that “there is no big need in individual access” and decoupling their technical activities from external contact (Internet from Beltelecom) and creating their *own* means to share files and play games). Further, these decoupling were realized in home LANs as *peripheral* field organizations and were different from the formal individual Internet-access proposed by dominant actors in the field. The field could also be characterized as *immature*: no organizations offering available or quality Internet access for users of home computers; no laws and standards existed that could legitimize and guide home LAN existence and development. By creating home LAN technologies citizens developed an initial home LAN identity as *innovative non-commercial communities of social computing*. Thus, they changed their perception from ‘users’ (or ‘victims of the digital divide’, Heeks (2010)) to ‘innovators’ and ‘non-profit innovative communities’.

During this phase, in the field with structural characteristics of multiple conflicting logics and conflict over means, the perception of constraint led to change in home LAN technology and

the perception of affordance led to change in home LAN routines. The pattern of sociomaterial imbrications proposed by Leonardi (2011) was thus supported in this phase of our case study.

3. 4. 2. Phase II: Home LANs interaction with private ISPs (2000-2005)

3. 4. 2. 1. Sociomaterial Entanglements in the Institutional Context

After home LANs reached a certain size in number a constraint in their goals appeared:

After we reached our goal – played games together and shared some files - the development of the network stopped. Why? On the one hand, we reached a certain result. On the other hand, the dial-up Internet-access from Beltelecom was too slow and expensive to be a stimulus for growth [home LAN administrator].

Following this constraint as well as desire to have available Internet-access, some home LAN administrators decided to interact with private ISPs. An administrator of one of the oldest and biggest home LANs in Minsk describes this in the following way:

We went through all the providers and told them: “We want Internet-access. We are not ordinary users, we are a network with many potential customers. So we need a reduced price”. First, only ‘Solo’ [a private ISP] took our proposition seriously and managed to see a business rationale in it... We negotiated a reduced price and special bonuses for home LANs with them. They even created a special department to find other home LANs and proposed us a job in it... Later, looking at the ‘Solo’ example, other providers followed and competition for home LANs started.

A private provider described the rationale to compete for home LANs in the following way:

Our clients were mainly companies with a few individual users. The company had to pay for the whole channel when consuming it only at 30-35 %. The evening and the night channels were not being used at all. This, of course, was very money-losing... Home LANs changed the situation.

Here, the last phrase of the citation, “Home LANs changed the situation” is very telling in terms of showing the sociomaterial nature and agency of home LANs.

When private Internet providers realized that cooperation with home LANs might be extremely fruitful, they tried to increase the number of home LANs as their users and stimulate the development of new home LANs. As a home LAN administrator explains:

Initially, private providers offered the ADSL access only at special conditions: a user should use the traffic above a certain amount which was so big that we could only raise it if about 10 people club together. After this, many started developing networks so as to get cheaper Internet-access.

Thus, private ISPs stimulated and influenced further development of the home LAN phenomenon. The *affordance* of cheap and quality Internet-access, as well as increased numbers of users led to a chain of important *changes in routines* of home LANs, from use of home computers for collective activities as separate non-commercial organizations. Important evidence of these include the statutes developed by members of some home LANs and declaring them as independent non-commercial organizations with specific rules, members' rights and responsibilities, etc. Other related evidence includes regular offline meetings of home LANs members where decisions important for its development were taken based on democratic voting, as well as the fact that home LANs often cooperated with several providers simultaneously, thus giving its users choice to select the ISP. The main website of Belarusian home LAN, homenet.tut.by, created in 2002, served as a means of sharing practices, experience, and knowledge for innovative services realized in home LANs and in the providers 'internal resources' space. This led to the development of a 'new wave' of home LANs created in the early 2000s for cheaper and better quality Internet-access. These organizations had a less mature structure than the home LANs developed in the 1990s. Among the factors that led to this development were a number of online and offline publications about home LANs and their particular stories (for an example, see [http: and and dom15.narod.ru](http://and.and.dom15.narod.ru) and [images and article.jpg](#)), development of special websites and forums discussing how to build and develop home LANs. Finally, the affordance of Internet access and the increased number of users resulted in the introduction of a regular small monthly fee that formed a financial fund for home LAN development and renovation. The latter was a necessity initiated by the material agency of home LANs:

'Air' cables were often a problem as they were often spoiled by bad weather conditions, such as snow or storms. When it was possible we tried to substitute them with underground cables, radio modems and even optic fiber that we bought from our common funds.

This, in turn, progressively led to home LAN *commercialization* and de-coupling from their initial identities as completely *non-profit* organizations.

During Phase II private ISPs became the main form of individual Internet-access, largely because of home LAN users and Ethernet services developed in collaboration with them. As a representative of a private ISPs working for a department specialized in the collaboration with home LANs explains:

Most of our services came from the home LANs. We monitored them and when we liked anything we just picked it up at our platforms. For example, when a network of 100 users had an interesting service, it often did not have enough facilities to share it with others. We offered them a bigger server or a place for their own server. Thus, they continued developing their innovations for all the clients of our provider... This was a gratis way to capture the market and new clients.

3. 4. 2. 2. Field structure characteristics and the foreground pattern of sociomaterial imbrications

Table 3.4 summarizes the details on the institutional field structure characteristics and home LAN organizational filters during Phase II.

Table 3. 4. Field Structure Characteristics and home LAN Filters in Phase II (2000-2005)	
Field Structure:	
Single and Multiple institutional logics	Multiple: government monopolist logics; civil society (home LAN) logics; private provider logics (economic interest in individual users)
Field centralization and fragmentation	Centralized field: Beltelecom's monopoly on Internet channel is not questioned; private providers and home LANs form cooperation for individual Internet-access; Beltelecom is not interested in individual Internet users
Conflict over means and goals	Conflict over means: Internet as an available means to share resources and play multi-party games
Field maturity	Moderately mature
Organizational Filters:	
Field position	Central
Internal representation of field logics	Multiple: civil society logics and private provider logics (through bonuses) logics co-exist in home LANs
Identity	Identity: Community-based social entrepreneurs
Structure (units)	Technical units are boundary spanning

During Phase II, the field of Internet infrastructure is characterized as *moderately mature* as the field level material agency evolved and some private ISPs started offering ADSL-access for individual users. The latter was one of the main reasons why the *multiple field logics* represented by home LANs and Beltelecom was enriched by the logics of private providers who progressively realized the importance of individual Internet users as their important source of revenue.

However, although in reality this led to the empowerment and independency growth of both private ISPs and individual users, the field remained *centralized* as the dominant logic of Beltelecom as monopolist for the Internet-channel stayed unquestioned while private ISPs and home LANs were looking for some *compromise* solutions. The reason why private ISPs sold Internet-access for individual users at high cost was that they had to buy access from Beltelecom. One the oldest private Internet providers in Belarus argued:

Whilst Beltelecom keeps its monopoly, the Internet in Belarus will never be cheap.

3. 4. 2. 3. LAN sociomaterial imbrications as embedded in the field structure characteristics

The cooperation of home LANs and private ISPs initiated changes both at the field and the organizational levels. Thus, the field structure changed from centralization to moderate centralization structure. The centralized power of Beltelecom monopolist was moderated by services provided by home LANs, and the cooperation of home LANs with private ISPs for mutually profitable individual Internet-access; multiple institutional logics such as the logics of Beltelecom; the logics of private ISPs and the logics of home LANs cooperating with each other. Resolved conflicts over goals and means of home LANs: due to the cooperation between home LANs and private ISPs individual users obtained the possibility of good quality and cheap Internet-access. Reduced centralization of the field: as the number of home LANs cooperating with private ISPs grew the influence of “Beltelecom” as an Internet provider reduced. Institutional voids on the law legitimating home LANs remained. Private ISPs supported home LANs Internet-access and developed bonuses and discounts for them; single internal representation: the cooperation between home LANs and private providers led to the appearance of representation of the interests and logics of private providers in the logics and material (through ADSL-modems and Internet broadband) and social (bonuses for administrators and users) structures of home LANs. Materiality of the organizational field also changed: fiber optic cables, coaxial cables, ADSL-modems, software applications to enable dial-up Internet technology, access through home telephone, its cables and automatic telephone stations; materiality of the main actors (government and private ISPs home LANs).

Thus, *the perception of constraint* initiated by *multiple field logics* led to the *change in technology*, i.e. the appearance and development of the technologies Internet-access in home LAN

infrastructures, development of technologies for a shared and cross-multiplied Internet access, such special devices for cross-multiplying the Internet channel (such as repeaters) and network topology improvement.

Second, the availability of Internet-access in home LANs and special bonuses from private ISPs (such as free modem equipment) significantly increased the number of home LANs and their users. Though students, teenagers, and people under 25 were still prevailing, a significant number of families, people in middle and even pensionable age joined the networks for the purpose of work or leisure, curiosity or a desire to ‘Skype’ their relatives abroad. This, in turn, led to the intensive development of diverse innovative services in home LANs. These services included the ones important for a large number of people, i.e. not only multiparty games or file sharing, but media gallery, offline social events, network radio, servers, network map, etc.

Furthermore, home LANs – private ISPs cooperation led to the development of *multiple internal logics represented in home LANs* which influenced the way that subsequent changes in routines were realized. Thus, besides the civil society logics, home LANs started representing the logics of private ISPs as the latter provided significant advantages for home LAN users and administrators. These included the following: significantly reduced Internet tariffs, one or several free ADSL-modems for a home LAN, bonuses for administrators (usually 10% of Internet traffic cost used by home LAN users joined Internet traffic account; reduced price for the pre-paid Internet traffic cards that administrators could then sell to users), a possibility of advanced technical support, and (later), free or reduced price for fiber optic laying if a home LAN was in the area of strategic importance to a private provider.

During this phase, in the field with structural characteristics of multiple conflicting logics and conflict over means the perception of constraint led to change in home LAN technology and the perception of affordance led to change in home LAN routines. The pattern of sociomaterial imbrications proposed by Leonardi (2011) was thus supported in Phase II of this case study.

3. 4. 3. Phase III: Interplay between Home LANs and Private and Government ISPs (2006-2010)

3. 4. 3. 1. Sociomaterial Entanglements in the Institutional Context

As a result of successful cooperation with private ISPs, home LANs became one of the main forms of Internet access and resources-sharing for 16 years in Minsk. They included thousands of members and covered all the city areas, giving their users cheap Internet access, network resource sharing, online and real social communication opportunities. As one of the specialists of home LANs described it:

In Minsk home computer networks are everywhere. I think more than 90% of all home computers are currently connected to them [Konstantyn Scherban, specialist in home networks, to the Belarusian News Portal 'Tut.By' (2.03. 2010), <http://and.and.news.tut.by/and/162645.html>]

As a reaction to this cooperation, in 2006 Beltelecom introduces its new Internet-access brand 'Byfly' specially developed for the individual users Internet access with ADSL-technologies. Before 2006 the slow and expensive dial-up access was the only service that Beltelecom proposed to its individual users despite ADSL-access being provided to organizations. The change resulted in a regular reduction of prices for Internet access by Beltelecom. Except for the affordable prices for ADSL-access the 'Byfly' brand offered a variety of 'internal resources' similar to the ones proposed by private ISPs. The website devoted to the brand states that "*... the specialists of Beltelecom studied the Internet market in Belarus, evaluated strong and weak sides of its competitors* (<http://and.and.www.byfly.by/and/intro/and/history/and/>)". Thus, a government provider that earlier did not participate in the market of Internet-access for individual users joined the competition by offering rather affordable tariffs and a range of internal resources. The change in the Beltelecom policy shook the established synergy of home LANs and private providers as the one providing 'the best' Internet-access: some members of home LANs that needed intensive Internet use left for Beltelecom. Thus, although the prices for Internet-access were still significantly higher than home LANs, the subscriber base of Beltelecom increased impressively. The company had 857 users in 2004 compared to 520,719 users in 2009, and more than 800,000 ADSL users in 2011. An important factor was the introduction of unlimited Internet-access for individual users, the advantage that only the monopolist of the Internet channel could afford.

Being both *empowered* by dominance in the field of individual Internet-access but simultaneously *de-powered* by Beltelecom's monopoly control of Internet-channel, price and a unique possibility to offer unlimited Internet-access to their users, private ISPs started their own movement for Beltelecom de-monopolization. This resulted in regular debates and notes in the

mass-media and IT news portals. Furthermore, the movements were enhanced by political debates about inclusion of Belarus into the World Trade Organization (WTO) which required that national telecommunication monopolist, Beltelecom, to be de-monopolized. As a result, in 2008, the Beltelecom demonopolization project was accepted in Parliament and was about to be enacted but it was not signed by the President which stopped the process. Similarly, in 2010 private providers sent a joint open letter to the President asking to restrict the monopoly of Beltelecom on the Internet-channel. The situation, however, has largely remained unchanged. An important consequence about the changed field centralization, and especially those of the private ISP empowerment facilitated by cooperation with home LANs, were a shift in Beltelecom's customer orientation and a series of government laws restricting and prohibiting home LANs. Thus, *conflict both over means and over goals* imposed on home LANs was initiated in the field.

Simultaneously, government laws appeared that imposed significant restrictions on home LAN organizations in 2007 and 2010. Thus, the government law of 2007 was the first law that officially recognized the existence of home LANs and prescribed details of their registration. The registration conditions, however, were enormously complicated. To register a home LAN one needed to register as a juridical person (i.e. an owner of the organizations which contradicted the nature of home LANs), have a business-plan, money to pay for related government projects, a license and an access point to Beltelecom. The registration cost of even a small network was thus evaluated in several thousands of dollars. Interestingly, different home LANs perceived the same *law as both constraint and affordance*. Thus, some administrators accepted the law as an *affordance* to change the noncommercial home LANs into their commercial organizations, by investing money in registration. The majority of home LANs, however, perceived this law as a *constraint* and registered as individual entrepreneurs providing computer services. They accepted *manipulation strategy* and decoupled their symbolic and technical activities:

That was a way to get agreement while saving money and avoiding a bureaucratic headache.

Another home LAN, being concerned about the 2007 government law accepted the 'assistance' proposed by private ISPs. Usually, this included incorporating home LANs into the infrastructure of private ISPs and keeping the administrators' place and bonuses. One administrators of these home LANs describes this decision as the following:

I realized that even whilst not earning money I may get big problems, as it turned out to be an illegal entrepreneurial activity. I did not have any knowledge about how to organize an individual enterprise and how to deal with the situation then. This seemed too complicated...

One user who became a user of the ISP infrastructure expressed their opinions as the following:

Yeah, we have a speedy Internet, services, technical support and a monthly fee. However, when we were in a home LAN all these were much more interesting and cheaper.

Yet another home LANs unwilling to legalize as a commercial enterprise, or trying to keep their independence accepted a defiance strategy and continued functioning in the underground:

We have the right to form associations and exchange information...Of course, we make Beltelecom lose money. The main reason, however, is that it is much more difficult to control what people talk and organize in home LANs. Also people know each other and you need to live in a certain place to be connected.

Further, in February 2010 the law known as the *Nº 60 Directive* was signed by the President and required all illegal home LANs to be legalized or dissolved. At the same time, the law facilitated some new private providers' registration. Home LANs reacted to the above described interplay and a forced change in different ways with some home LANs perceiving the law as an *affordance* to continue their hobby at a professional level:

As we grow up and need a job, and money from it, we cannot continue as administrators. The choice was either to do it professionally or to give it up. We decided that we have enough knowledge and experience not to give up everything we have created to the hands of others. We are now entrepreneurs risking our own money so we really work hard and develop a lot of services that we think are important to people.

Thus, these LANs turned into private providers and also had to change their technologies and to create new services to compete with other ISPs. Similarly, reacting to the influence of government 2007 law, home LANs in 2010 that did not have enough financial resources or a desire to transform themselves into other forms, went underground. In an interview carried out in April 2011 a private provider confirmed that they continue working with non-registered home LANs:

We provide the Internet to their modem but we do not meddle in the things on the other side of it. We just do not ask, that is not our business.

3. 4. 3. 2. LAN sociomaterial imbrications as embedded in the field structure characteristics

Table 3.5 summarizes the details on the institutional field structure characteristics and home LAN organizational filters during Phase II.

Table 3. 5 Field Structure Characteristics and home LAN Filters in Phase III (2006-2010)		
Field Structure:		
Single and institutional logics	Multiple	Multiple: government monopolist logics; civil society logics; private providers logics
Field centralization and fragmentation		Moderately centralized: private ISPs ask for Beltelecom demonopolization (the project supported by Parliament but refused by the President); government laws inhibiting home LAN existence.
Conflict over means and goals		Conflict over means and over goals: available and cheap Internet-access with services provided by home LANs, private and government ISPs and conflict over home LAN existence
Field maturity		Moderately mature
Organizational Filters:		
Field position		Peripheral
Internal representation of field logics		Multiple: civil society logics (home LANs that went underground), private providers logics (home LANs that turned into private providers), and government monopolist logics (home LANs that turn into individual entrepreneurs)
Identity		Identity: Commercial ISPs, entrepreneurs, underground LANs
Structure (units)		Technical units are boundary spanning

Phase III is characterized as a *mature* field with tense interplay of *multiple institutional logics* (i.e. civil society: and monopolist and private ISPs) increasingly becoming contradictory to each other. Differently from Phase I and Phase II, Phase III is characterized as *moderately centralized* as the power distribution at the field level was challenged. In particular, private ISPs and home LANs started challenging the supremacy of the Beltelecom monopoly and the dominance of its logics.

Multiple logics exists in the field: logics of Beltelecom; logics of private ISPs; logics of home LANs transformed into private ISPs; logics of underground home LANs. *The conflict over goals and means* of home LANs existence was created by the introduction of government laws prohibiting home LAN existence.

Furthermore, in compliance with these changes the pattern of home LAN intra-organizational sociomaterial imbrications of routines and technologies has changed as compared

to previous phases. Now, both the perception of affordances and constraints led to change in home LAN routines and only then in some cases did change in organizational technologies took place.

To summarize, the 2007 government law perceived simultaneously as *constraints* and *affordances* and led to home change in home LAN sociomaterial imbrications *in routines* (as they started enacting their practices on commercial or underground bases) and *not* a change in technologies. Furthermore, it resulted in multiple changes in home LAN *identities* (as commercial ISPs, individual entrepreneurs or underground communities) and *multiple internal representations* of private ISP logics, individual entrepreneurs and civil society logics which all influence home LAN perception of affordances and constraints and processes of sociomaterial imbrications. Further, as shown above, home LANs operating in *multiple institutional logics* and *moderately centralized fields* intensively changed their sociomaterial imbrications (of technologies). Finally, *the conflict over means* and *over goals* imposed on home LANs during this phase led only in significant changes in home LAN routines and insignificant change in technologies.

During this phase, in the field with structural characteristics of multiple conflicting logics and *conflict over means and over goals* both the perception of constraint (i.e. Beltelecom competition for users with ADSL access and unlimited Internet access; restrictive and prohibitive government laws in 2007 and 2010) and the perception of affordance (i.e. bonuses and competition for home LANs by private ISPs; facilitating law of registering new Internet providers) led to change in home LAN and insignificant change in home LAN routines. Interestingly, the pattern of sociomaterial imbrications proposed by Leonardi (2011) did not support at Phase III of this case study.

3. 5. DISCUSSION AND IMPLICATIONS

The case of home LANs described above illustrates how home LANs emerged and developed as a process of continuous and tight intertwining of human and material agencies entangled with the variety and dynamics of institutional actors (cultural and historical forces, policies of state and private ISPs, field structure characteristics). As shown in the data analysis described above, human and material agencies acquired their properties, form and structure in the process of these entanglements and emerged through and as a result of the latter. This paper thus argues that the processes of organizational sociomaterial imbrications of technologies and routines

can only be fully understood if larger contextual and inter-organizational aspects are taken into account. Following the process theories methodology (Langley 1999; Pettigrew 1990; Pettigrew, Woodman and Cameron, 2001) we analyzed the 16-year processes of home LAN sociomaterial imbrications of routines and technologies in the variety and dynamics of field structure characteristics summarized by recent developments on the institutional perspective (Greenwood et al. 2011, Pache and Santos 2010). As a result of our analysis, three main phases of home LAN development with different sociomaterial imbrications of routines and technologies and their patterns were distinguished. This finding illustrates that institutional dynamics and field structure do influence within-organizational sociomaterial imbrications of routines and technologies and how this influence may lead to the diversity in the imbrications' patterns and processes (Table 3.6).

The goal of this paper was to address the gap relating to the contextual and institutional influence to the current research on sociomateriality. This paper investigates organizational processes and patterns of sociomaterial imbrications as embedded in larger institutional dynamics and extra-organizational sociomaterial assemblages. By linking the institutional and sociomateriality theory perspectives we develop a framework to systematically analyze how the field structure characteristics influence within-organizational processes of sociomaterial imbrications of routines and technologies.

We now discuss contributions to theoretical and practical implications of these findings as well as avenues for further research and limitations of the study.

Table 3. 6. Summary Table of the Influence of Institutional Dynamics and Complexity on the Processes and Patterns of Sociomaterial Imbrications over three phases of home LAN development

	Phase I	Phase II	Phase III
Field structure			
Single and Multiple institutional logics	Multiple: government monopolist logics and civil society (home LANs) logics	Multiple: government monopolist logics; civil society (home LANs) logics; private providers logics (economic interest in individual users)	Multiple: government monopolist logics; civil society logics; private providers logics
Field centralization and fragmentation	Centralized field: Beltelecom's monopoly on Internet channel is no questioned; neither Beltelecom no private providers are interested in individual Internet end-users;	Centralized field: Beltelecom's monopoly on Internet channel is not questioned; private providers and home LANs form cooperations for individual Internet-access; Beltelecom is not interested in individual Internet users	Moderately centralized: private ISPs ask for Beltelecom demonopolization (the project supported by Parliament but refused by the President); government laws inhibiting home LAN existence
Conflict over means and goals	Conflict over means: Internet as an available means to share resources and play multi-party games	Conflict over means: Internet as an available means to share resources and play multi-party games	Conflict over means and over goals: available and cheap Internet-access with services provided by home LANs, private and government ISPs and conflict over home LAN existence
Field maturity	Immature	Moderately mature	Moderately mature
Organizational filters			
Field position	Peripheral	Central	Peripheral
Internal representation of field logics	Single internal representation: civil society logics represented in home LANs	Multiple internal representation: civil society logics and private providers logics (through bonuses) logics co-exist in home LANs	Multiple internal representation: civil society logics (home LANs that go underground), private providers logics (bonuses from private ISPs and home LANs that turned into private providers), and government monopolist logics (home LANs that turn into individual entrepreneurs, and home LAN paralyses and breakup)
Identity	Identity: Innovative non-profit communities	Identity: Community-based social entrepreneurs	Identity: Commercial ISPs, individual entrepreneurs, underground LANs
Structure (units)	Technical units are boundary spanning	Technical units are boundary spanning	Technical units as boundary spanning
Organizational responses			
Strategy	Avoidance	Compromise	Defiance and Manipulation and Acquiescence
Sociomaterial imbrications of routines and technologies and their patterns			
Patterns of sociomaterial imbrications:	Constraint: No organizations offering an opportunity to play multi-party games and share files-> Change in technology: development of home LANs technologies. Affordance: Great number of IT and computer science, country's strong historical position in IT and engineering, and special architecture of multistoried buildings -> Change in routines: collective use of home PCs . Perception of constraint Perception of affordance The pattern by Leonardi (2011) supported	Constraint: No stimulus to develop, expensive Internet -> Change in technology: Internet-access; development of innovative services and home LANs rebuilding. Affordance: cheap and well-quality Internet available in home LANs -> Change in routines: self-consciousness and independence of home LANs as non-commercial social organizations; development of statute, members' rights and responsibilities, financial fund; 'new wave' of home LANs development. Perception of constraint Perception of affordance The pattern by Leonardi (2011) supported	Constraint: Restrictive government law in 2007 -> Change in routines: home LANs break up and become a part of a provider's infrastructure and change administrators and look for ways to legalize. Affordance: The law acted in favor of those administrators who wanted to change noncommercial home LANs to their own individual enterprises -> Change in routines: some home LANs turned into commercial individual enterprises. Constraint: Inhibiting government law in 2010 -> Change in routines: home LANs continue as underground organizations or break up. Affordance: the law facilitates registration procedures for Internet-providing -> Change in routines: some home LANs turn into Internet providers. Perception of constraint Perception of affordance Perception of constraint The pattern by Leonardi (2011) NOT supported

3. 5. 1. Implications to Theory and Suggestions for Further Avenues

This paper provides contributions to sociomateriality theory, institutional theory and theories of organizational innovation.

First, the research contributes to knowledge on the processes and results of sociomaterial imbrications of routines and technologies (Leonardi 2011; Leonardi and Barley 2008) as embedded in larger institutional dynamics and complexities. Our findings indicate that within-organizational processes of sociomateriality are significantly influenced by field structure characteristics and their dynamics. We have shown how sociomaterial imbrications of routines and technologies within home LAN organizations entangled with the dynamic and complexities of the field structure characteristic and other actors in the field.

However, our findings only partly support the recent findings of Leonardi (2011) about the patterns of sociomaterial imbrications as we evidence that this is not applicable in certain types of environment. Thus, we evidence that the pattern that the perception of constraint leads to change in technology while the perception of affordances leads to change in routines (Leonardi 2011) holds true when an organization operates in centralized fields with multiple logics imposing conflicting demands mostly on organizational goals and when organizations do not experience strong dissonance or pressure to change their identities. These were described at phases I and II presented in Table 6.

However, we also show that in organizational fields where multiple and conflicting logics co-exist, the patterns of sociomaterial imbrications might be significantly different from those previously suggested. In particular, the examples of home LANs operating in phase III illustrate how organizations might produce sociomaterial entanglements of their human and material agencies by intensively changing their routines and making insignificant changes in technologies, despite the perception of both constraints and affordances. During this phase, the field structure characteristics of multiple conflicting logics, moderately centralized field (partly undermined by the empowered successful cooperation between home LANs and private ISPs), and conflict over both home LAN means and goals - all contributed to the ways

that technologies and routines created a pattern of imbrications different from those developed during the first two phases.

Second, this research contributes to institutional theory perspectives by providing insights on the role of sociomaterial agencies of technology and related routines in the process of translation when the institutional logics to the organizational level. Building on these findings, further research might develop an understanding about how the institutional logics are both constrained and enabled by the materiality of organizational technology.

Further, our findings provide some evidence that similar institutional logics might be translated both as ‘perception of affordances’ and ‘perception of constraints’ and thus lead to different outcomes and patterns of sociomaterial imbrications. This is illustrated in data analysis by home LANs which reacted differently to the same laws controlling their development. Thus, multiple representations of civil society, private ISP and government provider logics in some home LANs as well as multiple identities of home LANs resulted in the insignificant changes in technologies and significant changes and diversity in home LAN routines and practices (such as making them fully commercial, decoupling into symbolic and technical activities, and going underground).

Finally, our findings do not support several important assumptions implicit in the institutional theory perspective. Thus, we do not find support that the processes of sociomaterial imbrications in organizations in centralized fields tend to follow the pattern of technology and routines imposed by the dominant institutional logics. These findings are different from those discussed in institutional theory (Greenwood et al. 2011; Pache and Santos 2010; Scott 1991) which suggest that higher degrees of field centralization leads to the acceptance of standardized practices imposed by the dominant actor. However, the Phase III home LANs in the centralized fields diversified their routines greatly despite significant pressures from the dominant actor, the government provider, which shows that the opposite may be true.

Linked together, the contributions to the sociomateriality and institutional theories as well as a developed framework (Figure 1) provide a lens to systematically analyze the influence of the field structure characteristics and their dynamics on

organizational processes and patterns of sociomaterial imbrications of routines and technologies.

The research also has some more specific contributions related to the studies of organizational user-driven innovation. In particular, von Hippel (2005) argues that the existence of an innovative community, i.e. informal user-to-user cooperation, and lead users acts as the main driving forces of user innovation. Despite that, our findings do support the importance of innovative communities research (i.e. communities of home LAN users were, indeed, crucial to the creation and development of home LAN innovations), our findings also go beyond the boundary of the community and the lead user. With the case of home LAN grassroots Internet development, this dissertation illustrates that the processes of end-user innovation happen not in isolation but with the tight co-entanglements and co-creation with actors of a different nature and kind: human and non-human; citizens, government Internet providers, and non-government organizations; users and administrators; institutional logics, field characteristics, local culture and historical conditions, etc. In this light, the phenomenon of user (and organizational) innovation may be understood only when all of these are taken into account.

Finally, this research provides one of the few research contributions on sociomateriality in a developing country context. Thus, this paper contributes to the studies of technology use and acceptance in developing countries (Avgerou 2003; 2008; Silva and Westrup 2009; Walsham and Sahay 2006). In particular, understanding how institutional complexities influence the processes and results of within-organization sociomaterial imbrications provides valuable insights on how and why technology can be used in unexpected ways and changed by users themselves (Hayes and Westrup 2010; Heeks 2010; Sauer 1999). Further research might develop the processes and findings reported here and compare them to the relevant findings from other developing contexts.

3. 5. 2. Implications to Practice

The research has the following two important practical implications. First, it evidences that in organizational fields where multiple and conflicting logics co-exist

they impose both conflicts over means and over goals on organizations, both the perception of affordances and constraints lead to organizational change in routines and insignificant change in technologies. This finding provides an alternative explanation as to why most ambitious programs of innovation development, such as the EU 7th Framework program establishing organizational conditions to stimulate organizational innovations, do not fully reach their goals as too much institutional presence might lead to changes in routines and not changes in technologies.

Second, the case of home LANs could be of particular importance for companies cooperating with communities of end-users in the following two ways. The story of how home LANs developed and constructed useful ‘win-win’ merges with private ISPs (providers got the necessary infrastructure link with individual end-users that they themselves could not provide while home LANs got cheap Internet and some technical support) could be of particular interest to organizations looking to establish mutually-effective relationships with their end-users. Knowledge that particular field characteristics might more probably lead to change in routines only (see Phase III) while others enable change both in organizational routines and technologies contributes much to the profitability and efficiency of the above relations.

Finally, the discussion of how private and the government ISPs monitored and incorporated innovative services developed in home LANs could be of a particular interest to companies.

3. 5. 3. Limitations and Further Research

This research has several limitations that further research might address. First, we did not specially analyze the dynamics within the sample of home LANs. Further research could address this limitation by investigating how the dynamics within the actors of similar groups might influence the processes of sociomaterial imbrications by changing the internal representations of the institutional field logics imposed on particular organizations within the group or the group as a whole.

Second, in this research we did not analyze the effects that within-organizational home LANs sociomaterial imbrications of routines and technologies cause on the field level structures.

Clearly, an important area for further research is to develop these findings to understand how within-organizational sociomaterial imbrications of routines and technologies initiate changes in the nature of field structures and the dynamics of institutional logics. Such an understanding would enrich our understanding of the role of the technological artifact and institutional dynamics.

Finally, though having analyzed the general interplay between the field structure characteristics, we did not analyze the particular mutual effects and combinations of field characteristics. Institutional theory research suggests the possibility that field structure characteristics might reinforce or weaken each other (Pache and Santos 2011). Thus, further research could provide a broader understanding on how different combinations of field structure and patterns of sociomaterial imbrications relate.

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Chapter 4:
SUCCESSFUL INNOVATION WITH SCARCE RESOURCES:
IMPROVISATION AND EXPERIENTIAL LEARNING IN THE COMMUNITY-
BASED ORGANIZATIONS

Earlier versions of this paper were presented at:

- the IFIP 9.4 workshop ‘Technological Change and Development’ at the London School of Economics, London (UK) (Zorina and Avison, 2010);
- the International Conference on Information Systems (ICIS) Doctoral Consortium at St. Louis (USA 2010).

I am grateful for comments and questions on these occasions that have helped shaped this version.

ABSTRACT

In this paper, we aim at understanding how organizations might be innovative and develop successfully in the environment of scarce resources, high uncertainty and competition with organizations with wider access to resources and higher legitimacy. In particular, we look at the challenges, practices and strategic responses of the community-based, user organizations. These organizations were created by citizens from the bottom-up to build the alternative Internet infrastructure different to the unaffordable and inefficient Internet infrastructure provided by the government and private providers. They managed to create successful innovations with unique value as well as compete with government and private organizations over a long period despite the conditions unfavorable for innovation creation from the generally accepted view (contradictory and even hostile government policy, lack of significant financial investments and special managerial and marketing knowledge, elements of coercive pressure, etc.). Building on the practice theory and in particular on the theories of organizational innovation, improvisation and strategy as practice, this research aims at understanding and explaining the phenomenon. Our findings indicate that successful innovation was developed and its unique value was created based on a) improvisational and emergent rather than planned practices; b) on experiential learning in tight co-entanglement with organizational environment. Data also indicates that when planned activities and learning processes different from the experiential prevailed community-based organizations lost the majority of their innovativeness and sustainability. Insights and findings from the study contribute to the research in organizational improvisation, successful innovation development and implementation as well as to the emerging research on the user driven and community-based organizations.

Key words: innovation, improvisation, end-user, experiential learning, multi-case study, qualitative research

4. 1. INTRODUCTION

*‘Innovation in industry is a process that involves an enormous amount of uncertainty,
human creativity and chance’*

J.M Utterback, (1994)

This research aims at understanding how organizations lacking significant financial and managerial resources and operating in complex, uncertain and unfavorable environments manage to successfully create and develop innovations over a long period of time and even successfully compete with organizations with greater resources and higher legitimacy. In order to do so, we combine the perspectives of environmental influence, organizational improvisation and experiential learning to enhance our understanding of the processes of successful innovation creation and development.

Successful innovation creation and development is described by many researchers as ‘black box’ and one of the most challenging organizational processes (Fagerberg, Movwery and Nelson, 2004). Organizations aiming at successful creation and development of innovations need to overcome the problems of environmental uncertainty and turbulence (Nonaka and Takeuchi, 1995; Stacey, 1991; Stacey, 1996; Van de Ven and Poole, 1995); mismatch between mental organizational models and environmental responses (Hodgkinson, 2003; Walsh and Rivera, 1991; Weick and Westley 1996); the problems of bounded rationality and absorptive capacity (Lam, 2004; Simon, 1991); and unpredictability of actions (Stacey, 1991; Stacey, 1996); as well as the need to craft planned and situated actions simultaneously (Ciborra, 2004; March, 1991). How then can organizations innovate successfully taking into account the number and variety of challenges they face? This paper provides insights into answering these questions by investigating the processes of successful innovation creation in an environment with restricted resources through the lenses of organizational improvisation and experiential learning theories.

Some research acknowledges that particular environmental factors (such as culture, government support, financial resources, existence of venture institutions enabling investment loans, supporting legal environment, etc.) play a crucial role in

addressing the challenge of innovation creation and ICT development successfully (Eindor, Myers, and Raman, 1997; Heavin, Fitzgerald, and Trauth, 2003; Trauth, 2000). However, analysis of the environmental factors of successful innovation creation and ICT development through different contexts (developed vs. developing countries) reveals important inconsistencies in the way that these influence innovation processes (Avgerou, 2003; Hobday, 2000). Other research underlines the important role of organizational learning and improvisation in the ability to internalize and (re)combine resources and information from the field, managing environmental complexity, as well as crafting planned and unplanned actions (Ciborra, 1996b; Crossan and Sorrenti, 1996; Moorman and Miner, 1995, 1998b; Yanow, 2001). For example, research on organizations has shown that *ad hoc* character decisions are particularly relevant to the field of innovation creation and development where the environment is characterized as highly turbulent and competitive (Crossan and Sorrenti 1996; D'Aveni, 1995), where the result of the innovative process is seen as uncertain and unpredictable (Nonaka and Takeuchi, 1995; Van de Ven, Polley, Garud, and Venkataraman, 1999), and where innovators have to overcome the inertia and the biases of previous rationalities to make their innovation accepted (Schumpeter, 1950).

We illustrate how end-user bottom-up citizens organizations created successful innovations and developed their unique value when using an experiential learning approach and improvisational techniques in their practices (Ciborra, 2004; Vera and Crossan, 2005). Further, we also illustrate how the process of this creation and development was significantly entangled with the organizational environment, and challenges and opportunities created by the interplay of other actors from the organizational field. Our findings indicate that successful innovation was developed and its unique value was created: a) based on improvisational and emergent rather than planned practices; and b) in tight co-entanglement with the organizational environment. Here, we define 'successful innovation' as innovation (technological and/or organizational) that was developed and implemented in the organization and helped it to address the relevant environmental, resource-based and managerial challenges.

Building on an inductive, comparative case-study analysis we reveal patterns of resource-based, managerial and organizational and political and legitimate challenges

facing organizations when developing innovations. We then track organizational responses to those challenges, looking at their process of experiential learning and improvising in the process of innovating.

The research provides insights to understanding *the processes* of successful innovation creation and development in the conditions of complex, uncertain and restricted environments. The main contributions of the study lie in the areas of innovation development and implementation, organizational improvisation, and experiential learning as well as the emerging research on user-driven innovation and community-based technology activism (Powell, 2008; Powell and Meinrath, 2008).

The paper is structured as follows. The first part describes the theoretical background environmental factors influencing innovation creation and development, discussions on organizational improvisation and its value to deal with complexities and unpredictability of innovation creation. Further, we discuss how the lens of experiential learning might be valuable for understanding *the processes* of innovation creation in restricted and complex environments. The third section presents the details on the methodology and data collection. This is followed by the data analysis section. In the last section we provide discussion on the findings and conclusive remarks of this research.

4. 2. TRIGGERS OF SUCCESSFUL INNOVATION

In a general sense, the term ‘innovation’ refers to the *adoption of any device, system, process, problem, program, product or service that is new to the organization* (Dougherty, 1996, p. 424). In this research, we do not separate the phenomena of technological and organizational innovation. Instead, we look at both as parts of a common and highly intertwined process. As previous research reveals, technological innovation necessarily leads to organizational innovation (Barley, 1986; Barley, 1990), i.e. the creation or adoption of an idea or behavior new to the organization (Lam, 2004).

Analysis of the literature on innovation drivers reveals three main triggers of the process of successful innovation creation: context, improvisation and organizational learning. In this section, we elaborate on each of these triggers below.

This section is organized as follows. First, we discuss the process of innovating in the context and describe research on environmental factors influencing innovation creation and development. We show that these factors provide an important background for innovation creation. Yet, research is inconsistent in the analysis of their influence. Second, we discuss how improvisation might be useful to deal with environmental complexities, restrictions and uncertainty in the process of organizational innovation creation and development. Finally, we present the lens of experiential learning and discuss how this is valuable in understating the organizational process of innovating.

4. 2. 1. The Context and the Environment of Innovation

One of the most central findings in the innovation literature is the observation that firms do not create innovations in isolation but rather through extensive interaction with their environment (Fagerberg, Movwery and Nelson, 2004). Innovation is by its very nature a new combination of existing resources where this combinatory activity is realized though the interplay between entrepreneurial firms and their environment (Schumpeter, 1950). In particular, this combinatory ability of the firm is possible because of absorptive capacity mechanisms to internalize knowledge and other resources from outside (Cohen and Levinthal, 1990).

However, there is a debate among information systems scholars about the existence of a number of common contextual factors important for successful innovation and ICT development. Some authors (Ein-Dor et al., 1997; Heavin et al., 2003; Trauth, 2000) argue that successful ICT innovation development requires a certain level of development in such factors as demographics, culture, national and enterprise policy and the individual qualities of people. Other authors, however, underline that ICT innovation is a process depending on a particular social and organizational context (Avgerou, 2003; Hobday, 2000; Suchman, 1987).

Despite the above contradictions, both views agree on recognizing government and their interventionist policies as one of the most necessary conditions for national ICT success. This coincides with institutional theory underlying the importance of the dominant logics, legitimate and normative mechanisms that institutions and actors like

government might impose on organizational behavior and the process of producing technology and innovations (DiMaggio and Powell, 1983; Greenwood and Suddaby, 2006; Hall and Soskice, 2001; Scott, 2001). In this light, the macro country environment is considered to act as the driver of the micro level's incentives and knowledge on how to work, coordinate and share practices (Kogut and Zander, 1992; Lamb and Kling, 2003).

Similarly, research on culture and technology suggests that the former might be a source of resistance for innovation transfer (Straub, Loch, Evaristo, Karahanna, and Srite, 2002; Trauth, 2000) as some cultural values and behaviors can be contradictory to those required for ICT by multinational and global companies (Leidner and Kayworth, 2006). In this light, a universal approach on ICT development and diffusion contrasts with the variety of distinct historically-formed collective behaviors, as national culture itself is dynamic and emergent (Walsham, 2002; Westrup et al., 2003).

4. 2. 2. Challenges of organizational innovation in the context

A firm's ability to innovate thus depends greatly on its capacity to absorb knowledge and resources from the outside world (Cohen and Levinthal, 1990). Some researches argue that the greater the variety of factors within a given environmental system, the greater the scope for them to be combined in different ways producing new and even more complex and sophisticated innovations (Diamond, 1998). However, ever increasing studies in organizational innovation and learning indicate that organizations trying to innovate in a complex and turbulent environment face major problems and challenges. Below we list some of them.

- 1) 'Bounded rationality' (Lam, 2004; Simon, 1991): individuals and organizations are bounded in their rationality. As Lam (2004, p.123) puts it:

individuals are limited in their ability to process the complex variety of stimuli contained in the external environment

- 2) Mismatch of mental models and environmental response: as individuals and organizations are bounded in their ability to rationalize in complex environments, they develop intervening mental models to perceive, construct and make sense of

their worlds (Lam, 2004; Weick and Wastley, 1996). These shared interpretive schemas affect the way organizations adapt to the environment and may block their decision-making and change processes.

- 3) Unpredictability in highly complex and uncertain environments: Complexity theory and the law of small effects suggest that the amount of information possessed about the environment does not lead to its predictability (Stacey, 1991; Stacey, 1996). A commonly shared view on innovation is that it is not possible to predict what the most relevant factors of its creation are and what the potentially rewards of innovation can be (Nonaka and Takeuchi, 1995; Van de Ven et al., 1999; Van de Ven and Poole, 1995).
- 4) The need to keep an ‘exploration-exploitation’ balance (March, 1991) which requires craft in balancing situated and planned actions.
- 5) ‘Past dependency’ problems: This is associated with the situation when the ‘organizational memory’ locks in or keeps the innovator on a particular path while better knowledge, new paths and alternative solutions appear (Arthur, 1994; Fagerberg, Movwery and Nelson, 2004).

The following subsection discusses how improvisation might be valuable in addressing the above challenges and acts as an important trigger to a successful innovation process.

4. 2. 3. Innovating and Improvising

Studies on organizational improvisation, originally coming from the settings of jazz playing, theatre, and the emergency services, provide useful insights on how organizations and their group members learn, create new knowledge and manage in highly uncertain and complex environments (Barrett and Peplowski, 1998; Vera and Crossan, 2004; Weick, 1993; Weick, 1998; Yanow, 2001). Improvisation has been considered as an important part of innovation processes development (Cunha, Cunha, and Kamoche, 1999; Eisenhardt and Tabrizi, 1995; Moorman and Miner, 1998a; Vera and Crossan, 2004). This is supported by recent findings in dynamic capability research indicating that organizations with less routine behavior compete better in dynamic

environments (Gavetti, Levinthal, and Rivkin, 2005; Kaplan and Tripsas, 2008; Tripsas and Gavetti, 2000). The patterns of improvisation are seen in many managerial activities in making choice in price systems (Hayek, 1945); within hierarchical work organizations (Brown and Duguid, 1991; Suchman, 1987); in spontaneous managerial activity (Mintzberg, 1973); and in innovation creation (Brown and Eisenhardt, 1997; Eisenhardt and Tabrizi, 1995). *Ad hoc* character decisions are observed throughout managerial, marketing and even hierarchically operational activities in organizations (Brown and Duguid, 1991, 2000; Mintzberg, 1973; Suchman, 1987).

Research in organization theories, psychology, sociology, and in some other areas has proposed various definitions of improvisation. Thus, Orlikowski and Hofman (1997) define improvisational activities as those

enacting an ongoing series of local innovations that embellish [a prescribed] structure, respond to spontaneous departures and unexpected opportunities, and iterate or build on each other over time (p.13; quoting Cunha, Cunha, and Correia (2001, p. 98)).

Improvisation has a number of key features which make it a unique phenomenon. It is spontaneous and intuitive (Crossan and Sorrenti, 1996); rests past experience and sustained practice over time (Yanow, 2001); focuses on its subject and its circumstances (Weick, 1993; Yanow, 2001); is based on real-time learning (Eisenhardt and Tabrizi, 1995); and when an actor is fully present, fully engaged in the process (Weick, 1993; Yanow, 2001). Making a parallel with the definition of organizational action given by Miner et al. (1996), Cunha, Cunha, and Correia (2001) argue that improvisation is *organizational* when it is carried out by an organization and/or its members, on behalf of a team, an organization or a project.

One of the most fascinating features of improvisation is that the same circumstances perceived as challenges and problems in the organizational learning and innovation fields are treated as opportunities and necessary conditions for improvisation. Below, we summarize the conditions necessary for improvisation to appear as indicated in the literature.

- 1) One of the most important conditions for improvisation to occur is a lack of expected and planned circumstances (Ciborra, 1996a; Crossan and Sorrenti,

1996; Weick, 1993, 1998a). In these conditions improvisation is needed to fill the gaps of planning and to face emergencies (Ciborra, 2004).

- 2) A second important trigger for improvisation is the need to operate in complex and emergent environments (Crossan and Sorrenti, 1996; Crossan, 1996; Moorman and Miner, 1998a; Moorman and Miner, 1998b).

These two necessary conditions for improvisation fit in with the problems of uncertainty of innovative outcome (Nonaka and Takeuchi, 1995; Van de Ven et al., 1999). Furthermore, there are other reasons that make improvisational activities particularly important for firms when organizing for innovation:

- 3) The nature of improvisation and innovation are similar. According to Ciborra, (1996a, p. 104) improvisation is about efficiently generating *new combination of resources, routines and structures which are able to match the present, turbulent circumstances*.
- 4) Cognitive studies usually link improvisation to the exploitation of tacit knowledge. This question is of particular importance in the literature on organizational learning (Brown and Duguid, 1991; Lave and Wenger 1991; Nonaka and Takeuchi, 1995). The research in this field underlines the importance of context for mobilizing tacit knowledge on which improvisation also builds. For example, Yanow (2001) suggests that organizational learning has improvisational quality as it is not scripted, dynamic and provisional, context-specific, and situated in the moment. She argues that training only in scripted practice does not equip individuals for engaging with unscripted images and ideas, which are tacit knowledge.
- 5) A mismatch between the mental model of organizations and environmental response, including those when an organization obtains a new vision of itself, may cause its shift for improvisation (Cunha, Cunha, and Correia, 2001; Moorman and Miner, 1998a; Moorman and Miner, 1998b).
- 6) Another source of improvisation is related to operating in a highly turbulent environment, where the speed of answer is especially important. The faster organizations respond to the environmental variations and to each other's actions, the higher is the likelihood of undertaking improvisational activities

(Cunha, Cunha, and Correia, 2001; D'Aveni, 1995). This is particularly relevant to innovation where time of the operational circle and responding to competitors is shortening (Crossan and Sorrenti, 1996). In these circumstances organizations have less opportunity to plan their resources and must improvise with those that are available to them in real time (Moorman and Miner, 1998b; Vera and Crossan, 2005; Weick, 1993). However, though speed is found to be one of the fundamental features of improvisation, some researchers consider improvisation to be more than just fast and simultaneous actions (Ciborra, 2004; Weick, 1998). For example, Weick (1998) points out that some preplanned and routinized actions can be faster than actions taken when improvising.

Yet, the most profound reasons which explain why improvisation is important and appeal to the very origins of any improvisational and innovative activity are the notions of 'initiative' and 'mattering' given by Ciborra (2004). Building on the phenomenology of situated action and on the plurality of terms by which 'situation' can be described (Heidegger, 1962, p. 34), he defines improvisation as a special understanding by an actor of his situation:

improvisation is... the 'moment of vision': the look of resolute decision in which the full situation of action opens itself, and keeps itself open to our initiative of re-registering, recombination, and intervention... This is only possible because, suddenly, the world and its resources and people matter differently, so they can be singled out and recombined differently.

This 'initiative' and 'mattering' are important because they go beyond the usual opposition of improvisational and planned activities established in the previous literature. In particular, they link improvisation to personal interest and motivation in his or her practical activity. Ciborra (2004, p. 32) calls this intrinsic situation of an actor the concept of 'mood', which discloses the world such that a certain representation of things, people, or circumstances matter and colors *the flat world of cognition and action, whether planned or situated*. That is why he links planned action, which is characterized by a lack of initiative and personal 'mattering', to the concept of profound boredom and inaction. In our research we build upon and test the mattering, existential aspect of improvisation indicated by Ciborra (2004) as the one based on initiative and personal

matter. We argue that because of the above indicated conditions, improvisation can be valuable in many processes of innovation creation and development.

Among the difficulties of improvisation is the challenging task of its creation as a planned action; inability to buy it but a need to grow it within organizations; problems of team effective communication, and possible problems of biased decision-making (Brown and Eisenhardt, 1997; Miner, Moorman, and Bassoff, 1996). However, Cunha, Cunha, and Correia (2001) argues that the result of improvisation may to a great extent depend on which kind of trigger drives it. Thus if the organization, improvising, perceives the change of environment as a threat and tries to neutralize it so to return to its usual state, then serious negative effects are possible. Yet, if instead the organization perceives environmental change as an opportunity and tries to benefit from it, it is more likely to receive a positive feedback (Moorman and Miner, 1995).

In the following subsection, we introduce the theory of experiential learning as proposed by Kolb (1984) and discuss how this might be valuable to study the processes of (successful) innovations and improvisation in restrictive and challenging environments.

4. 2. 4. Organizational Process of Experiential Learning

Theories on innovation argue that learning processes are crucial for successful innovation creation and development as they enable the transformation of tacit knowledge to explicit (Nonaka and Takeuchi, 1995; Polanyi, 1966), stimulate the exploration – exploitation processes (March, 1991), influence the process of knowledge internalizations from outside (Cohen and Levinthal, 1990, p. 32), and thus influence the recombinatory and innovative capacity of organizations. In a most general sense, learning is the *major process of human adaptation*. It encompasses life experience, creativity, problem solving, decision making, change, and development (Kolb, 1984).

We elaborate here on the concept and process of experiential learning as described by Kolb (1984). We see this as a particularly valuable perspective to understand the processes of successful innovation creation and development and their outcomes.

Traditional theories of learning, i.e. those based on behavior and cognitive models, focus on the result of the learning process and thus implicitly or explicitly assume that there is a one ‘correct or best’ way of doing things. They thus assume that knowledge could be acquired or transmitted independently from the process of learning. In contrast to these, the theory of experiential learning argues that knowing the outcome of learning (i.e. in our case, an innovative solution to a challenge imposed on an organization) is not far enough. In experiential learning in order to so, one should look at the process of adaptation and knowledge (re)creation in the environment. The experiential learning perspective is thus defined by Kolb (1984, p. 38) as following:

Learning is the process whereby knowledge is created through the transformation of experience... This definition emphasizes several critical aspects of the learning process as viewed from the experiential perspective. First is the emphasis on the process of adaptation and learning as opposed to content or outcomes. Second is that knowledge is a transformation process being continuously created and recreated, not an independent entity to be acquired or transmitted. Third, learning transforms experience in both its objective and subjective forms. Finally, to understand learning, we must understand the nature of knowledge, and vice versa.

Thus, the perspective of experiential learning argues that learning should be conceived as a process based on the experience and mutual transformation of the learner and his environment. In particular, the theory of experiential learning underlines the fact that learning happens between the individual or organization and its environment that reciprocally transform each other and that transformation acts as an impulse for further learning. Below we present the model of experiential learning as proposed by Dewey (Figure 4.1)

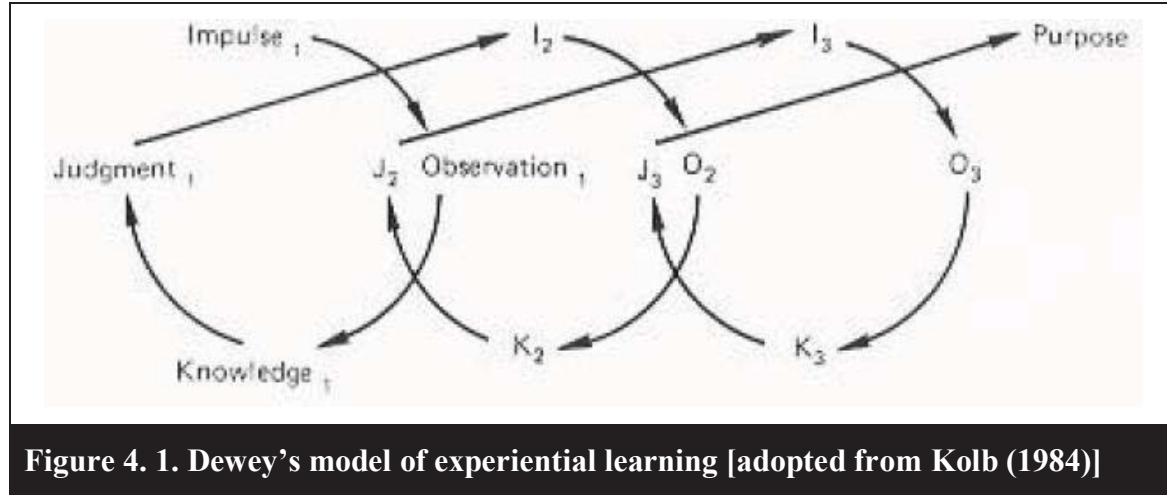


Figure 4. 1. Dewey's model of experiential learning [adopted from Kolb (1984)]

According to Dewey (1938), learning integrates experience and reflection, observation and action. In his model, Dewey distinguishes three main stages: 1) observation of surrounding conditions and environment; 2) knowledge on similar situations in the past, recollection of information, advice, etc.; and 3) *judgment* which puts together what is observed and what is recalled.

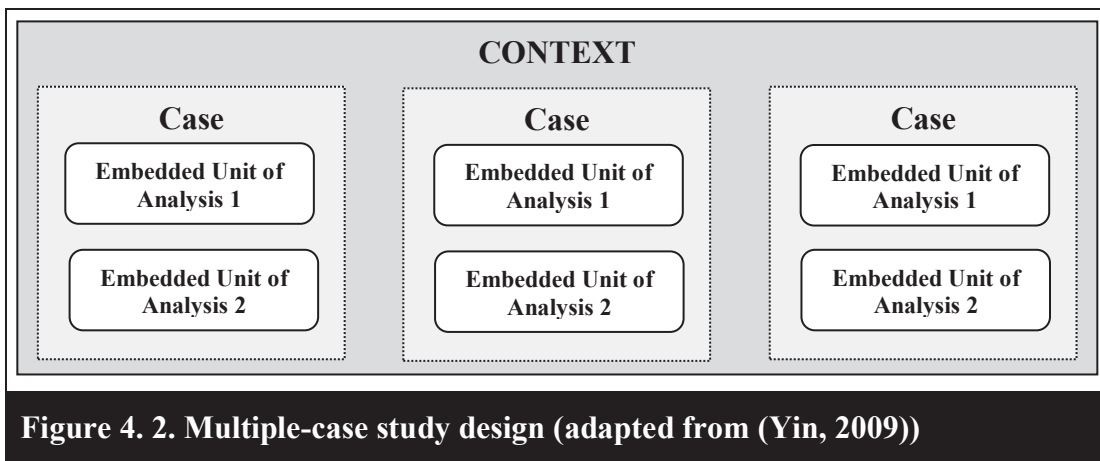
As mentioned above, the process of innovation creation is necessarily embedded into the learning process. In this light, we see the lens of experiential learning as particularly valuable to understand successful innovation and improvisation as it emphasizes the process and the environment of learning as well as underlines the mutually transformational character of the learning environment and learning outcome. In particular, the perspective of experiential learning is able to better explain the process of transformation of tacit to explicit knowledge, exploration and exploitation, as well as the role of environmental challenges when innovating.

4. 3. METHODOLOGY

This study follows an inductive qualitative comparative multiple-case study design based on multiple data sources and historical data analysis. We now explain our research design choice and methodology processes.

The inductive approach was employed in this research in order to build generalizations on the phenomenon of successful innovation creation in process through

the observation of a number of cases (Peirce, 1955; Richardson and Kramer, 2006). The qualitative research design is based on a comparative multiple-case study approach that enables us to address the novelty and the complexity of the phenomenon within the real-life context (Yin, 2009) as well as investigate its nuances and details. As a guideline to our research design of qualitative inquiry, we used Yin (2009) and Silverman (2000) as well as suggestions on managing interpretive research in information systems by Walsham (1995). Compared to the classical single-case study, the multiple-case study approach follows a different underlying rationale, i.e. the replication logics. The latter does not require the enumeration of all potential cases but implies that selected cases provide theoretically justified replication necessary to address the research inquiry (Yin,



2009) and the locally embedded units of analysis (see Figure 4.2).

Furthermore, the research setting of this paper investigates the 16-year period of home LAN development, from 1999 to 2010, in Minsk, Belarus, and thus builds on the analysis of historical and retrospective data. Retrospective analysis requires the accurate reconstruction of temporal chronologies but is well established in the management discipline (Langley, 2009). The data collection process for this research took place from July 2010 to April 2011 and generated multiple data sources.

We carried out a series of semi-structured interviews aimed at building a picture of how the interviewees, administrators and key users of Internet-access services thought about their roles and practices. Interviews provided insights on the diversity of embedded challenges that particular home LAN organizations met, the processes of their

sense-making and learning about these challenges and possible innovative solutions (i.e. organizational or technological innovations) to these, the processes of creation and implementation these solutions, and broader effects of these to the home LAN functioning and further development. We use Lincoln and Guba (1985) and Silverman (2000) as guidelines to our research design as well some suggestions on how to manage interpretive research in information systems by Walsham (1995). To structure interviews we also use the guidelines of Myers and Newman (2007).

In order to provide deeper insights to the cases and better understand what factors mattered for our respondents and why they selected certain types of strategies and practices, we used documents, archival records, and observation of the physical artifacts that complemented our interviews. The documents included home LAN statutes, news at the journals, websites, a great variety of photo and video-recorded material from the field, forums' discussions, related government laws of Internet-access regulation, and documented opinions of experts and politicians. Documents are important data sources as they contain information on name, dates, references and details on the event; are unobtrusive (are not created as a result of the case study); and often cover long periods of time and many events (Yin, 2009). Archival records included home LAN organizational records (such as balance sheets and user records), maps and charts with the geographical characteristics of home LANs. Archival records provide useful insights to the case under research as they contain precise and concise information (Yin, 2009). We also observed key physical artifacts in home LANs such as home LAN technologies – wired connections, hubs, modems, network chats, file search services, media galleries, etc. Physical artifacts are valuable data sources in case study research as they provide insights to the cultural features and technical operations of the studied phenomenon (Yin, 2009). All the data sources were triangulated and informed the research and knowledge generative processes.

First, 56 semi-structured interviews with administrators and users of more than 30 different home LANs were conducted, and a variety of documents, video and photo material, archival data was collected. Each interview lasted approximately 40 minutes, and was type-recorded and then written up to mark some important insights about the informants' reports. Using the data collected as a 'data base' as well as a knowledge

base on the phenomenon, we then selected, on the theoretically justified basis, three different home LANs that were particularly successful in developing innovations in the conditions of restricted environment and conducted a detailed retrospective multiple-case study analysis of their activities.

We justify the selection of each case as following. First of all, all the selected cases share the same context and have the same units of analysis in terms of challenges that they faced. Thus, a necessary requirement on the reliability of the multiple-case study approach (Yin, 2009) is met. Moreover, the selected organizations provide a representative sample of the whole population of home LANs as they cover a variety of organizational forms, path of development, number of users, and dates of creation. The details on these are presented in Table 1 in the following section.

The unit of analysis in this research is the process of successful improvisation and innovation creation in a restrictive environment. In order to classify different types of challenges imposed to home LANs by the restrictive environment, the following categories or comparative variables emerged from the data: ‘managerial challenges’, ‘resource-based challenges’, ‘organizational challenges’, and ‘political and legitimate challenges’. Building on these categories, we specified our unit of analysis to the subcategories such as the ‘process of successful improvisation and innovation creation in the environment with managerial challenges, resource-based challenges, etc. Following the general schema of multiple-case study research approach provided in Figure 1, we then compared the selected home LANs according to the above categories and based on the unit of analysis described above. Based on this approach, we aim at reaching the goal of multiple-case study, that is to build a general explanation that fits each individual case though differences in each case details (Yin, 2009), and thus provide insights into how organizations might innovate successfully in the context of restrictive environments.

4. 4. DATA ANALYSIS

4. 4. 1. Home LANs and their Context

The research setting of this study is presented by organizations called home local area networks (LANs) in Minsk, Belarus. They were created by citizens themselves from the bottom-up by linking their home personal computers with wires and other equipment to develop an alternative to the unaffordable Internet access and the inability to play multi-party games and share files. The case of home LANs as a research setting to understand the processes of successful innovation creation in the environments of restricted resources is interesting for a number of reasons:

- 1) Home LANs were developed by citizens lacking any professional and specialized technical and managerial knowledge;
- 2) Furthermore, they were developed in environmental conditions with highly restricted resources. In particular, there was a shortage of financial and operational resources and thus all home LAN equipment was afforded by home LAN users only by pooling money for it together and, as a consequence, sharing the common property rights on it. Thus, home LAN users combined professional networking devices (such as D-link, Genius LAN, etc.) with bricolage-made devices such as boxes for hardware storage in attics, lightning rods (see Figure 4.3).
- 3) Despite the limitations, home LANs attracted a great number of users that even competed against users attracted by state and private Internet service providers, - organizations with significantly higher access to financial, managerial, operational, and other resources and greater legitimacy. Thus, according to the evaluations of some experts ('Tut.By', 2.03.2010) about 90% of all home computers in Minsk were connected into home LAN networks.
- 4) The phenomenon of home LANs lasted through a long period of time - 16 years, - from creation of the first home LANs in 1994-1995 until 2010, the time when a government law announcing them illegal appeared and some home LANs developed into private Internet providers themselves.
- 5) When solving the challenges of restricted resources and legitimacy imposed by the environment, home LANs managed to cooperate with local municipal services and private Internet service providers. Notably, the cooperation with the

latter led to the creation of a number of successful technological and accounting innovations such as the ones enabling the link up of many users despite a limited number of modems and poor record keeping of Internet traffic of individual users within the network.

- 6) Despite the restrictions, home LANs created a variety of technical and organizational innovations that was monitored and captured by Internet service providers and later became the prototype of national Ethernet services offered by Internet providers, including the state-owned one, in addition to residential Internet connection.

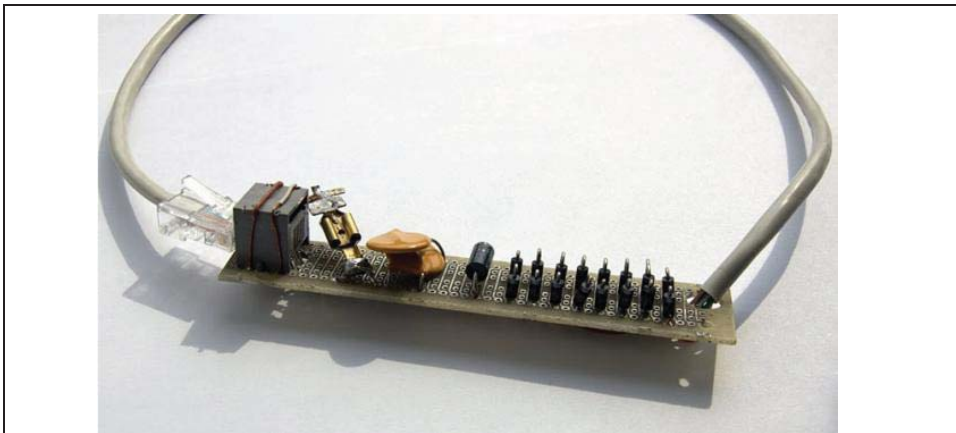


Figure 4. 3. Illustration of a hand-made lightning rod lightning rod – a device to keep home LAN wired connection safe during storms

On the one hand, the context of home LANs was enacted by the state-owned Internet provider Beltelecom and a number of private Internet service providers (ISPs). The Beltelecom company was keeping the monopoly for the external Internet channel (which meant that private ISPs were obliged to buy the primary Internet traffic from the monopolist inside the country at high prices). As a result, private ISPs offered expensive Internet access for individual residents. At the same time, the Internet service offered by Beltelecom was expensive as well and, moreover, offered poor quality (i.e. dial-up-based technology) service as compared to private ISPs. As a result, individual Internet access in Belarus and in Minsk in particular was largely unaffordable for citizens.

On the other hand, the context of home LAN creation was enacted in the conditions where Belarus and Minsk in particular were historically one of the main centers of computer science, engineering and electronics in the former USSR. These conditions resulted in the great number of people sharing the IT and computer culture and hobbies which facilitated and enhanced the processes of home LAN creation and development.

The following categories of challenges facing home LANs were developed from the data: managerial and organizational challenges, resource-based challenges, and political and legitimate challenges. Despite that we are aware that the above challenges intertwine in practice, we argue that in this paper distinguishing between them provides a better understanding of the innovation creation by home LANs. Below, we briefly describe the nature of each challenge.

We define *Resource-based challenges* as the challenges that home LANs experienced when lacking resources important for their creation and successful development. These challenges encompass the lack of financial and operational resources, and a lack of special knowledge of standardized solutions and know-how. We define *Managerial challenges* as the challenges facing home LANs organizational processes in the conditions of turbulent, complex, and unpredictable environments. Finally, we define *Political and legitimate challenges* as challenges of home LAN deficiency in political power, representation and legitimacy. The following subsection describes how the home LANs selected for the multi-case study responded to the above challenges.

4. 4. 2. The Selected Cases

We look at three home LANs that were one of the first among the home LANs created in Minsk (1994 - 1995) and managed to operate successfully over a long period of time (2008 - 2011); that were the first to cooperate with private ISPs and municipal services; that later developed into successful private Internet providers themselves. When selecting the cases, we also tried to select home LANs which were different in size, structure, and life histories to increase the representative power of the study. As a

result, the following three cases were selected for the analysis (see Table 4.1): ‘East’, ‘Centre’, and ‘West’ – named according to the Minsk city areas where they developed. For the reasons of home LAN protection, the original organization names are not displayed.

Table 4. 1. Characteristics of home LANs selected for the analysis and their innovation processes

Home LAN	Case 1 EAST	Case 2 CENTRE	Case 3 WEST
Year of creation	1998	1998	2000
Change in the organizational form	2010	2008	2009
Average Size	Several thousands of users	300 – 600 users	500-800 users
Structure	A ‘tree’ of administrators each supporting his own branch of the network, with the main and the oldest branch by the founding administrators	One main administrator and several key users assisting him	Several founding administrators (friends)
Innovation processes			
Managerial challenges:	Mainly based on experiential learning	Mainly based on experiential learning	Mainly based on experiential learning
Resource-based challenges:	Combination of planned and improvisational practices	Combination of planned and improvisational practices	Combination of planned and improvisational practices
Political and legitimate challenges:	Became a part of the Ethernet infrastructure of the existing private ISP (at the conditions profitable for the founding administrators)	Developed into an entrepreneurial organization	Developed into a private Internet-Ethernet provider itself

4. 4. 3. Case 1. EAST home LAN

Organization description

This home LAN was developed in 1998 and was initially founded by five 17-18 year old friends. Developed initially as an initiative of a couple of friends to have a means to play games together, the network eventually developed into one of the biggest and most successful among Minsk home LANs. As the founding administrator explains:

We started with technologies that at those times were extremely expensive, and now they are so old that just not possible to find in the market: with coaxial cables, low-speed network cards costing 50 dollars one, and network adapters that were

very expensive... At the moment when we stopped our development, we had the biggest network in the city.

The administrators of this home LAN were actually the main initiators of cooperation between the city home LANs and private Internet service providers. In particular, when the EAST home LAN had several thousand users, they visited all private ISPs in Minsk and proposed mutually profitable cooperation: cheap and quality Internet access for a big number of users. They managed to persuade a private provider to try the cooperation that proved to be very successful both for the EAST LAN (that received cheap Internet access and even more significant growth in the number of users) and for the private provider (that later became the leading company at the market of individual Internet access Minsk). Moreover, the cooperation led to the development of a number of organizational and technical innovations. In 2010 the founders of the home LAN sold the rights on the EAST LAN infrastructure to the private provider and created their own start-up in the same area.

Processes of Innovation Creation

During the time of its development, the EAST home LAN continuously met challenges of a resource-based, managerial and political nature. The data analysis shows that improvisational practices and experiential learning were of a great help in overcoming these challenges. This is how the founding administrator describes this:

Everything was first done with resources at hand, and we made plenty of mistakes and nothing worked well. Over time, we were looking at why something worked badly, what was wrong with it and we changed things. This is how we gradually developed our knowledge. This was **learning at practice** – the only way to create these things in our circumstances: nobody practiced this in our country then.

In the beginning, we only linked up with friends and peers. Explaining this to an outside person would be too complicated and, besides, we could not explain how it was working then; **we could only explain what we did to make it work.**

With the examples below, we illustrate how experiential learning and improvisation were important in addressing the challenges of the EAST home LAN met.

Resource-based challenges

As for all home LANs in Minsk, EAST home LAN equipment was created by combining professional equipment with bricolage technologies and improvising:

The basic network could be built with the most basic equipment. You just need an old computer and a program written in the LINUX application. It does not matter for the network which kind of operating system we use as it only plays the role of router linking some networks together [EAST home LAN administrator].

In order to buy the equipment necessary for the home LAN construction or reparation, all the users in the community equally pooled money together. However, with the increasing number of users the challenges of organizing for common resources increased either. This is how experiential learning helped to address this challenge:

When we became a group of 50-60 people, some serious problems appeared. Many things working for a small group did not work for bigger ones. Equipment reconstruction was necessary. The architecture was built in a chaotic manner and, besides, some equipment needed to be changed as it had deteriorated. We as administrators did not have enough money and we did not want to invest in them. Introducing a monthly fee or commercializing the network a bit was seen as a solution to create some regular funds. However, explaining to other people, especially to those far from the technical issues why they needed to invest money for the reformation was complicated: they had their network working somehow so why should they pay for something that they did not pay for before? So we started looking for a solution in the form of diverse marketing and management technologies and devices... This is how we developed a system of a small monthly fee and monitoring of the regularity of payments by individual users.

As a result, administrators in EAST home LAN introduced control switches, routing technologies, some bricolage developed applications and programs to the structure of their network. As one of the EAST administrators explains:

We were aware of the existence of some professional controlling equipment and solutions. However, this was too expensive for us. We wanted to make it with as cheap as we could. This is why we had to invent it. We specially looked for some already existing programs and adjusted these to our needs, or even developed some applications by ourselves and thus acquire knowledge in a new area.

Managerial challenges

The example described above also represents one of the managerial challenges faced by home LANs too – a necessity to organize and manage behavior of people so that the whole system carried on working and developing.

Another example of a managerial challenge faced by EAST home LAN was the necessity to organize for organization expansion and mergers with other networks.

Not all home LAN administrators in networks with whom we wanted to merge were happy about this. First of all, it was a question of power: “I created this, this is mine!”. Once again, we needed to think about tricks of how to help us merge the network and avoid the power battles. Furthermore, the networks usually had different architectures. Some remained at the archaic level, others were super-developed. And we had to think of something to link them technically and not to infringe upon the pride of local administrators... We found a solution by dividing the responsibility between administrators and by arguing that they needed to manage the technical problems by themselves in the network that they administer.

Political challenges

One of the biggest political challenges that EAST home LAN met was the challenge of founding an Internet provider that would agree to cooperate with them and sell Internet to the network users for low prices. As one of the EAST home LAN administrators explains:

We visited all the providers but at that moment only one of them, ‘Solo’, agreed to try this risky venture. Others were focused on the dial-up technologies, did not want to try anything new and were not so far sighted.

Initially, when we created the network, nobody thought that we will use it for shared Internet access. The network was for sharing files and multi-party playing. Then, the Internet was dial-up and only a few could afford this. The cost of a sole modem was 50 dollars – why would anybody buy it? Nobody had an idea what one could do in the Internet. However, when we created the network, we thought: So we are 50, and we are the network. The Internet is also a network but with millions of users. Then we started looking for a cheap way to get there. The easiest way was to buy one Internet access and share the access with the network technologies that we had. With the network technologies we created, we already knew how to do this.

We told ‘Solo’ ‘we have many users (this was our subject of trade) and we are what you need’. At the end, we negotiated that they will connect us for free and with a new technology previously unused in Belarus, and that they also develop special tariffs for us.

In particular, the cooperation of EAST home LAN and the ‘Solo’ provider led to a number of technical innovations including the pioneering use of VPN technologies in Belarus, the planning and implementing of fiber optics in the city home LANs, the development of accounting and banking technologies, and systems keeping stock of individual Internet traffic in shared modems, etc.

4. 4. 4. Case 2. CENTRE home LAN

Organization description

CENTRE home LAN was developed in 1996 by three friends of 15-16 years old. It is particularly interesting because it developed successfully and sustainably over a long period by the home LAN administrator and his several assistants while its users developed a number of innovative services and technologies. In 2010, the network was registered as individual entrepreneurial organization.

Processes of innovation creation

As with the case of EAST home LAN, the process of innovation creation here met a variety of resource-based, managerial, and political challenges and was addressed by improvisational practices and experiential learning.

Resource-based challenges

Similar to the EAST home LAN, the main challenges of CENTRE home LAN were a lack of financial resources and knowledge on how to construct the network. In the words of a home LAN administrator:

We invested 20 dollars each and bought two switches, cable, a spanner for crimping RJ-45 cables and 100 connectors. We had so many of them because we did not know how to crimp then and had to train ourselves. After succeeding in crimping, we drilled holes between the floors, connected everything with crimped cables and ... it did not work! It turned out that the way we crimped caused a lot of noise so the signal could not be transmitted correctly over long distances. So we had to re-learn.

When we first decided to build a network to play, none of us had any knowledge in this area... We looked for some books, my father had general technical knowledge in telecommunications, and the rest came from practice.

Managerial challenges

As with the EAST home LAN, CENTRE had to overcome the managerial challenges of motivating administrators from other home LANs to link-up. As one CENTRE home LAN administrator explains:

Until we were interested we absorbed neighborhood networks. We wanted to unite local small networks that often consisted of a one building, so to create a bigger network. We usually came to those people and told them: “We will link you up if you want. You do not have to change anything in the network architecture. We just link the networks together and you give money for the equipment... The logic that we conveyed to them was the following: the more people, the more resources we can share, and the more networks with modems that are united for the better and the cheaper the Internet is.

Another managerial challenge was a question: how to attract new users. The founders of the CENTRE home LAN were very enthusiastic about the network and they wanted to share their achievement and technology with other people. Their main logo was: ‘More people – more fun’. However, the administrator of this network acknowledges that after the initial main goal of the network creation was reached (i.e. the means to share files and play multi-party games was created), extensive development of the network stopped. This is how the CENTRE administrator describes how he managed this challenge:

Of course, I put the notice about our network and asked all friends and friends of friends who had computers to join. Furthermore, as I really wanted the number of users to grow, I asked all the people I knew in the neighborhood about their plans to buy a home computer and join our network. I had a special memo-book where I put all the names, telephone numbers, etc., of those who were potentially interested and I phoned them from time to time.

Finally, facing both resource-based and managerial challenges of collecting a monthly fee for the network development and stimulating users to pay regularly, the CENTRE home LAN administrator developed a number of innovative tricks:

I came up with an idea of a ‘transparent accounting’ in order to stimulate people paying at least the monthly fee. So I created an accounting documentation system which I put on the net server available to all users and renewed it on a regular basis. First, everybody could see who pays and who does not. Second, as all the costs and revenues were documented, people could see where the money was going. Finally, since at one of our regular meeting we decided to introduce some small regular fee for the administrator’s technical support, I tape-recorded and took a picture of every problem or repair that I made and posted it on our website.

My another approach was to produce computer video tutorial solutions to the most typical problem of the network users: how to connect to the LAN, specify the

network settings, etc. This is how I set myself free from the most boring and repetitive administrator tasks and gained time to connect new users.

These activities were successful:

In general, I linked up about two new users per day on average. A general law was the following: one new user in a new multi-storied building immediately brought another 5 people wanting to link-up in this building. There were even people waiting in line until I will be able to connect them.

Political challenges

A typical challenge for a home LAN was to cooperate with municipal organizations holding keys to attics and basements and underground channels of telecommunications – places important for home LAN equipment. This is how CENTRE home LAN addressed the challenge:

We tried to keep good relations with municipal organizations. We looked for some personal social ties as talking to a director or the main engineer directly. Besides, in our home LAN we had several users working in municipal services themselves, or whose parents or relatives worked there. Another way that we found was making some work for them like building flowerbeds or planting flowers for them in public places, etc.

In 2007 a first government law restricting home LANs was introduced. They were required to register legally but there was no law for them to register as community-based organizations or non-profit associations of individuals. In particular, according to the law, organizations in the area of telecommunications (home LANs were these organizations as they used low-power communications) had a choice of registering either as individual entrepreneurial organizations or as private organizations with a specific owner, but this contradicted to their community nature and common property. Furthermore, the registration process itself required the investment of several thousand dollars for an average network of 400-500 users and this acted as an additional obstacle. Nevertheless, in 2010 CENTRE home LAN was registered as an individual entrepreneurial organization by its administrator.

4. 4. 5. Case 3. WEST home LAN

Organization description

The organization was developed by three founding home LAN administrators in 2000. The motivation behind its development was the same as in EAST and CENTRE – playing multi-party games and sharing resources in the conditions where no affordable means existed for this. WEST home LAN had 500 – 800 users. In 2009 another three persons joined the three administrators of WEST home LAN and together they launched a start-up developing into a private Internet provider themselves. Notably, when developing into a private provider, the administrators of WEST home LAN created a new organization while also keeping their home LAN as a platform for keeping their users. We explain this decision in the subsection on political challenges,

Processes of innovation creation

Resource-based challenges

As with EAST and CENTRE home LANs, WEST home LAN experienced problems of lacking sufficient financial and operational resources. The organization answered this challenge with improvisational practices and learning from practice. Below, we provide an example of how WEST home LAN addressed the problem of insufficient operational resources.

At some point, we needed a wire of a good quality and also resistant to bad weather conditions. The wire that would fit this demand perfectly was the fiber optics, but the price for this was just unreachable. We found a better solution, however. One of our home LAN users was a former military personnel and he had a big piece of military field cable P-296 somehow saved at his place since the Soviet break down. The cable fit us perfectly – this was isolated, indifferent to weather conditions and coopered, and thus increased the quality of signal in the network significantly.

Managerial challenges

In line with resource-based challenges, WEST home LAN addressed managerial challenges with improvisational practices and experiential learning.

Constructing a network connection between the neighboring multi-storied buildings was challenging. In order to overcome the difficulty, we developed a special technique: a cord was pulled down from the roof, tied to the cable and then pulled on back on the two roofs. Sometimes, however, even this technique did not work: for example, when there were growing trees or tramway cables between the buildings which blocked the rope trick. In these cases, the process of the wired

construction turned into a pure creativity: in the attempts to build this we used a bow and arrows... child electrical cars and planes... and even potatoes (as stones were too dangerous to throw).

Political challenges

As mentioned above, a government law prohibiting home LANs appeared in 2007. Following this, another government law announcing all home LANs illegal appeared in 2010. In 2009, WEST home LAN administrators and another three persons launched their own providing company of individual Internet access. However, they also kept the WEST home LAN structure unchanged. There were two underlying reasons for such a decoupling. First, the founders of a new Internet provider still needed all the special permissions for planning and building their own Ethernets to be approved by the National Ministry of Connection and Telecommunication. At the same time, older and already well-known providers had permissions to build their own Ethernets in the city areas. As a result, a competition for users was high and Internet providers used various means to gain users from each other. Many users of home LANs left them for the rich resources proposed by Ethernets of private providers. As administrators of WEST home LAN mention, in 2010 there were only about 200 users of WEST home LAN left as compared to the previous number of 800. Thus, when administrators of WEST home LAN developed into a private provider themselves and were waiting for all the permissions to be approved, they kept several Internet operators in their previous WEST network. As they explained:

In our home LAN, we support three providers. Each user has the possibility to choose the provider he likes and change it at any moment while also keeping the services of the home LAN independent.

This trick helped the founders of the ex-WEST home LAN to keep their users and save them from ‘takeover’ by more powerful and legitimate Internet providers.

4. 5. DISCUSSION AND CONCLUSION

This paper studies how organizations might develop and innovate successfully in the conditions of limited resources, organizational complexities and a lack of political

legitimacy. The research is based on an inductive multi-case study of three home LANs in Minsk, Belarus. Home LANs were the innovative communities of end-users linking their individual home computers to create a means to share files, play multi-party games and substitute for the unaffordable Internet access services. Even though home LANs did not have special financial investment, management and marketing departments to create rational strategic plans and strategies, and were even a subject of coercive pressures coming from government and private organizations, they managed to successfully compete with those organizations over a long period.

The three selected cases represent home LANs with different structure, time of creation, and strategic choices: those that accepted the institutional and political pressure and broke up being assimilated into the infrastructure of a private ISP; those that developed into an entrepreneurial organization; and those that developed into a private Internet provider themselves. The data analysis showed that home LANs managed to create successful innovations because they focused on the improvisation and learning, emphasizing the process, experience and co-evolution with the environment rather than planned actions, standardized solutions, and focus on the outcome. The research has the following theoretical and practical contributions.

The main contributions of the study lie in the areas of innovation development and implementation, organizational improvisation, experiential learning as well as the emerging research on user-driven innovation (Castells, 2001; Von Hippel, 2009) and community-based technology activism (Powell, 2008; Powell and Meinrath, 2008). In particular, using the lenses of organizational improvisation and experiential learning, the research provides insights to understanding *the processes* of successful innovation creation and development in the conditions of complex, uncertain and restricted environments. Furthermore, in contrast to Von Hippel (2009) arguing that users innovate after they become experienced 'lead' users and that they develop innovative processes based on the their existing knowledge and capabilities, we find that user-driven innovation processes and the processes of their learning, expertise and knowledge creation develop simultaneously.

The research has a number of practical contributions. Thus, the case of home LANs illustrates the processes and practices of successful innovation creation in the

conditions of complex and restrictive environments. Our findings indicate that successful organizational innovations in restrictive environments requires organizations to emphasize experiential learning, focus on the process rather than the outcome, and employ improvisational rather than standardized solutions and emergent strategies as an answer to a particular environmental challenge. In this light, our study contributes to understanding the processes of organizational innovation in general and provides insights to end-user and grassroots innovations in particular.

End-user and grassroots innovations are argued to be a widespread and an important phenomenon to the realities of contemporary society (von Hippel 2009; IESE, 2011; Castells, 2001; Fitzgerald, 2006) that becomes of underlying importance of industry. Thus, as Anthony Townsend, the research director at the Institute for the Future, given at the 2011 World Congress ‘Smart City: Aligning Industry and the Grassroots’,⁵ argues:

What the grassroots provide is creativity, new ideas, new ways of thinking about problems and solutions. What the industry provides is incredible excellence, the ability to engineer robust systems and to do massive scales. (IESE, 2011)

In this light, the case of home LANs represents the case of successful innovation creation by the grassroots innovative communities in the conditions of highly restricted resources and a variety of challenges, i.e. of resource-based, managerial and political nature, that are relevant to the context of many developing countries. For example, Garcia-Perez, Mitra, and Somoza-Moreno (2006) discuss how free and open-source software (FOSS) innovative communities might be essential for the national IT infrastructure development in a resource-scarce country like Cuba.

As a contrast to the more traditional actors in the fields, i.e. Internet service providers, having vertical hierarchical structure and operating with deliberate strategies (Mintzberg, and Waters, 1985), grassroots organizations, i.e. home LANs, had mostly horizontal structure and were developed by citizens from the bottom-up. Below, we present a summary of home LAN activities that we argue enabled them to create successful innovations in the conditions of restrictive and unpredictable environment:

⁵ The World Congress incorporated 51 large IT organizations, including CISCO, IBM, SIEMENS, Schneider Electronics, Indra, etc., and researchers worldwide

- Their activities were often spontaneous, intuitive, and improvisation-based.
- Their activities were based on real-time learning.
- The know-how of administrators and users was coming from books, forums, discussing with each other and then trying to implement some activities or searching for in the Internet for a piece of code and then developing it.
- There were no special marketing or management departments in social innovative organizations;
- No special management strategy of competition with government or private organization was developed but a focus was on people's need and a try to satisfy it.
- Home LANs developed their innovations by focusing on their users' needs and circumstances in real time rather than planning in advance and trying to implement what was scripted.

Further research might investigate whether the identified innovative practices hold true in the organizations with more traditional hierarchical structure and which have a non-community-based nature.

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Chapter 5:

CONCLUSION

This chapter summarizes and consolidates the results presented in this dissertation. It does so by elaborating on the conclusions established in each paper and by highlighting the potential implications of this research as a whole and its theoretical contributions. The chapter is structured as follows: we first present the dissertation summary, and then discuss its main implications and theoretical contributions.

5.1. DISSERTATION SUMMARY

This dissertation contributes to our knowledge of the phenomenon of end-user innovation. Through the three research essays it shows how technology enacted by end users becomes a background for end-user innovation and broader organizational, social and institutional transformations. In particular, it argues that the creation and development of end-user innovations is the result of the contingent interplay of the actors of different nature and kind: human and non-human; citizens, government Internet providers, and non-government organizations; users and administrators; institutional logics, field characteristics, local culture and historical conditions, etc.

The dissertation builds on the research setting of a developing country, Belarus and its capital Minsk, where a local Internet infrastructure was developed by citizens mobilizing from the bottom-up and creating community networks, called home local area networks (LANs). The research setting provides a fruitful background for studying the phenomenon of user innovation and related broader transformations. In particular, it looks at the 16-year process of Internet infrastructure development by citizens, eventually linking their home computers with wires to a mature ‘million-user’ infrastructure of home LANs and the development of a series of service innovations accepted as prototypes of national Ethernet services by Internet providers.

Each of the three research papers constituting the dissertation takes a different angle on the phenomenon of end-user innovation in home LANs. Paper I looks at how technology structure and meaning in home LANs eventually co-evolved with the communities of their users, users’ inquiries and the interplay between the meaning of

technology as a tool (i.e. pragmatic meaning) and technology as a symbol (i.e. symbolic meaning). Paper II looks at the foreground patterns of change in home LAN technology and routines co-entangled with the broader institutional dynamics and field characteristics, and the interplay of other Internet actors. Finally, Paper III looks at how successful innovations in home LANs were possible in conditions of highly restricted resources and a variety of challenges. The paper argues that innovations were successful because home LANs focused on the improvisation and learning, emphasizing the process, experience and co-evolution with the environment rather than planned actions, standardized solutions, and focus on the outcome.

5.2. IMPLICATIONS OF THE RESEARCH

The dissertation has two broad implications: end-user innovation and ICT-enabled community networking and technology activism.

5. 2. 1. End-user Innovation

End-user innovation and technology co-creation is a phenomenon that played an important role in the development of many important contemporary technological artifacts (i.e. the telephone, Internet, home PCs (Castells, 2002; Dutton, 2008; Fischer, 1992; Kraut, Mukhopadhyay, Szczypula, Kiesler, and Scherli, 1999; von Hippel, 2009, 2010).

With the case of home LAN grassroots Internet development, this dissertation illustrates that the processes of end-user innovation happens not in isolation but with the tight co-entanglements and co-creation with other actors. This view differs from and contributes to the understanding of the phenomenon of user innovation as proposed by von Hippel (2005, 2009, 2010) - perhaps, the main reference in the area of user innovation. In particular, von Hippel (2005) argues that the existence of an innovative community, i.e. informal user-to-user cooperation, and lead users act as the main driving forces of user innovation. Although our findings do support the importance of innovative communities (communities of home LAN users were, indeed, crucial to the creation and development of home LAN innovations), our findings also go beyond the

boundary of the community and the lead user. The dissertation evidences that the phenomenon of user innovations in home LANs was only possible because of the tight interplay and co-entanglements of a variety of other actors: government and private Internet providers, institutional drivers, culture, non-human agencies such as wires, hubs, modems, etc. This interplay enabled the creation of sociomaterial entanglements of different levels (i.e. ‘macro’ and ‘micro’), symbolic and pragmatic meanings, and improvisational and bricolage practices - all crucial to the creation and development of user innovation in home LAN communities. In this light, this finding supports the arguments of van Oost et al. (2009) arguing that users might act as the driving force in *all phases* of the innovation process.

5. 2. 2. Community Networking

The changing nature of contemporary technology (i.e. the Internet, social media, and Web 2.0 technologies) change the scope and the nature of communication providing increasing opportunities for networking and communication of actors that otherwise would stay unconnected and immobilized. This phenomenon takes place all over the world and holds true through both developed and developing contexts. For example, the phenomenon similar to the case of home LANs in Belarus took place in Canada where local citizen communities developed an alternative to the traditional top-down wireless Internet infrastructure from the grassroots in order to address the digital divide, create new opportunities to participate in civic life, and solutions for freelance workers, and create ‘public good’ (Powell, 2008a, 2008b; Powell and Meinrath, 2008). A similar case of wireless end-user community development is discussed by van Oost et al. (2009) studying ‘Wireless Leiden’, a local wireless network infrastructure in the Dutch town of Leiden initiated, designed, and maintained by a local community of users. Other examples include the projects ‘Paris sans fils’ (<http://and.and.www.freenews.fr> and spip.php?article5062), (Rees, 2007), France; ‘Neighbors online’ taking place in St. Paul and Minneapolis cities, USA, (<http://and.and.blog.e-democracy.org> and [posts and 1430](http://posts.and.1430)); and the ‘Blacksburg Electronic Village’ an example of a local community – university link (<http://and.and.www.bev.net> and www.bev.net).

This ICT-enabled networking has a vibrant transformative potential of not only connecting and empowering new actors, previously unconnected and invisible, but also to provide alternative and local solutions to the already existing institutions and actors, as well as mesh up and reconnect the old and the new actors, i.e. the industry and the grassroots (Castells, 1996; Dutton, 2009; Dutton and Eynon, 2009).

In this light, understanding the processes of how technology becomes a background for end-user mobilizations, community networking and development as illustrated in this dissertation with the case of home LANs makes sense. In particular, the knowledge of the main contribution of this dissertation – that the above processes develop not in isolated user communities but are tightly co-entangled with a variety of actors, including those of the non-human nature, provides valuable insights.

5.3. THEORETICAL CONTRIBUTIONS

The dissertation has theoretical contributions in line with its research papers.

Paper I: The paper contributes to both activity theory (Leontiev, 1978; Lorino, 2006; Peirce, 1931, 1955; Vygotsky, 1978, 1983) and the theory of technology enactment (Orlikowski, 2000; Orlikowski, 1992) by opening debates on the importance of differentiating between the symbolic and pragmatic meanings of technology and considering the interplay between them. Furthermore, our findings indicate that the dynamics of organizational identity influenced the symbolic meaning of technology and the way the structure of technology was enacted by end-users. We find support for the findings arguing that: i) end-users might act as co-creators of technology structure and meaning in the process of technology enactment (Castells, 2002; Ciborra, 2004; Gopal and Prasad, 2000; Green, 2001; Heeks, 2010; Morawczynski, 2008; Orlikowski, 2000; Orlikowski, 1992); and ii) that this enactment might lead to important technological and organizational innovations (Castells, 2002; Ciborra, 2004; Dutton, 1999; Dutton, 2008). In contrast to previous studies acknowledging that individuals might be involved in the technology feature extension behaviors only after gaining substantial experience in technology use (Cooper and Zmud, 1990; Goodhue and Thompson, 1995; Kwon and Zmud, 1987; Saga and Zmud, 1994) or by the lead users (von Hippel, 2005), our

findings indicate that end-user co-creations might happen at the pre-adoption, adoption and post-adoption stages (Rogers, 1995). Thus, the Internet technologies and infrastructures in home LANs were eventually co-created by users through the three stages.

Paper II: This paper provides contributions to both sociomateriality and institutional theory. First, it contributes to the knowledge on the processes and results of sociomaterial imbrications of routines and technologies (Leonardi, 2011; Leonardi and Barley, 2008; Orlikowski and Scott, 2008; Scott and Orlikowski, 2009) as embedded in larger institutional dynamics and complexities. In particular, the paper argues that the processes of organizational sociomaterial imbrications of technologies and routines can only be fully understood if larger contextual and inter-organizational aspects are taken into account. Our findings only partly support the recent findings of Leonardi (2011) about the perception-based nature of these changes as we evidence that this is not applicable in certain types of environment. Thus, we show that in organizational fields where multiple and conflicting logics co-exist the patterns of sociomaterial imbrications might be significantly different from those previously suggested. Second, the paper contributes to studies of institutional theory by highlighting the role of objects, such as technology, in the process of institutional change (Arjaliès, 2011; Knorr-Cetina, 1997; Spee and Jarzabkowski, 2009) and providing an understanding on how technologies and technology-related practices are embedded and shaped by broader institutional influences (Avgerou, 2008; Lamb and Kling, 2003; Orlikowski and Barley, 2001). Linked together, these two contributions provide a framework to systematically analyze the influence of the field structure characteristics and their dynamics on within-organizational processes and patterns of sociomaterial imbrications of routines and technologies.

Paper III: The paper half-opens the black box of successful innovation creation processes (Fagerberg, Movwery and Nelson, 2004). It uses the lenses of organizational improvisation (Ciborra, 1996; Crossan and Sorrenti, 1996; Crossan et al., 1996; Cunha, Cunha, and Kamoche, 1999; Moorman and Miner, 1998a, 1998b) and experiential learning (Dewey, 1938; Kolb, 1984) to contribute to our understanding of *the processes* of successful innovation creation and development in the conditions of complex,

uncertain and restricted environments. The main contributions of the study lie in the areas of innovation development and implementation, organizational improvisation, experiential learning as well as the emerging research on user-driven innovation (Castells, 2002; Von Hippel, 2009, 2010) and community-based technology activism (Powell, 2008a; Powell and Meinrath, 2008).

The theoretical contributions described above provide a background for further research investigating the process of user technology enactment, sociomateriality of technology and organizing, and innovation processes.

5.4. LIMITATIONS OF THIS RESEARCH

This research has several limitations. First, we present only a potted history of home LAN development as a phenomenon that first started in 1994-1996 and declined or went underground in 2010.

Second, although our data analysis has shown significant commonalities through the diversity of home LANs, every network comprised its individual and unique story. For example, some home LANs were created in 1995 while others were created in 1998 or 2002.

Finally, because of the lack of clear historical and accounting descriptions, we did not consider merges between home LANs as a particular change event in the boundaries of the community of users. Instead, we looked at the change in the number of users without trying to explain its origins. However, merges were important and necessary events in the development of home LANs, especially those that incorporated hundreds and thousands of users. The aim of this research, however, was not to describe the whole population and individualities of home LANs but to reveal important commonalities in the ways that technologies, their meaning and practices of use co-evolved in home LAN communities and structured themselves around the initial technology of home computers.

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Chapter 6 : RESUME SUBSTANTIEL EN FRANCAIS

6. 1. INTRODUCTION

“En ce moment, il y a des innovations grassroots vraiment très vibrantes... Il ne s’agit pas seulement de prendre les systèmes technologiques et de les faire fonctionner un peu mieux, mais de transformer l’expérience totalement pour la rendre plus sociale, plus transparente et plus inclusive...”

“Ce qui se passe en ce moment est très fortement animé par la vision de l’industrie. Une possibilité existe que nous n’allons pas entrer dans l’avenir des technologies qui soient à la fois grandes et rentables et refléter des valeurs démocratiques et ouvertes et de la culture. Nous avons des industries qui viennent et peignent leur vision sur la ville en s’organisant autour de leurs technologies et n’écoulent pas ce qui se passe dans les grassroots où les gens ont une vision et des objectifs très différents... Si seulement nous pouvions entamer une conversation...”

Anthony Townsend (IESE, 2011)

Les citations précédentes proviennent de l’interview d’Anthony Townsend, le directeur de recherche à l’Institut pour l’Avenir, qui a été donnée au Congrès Mondial 2011 ‘Smart City : Alignement de l’industrie et des grassroots’⁶. Ces citations soulignent l’importance des innovations grassroots, leur pouvoir de transformation et leur différence par rapport aux visions traditionnelles de l’industrie. Cette thèse étudie le phénomène de l’innovation grassroots à l’aide des TIC en considérant que les développements ci-dessus se fondent sur la nature variable de la technologie contemporaine et l’interaction utilisateur–technologie.

La recherche a reconnu certains des changements dramatiques en cours liés à la nature des objets technologiques et aux reconstitutions connexes de la technologie par les utilisateurs. Parmi ces contributions à la recherche sont les arguments que la technologie devient de plus en plus complexe et intensive en connaissances (Nambisan, Agarwal, and Tanniru, 1999); flexible et modulaire (Leonardi, 2011); symbolique et non neutre (Aakhus and Jackson, 2005; Ågerfalk, 2010; Prasad, 1993); omniprésente et utilisée dans des contextes différents (Attewell and Savill-Smith, 1992) tandis que son sens ne peut pas être transmis et doit être découvert en continu ‘de novo’ par les

⁶ Ce Congrès Mondial a rassemblé 51 grandes organisations informatiques, y compris CISCO, IBM, SIEMENS, Schneider Electronics, Indra, etc. et les chercheurs à travers le monde.

utilisateurs (Attewell and Savill-Smith, 1992; Nambisan et al., 1999). Ces changements transforment la façon dont les utilisateurs adopter la technologie : de plus en plus souvent, les utilisateurs deviennent co-producteurs de la technologie (Castells, 2002; Green, 2001; von Hippel, 2005, 2007, 2009), se mobilisent et font des innovations en partant des grassroots (Heeks, 2010), créent des nouvelles structures sociales informelles et alternatives à l'aide des TIC et des réseaux sociaux (Aakhus and Jackson, 2005; Ågerfalk, Aakhus, and Lind, 2009), et travaillent en réseau de manière transformative avec des acteurs plus traditionnels de la société (Dutton, 2009; Dutton and Eynon, 2009). À la lumière de ces changements, des nouvelles optiques et idées théoriques qui pourraient expliquer l'utilisation et le développement des technologies contemporaines dans les organisations, deviennent nécessaires (Orlikowski and Scott, 2008) (Orlikowski, 2009; Scott and Orlikowski, 2009) .

Cette thèse propose une enquête sur le phénomène de la co-crédation de la technologie par l'utilisateur final (par opposition au changement de la technologie dicté par l'industrie) et les processus et les effets des développements d'innovations grassroots. La question principale posée par la thèse est alors la suivante :

Comment les TIC et les technologies des réseaux sociaux deviennent un fond pour l'innovation par l'utilisateur final et les mobilisations ascendantes des citoyens et comment ces évolutions pourraient modifier et créer des alternatives aux infrastructures, institutions et acteurs existants?

Afin de répondre à cette question, la thèse prend le point de vue du *processus* du phénomène qui fait évoluer le *contexte* – l'interaction et l'enchevêtrement des différents acteurs et complexités de l'environnement – et aborde le phénomène à *plusieurs niveaux*. Ce faisant, la thèse mobilise les perspectives de la théorie institutionnelle, les théories de pratique (à savoir, la théorie de sociomatérialité, les théories de la technologie-en-pratique et l'adoption des technologies), la théorie de l'interaction symbolique, l'improvisation organisationnelle et l'apprentissage expérientiel, ainsi que les théories pour faire face aux données des processus et l'analyse contextuelle du changement. Sur le plan méthodologique, la thèse est basée sur la construction d'une enquête qualitative approfondie par les approches abductive et inductive, et les études de cas.

La thèse est composée de trois articles qui partagent le même cadre de recherche et contribuent aux connaissances colligées pour l'enquête de recherche sous-jacente. Les articles (ci-après dénommées Articles I, II et III) sont les suivants :

- I- Co-Création ascendante : Adoption transformative des technologies par l'utilisateur final et sa signification dans les organisations à base communautaire.
- II- Comment la sociomaterialité et les institutions s'enchevêtrent : Une étude de cas de communautés d'utilisateurs finaux et de développement de l'infrastructure Internet.
- III- Succès des innovations avec des maigres ressources : Pratiques d'improvisation et apprentissage expérientiel dans les organisations communautaires créées par des utilisateurs.

Le cadre de la recherche de cette thèse est basé sur les 16 ans de la co-crédation de l'infrastructure Internet locale grassroots à Minsk, en Biélorussie, par les organisations de citoyens résidentiels appelés des 'réseaux locaux domestiques' (LAN domestiques). Ces organisations ont développé l'infrastructure Internet alternative qui est venu suite de l'incapacité du gouvernement et des fournisseurs d'accès Internet privés de créer une infrastructure Internet à prix abordables pour les utilisateurs individuels.

Le phénomène de la co-crédation de l'infrastructure Internet grassroots de LAN domestiques à Minsk fournit une riche expérience pour répondre à la question sous-jacente de la thèse et comprendre le phénomène de la co-crédation de technologie par l'utilisateur final des points de vue multiples. Le cas est particulièrement intéressant pour un certain nombre de raisons :

- 1) LAN domestiques ont créés une infrastructure Internet alternative pour plus d'un million d'utilisateurs.
- 2) Les citoyens ont développé avec succès des innovations technologiques et organisationnelles dans des conditions de ressources financières limitées, manque de connaissances en gestion spéciales et à travers d'une logique et une dynamique du domaine institutionnel complexes, ainsi que d'autres complications. Néanmoins, les LAN domestiques sont restés une des formes principales de services d'accès Internet pour les citoyens pendant les 16 ans de 1995 à 2010.

- 3) Les innovations technologiques développées en cours de création des LAN domestiques ont été copiées par des fournisseurs d'accès Internet privés et d'État, intégrées à leurs propres plates-formes et sont devenues plus tard les prototypes des normes nationales Ethernet.
- 4) Pendant une période importante de leur développement, les LAN domestiques ont réussi à coopérer avec succès avec des organismes privés et municipaux, fournissant ainsi un cas de collaboration entre les grassroots et l'industrie.
- 5) Le cas des LAN domestiques comme nouvelles formes d'organisation développées sur la base informelle par les citoyens eux-mêmes de manière ascendante, ce qui rend le processus de développement de l'infrastructure Internet plus inclusive, sociale et transparente et cela coïncide avec les phénomènes de modèles de développement transformatif aidé par les TIC grassroots (Heeks, 2010), organisations en réseau collaboratives (Dutton, 1999), activisme technologique communautaire (Powell and Meinrath, 2008) et mobilisations citoyennes.

Des phénomènes similaires à des LAN domestiques en Biélorussie (mais à une échelle relativement plus petite) a eu lieu dans d'autres pays comme la Russie, l'Ukraine, la Pologne et la Roumanie, ainsi qu'en Amérique du Nord (par exemple, la création de l'infrastructure Internet alternative par les communautés canadiennes de réseaux sans fil) (Powell and Meinrath, 2008) et en Pays-Bas (van Oost, Verhaegh, and Oudshoorn, 2009). Toutefois, les organisations grassroots qui proposaient l'accès Internet, par exemple en Russie et en Ukraine, ayant des origines libres à la base, ont été rapidement transformé en des formes plus viables commercialement, poussés par l'achèvement du marché de fournisseurs d'accès Internet privés. En Biélorussie, le processus de co-crédation de l'infrastructure Internet par des organisations grassroots et leur transformation en des formes plus viables commercialement (Fitzgerald, 2006) a été grandement temporisé en raison des conditions administratives, du monopole d'État sur la vente du canal Internet et des conditions du marché sous-développées. Cette procrastination crée une rare occasion d'étudier et de comprendre le processus de la co-crédation de l'infrastructure Internet et de ses technologies et de leur développement en profondeur. En conséquence, l'étude se réfère à un phénomène qui n'est pas unique,

mais donne un aperçu d'un phénomène largement sous-théorisé dans la littérature. Le paragraphe suivant, ainsi que les trois articles qui forment les chapitres 2, 3 et 4 de cette thèse, donnent de plus amples détails sur le cas.

Les trois articles s'appuient sur le cadre de recherche décrit ci-dessus. Cependant, chaque article adopte un point de vue particulier sur le phénomène et pourrait être considéré comme un projet de recherche indépendant. Le premier article, 'Co-Création ascendante : Adoption transformative des technologies par l'utilisateur final et sa signification dans les organisations à base communautaire', introduit le lecteur dans la théorie et les cas pratiques de l'innovation par l'utilisateur final et développe un modèle pour étudier l'adoption et le changement des technologies par l'utilisateur final. En outre, il examine comment des artefacts technologiques et leur signification co-évoluaient dans les communautés d'utilisateurs de LAN domestiques au cours des 16 ans – de l'utilisation résidentielle d'ordinateurs à domicile au développement d'une infrastructure Internet alternative. Le second article, 'Comment la sociomatérialité et les institutions s'enchevêtrent : Une étude de cas de communautés d'utilisateurs finaux et de développement de l'infrastructure Internet', se penche sur les tendances de premier plan du changement dans les technologies et les routines de LAN domestiques et sur leurs imbrications sociomatérielles comme incorporées dans les dynamiques institutionnelles plus grandes. Cet article contribue à notre compréhension de la façon dont les enchevêtrements de la matérialité sociale et les tendances de premier plan de changement dans les routines et / ou technologies organisationnelles sont formés dans la pratique. Le troisième article, 'Succès des innovations avec des maigres ressources : Pratiques d'improvisation et apprentissage expérientiel dans les organisations communautaires créées par des utilisateurs', se penche sur les processus de création de l'innovation, l'improvisation et l'apprentissage expérientiel dans les LAN domestiques. L'article vise à comprendre et à expliquer comment les LAN domestiques ont réussi à innover et à se développer avec succès dans un environnement avec de maigres ressources, l'incertitude élevée et la concurrence avec des organisations ayant un accès plus large aux ressources et une plus grande légitimité. De plus amples détails sur les études, y compris leur présentation, les unités d'analyse et les principales contributions sont fournies dans la section 1.5.

Avec les travaux de recherche mentionnés ci-dessus, la thèse fournit des contributions théoriques et pratiques liées aux conditions préalables, le processus et les conséquences de l'innovation et de la co-crédation de technologie par l'utilisateur final, à la co-évolution de la signification et la structure de technologie, à l'activisme technologique communautaire, au potentiel des grassroots et aux liens avec l'industrie, ainsi que la compréhension des modèles de premier plan d'enchevêtrements sociomatériels et de changement dans les routines et les technologies (c.-à-d. l'interaction des agences humaines et matérielles) tel qu'ils sont inscrits dans les grandes dynamiques et complexités extra-organisationnelles.

Ce chapitre d'introduction donne un aperçu de la recherche. La section 1.1 fournit une description de développement grassroots des infrastructures Internet de LAN domestiques en Biélorussie. La section 1.2 fournit un aperçu des questions de recherche à l'étude. La section 1.3 aborde le contexte théorique de la thèse. La section 1.4 donne des détails sur les méthodes de recherche, les sources de données et les procédures de collecte de données. Enfin, la dernière section du chapitre introductif propose un résumé des trois études constituant la thèse et donne un aperçu en termes de leurs questions de recherche, idées théoriques et processus de recherche, unités d'analyse et contributions principales. Ceci est suivi par une conclusion générale.

Les trois travaux de recherche sont ensuite présentés dans les chapitres deux, trois, et quatre de la thèse. Le chapitre cinq conclut la thèse, en discutant ses principales conclusions et les contributions théoriques et pratiques de l'étude, ainsi que ses limites et des suggestions pour des recherches plus poussées.

6. 2. DESCRIPTION DE CAS

La thèse étudie la période de 16 ans de la création et le développement de LAN domestiques à Minsk, la capitale de la Biélorussie, à partir de l'année 1995 quand des LAN domestiques ont été créés pour la première fois par des citoyens jusqu'en 2010 à la suite d'une loi gouvernementale annonçant ces organisations illégales. Ce paragraphe donne des détails sur le cas et le contexte du phénomène de LAN domestiques. Après avoir décrit les LAN domestiques, je vous présente un aperçu du contexte de leur

création et décrit d'autres acteurs importants du développement de l'infrastructure Internet à Minsk.

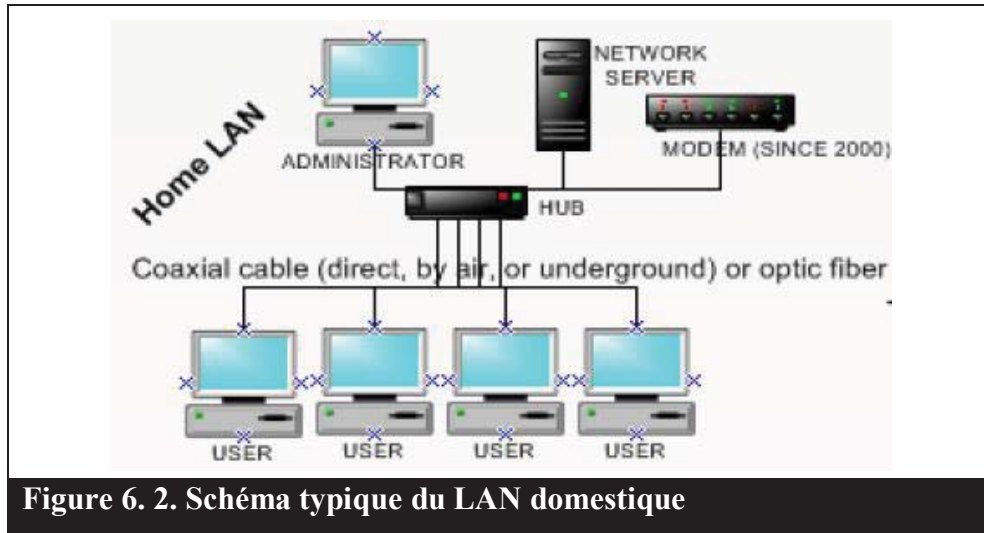
6. 2. 1. Une brève description de LAN domestiques

Les premiers LAN domestiques ont apparu autour de 1994 et 1995. Ils ont été créés principalement par des jeunes inspirés et fortement intéressés par les ordinateurs personnels (PC) qui n'ont commencé à devenir abordables en Biélorussie que vers le milieu des années 1990. Un désir de pouvoir jouer à des jeux vidéo multi-joueurs et la nécessité d'un partage de ressources étaient les motivations importantes derrière la création de premiers LAN domestiques. Cependant, comme l'accès Internet pour les utilisateurs individuels n'était pas disponible jusqu'en 1999, la nécessité a trouvé d'autres façons d'être satisfaite. Comme disent les premiers créateurs de LAN domestiques, ils ont décidé de créer leur propre version locale d'Internet, c'est à dire un 'réseau domestique' reliant les utilisateurs résidentiels d'ordinateurs personnels à l'aide des câbles coaxiaux et plus tard avec de la fibre optique et des modems radio reliant les utilisateurs à travers différents appartements et bâtiments à plusieurs étages (voir Figure 6.1).



Figure 6. 1. Câble aérien liant deux bâtiments séparés du même LAN domestique

Au sein du réseau, les ordinateurs des utilisateurs sont liés à des dispositifs technologiques spéciaux, tels que des concentrateurs / commutateurs, des répéteurs, des câbles et (plus tard) de la fibre optique qui connectent les utilisateurs dans des différents appartements et des bâtiments à plusieurs étages.



Un LAN domestique typique se compose d'un ordinateur appartenant à un (des) administrateur(s), une personne (ou personnes) responsable(s) de l'organisation et le soutien technique du LAN domestique, et des utilisateurs 'ordinaires' (voir Figure 6.2). Afin de construire un LAN domestique, ses administrateurs et utilisateurs ont combiné des dispositifs de réseautage professionnels qu'ils ont pu se permettre par la mise en commun de l'argent (par exemple, D-link, Genius LAN, etc.) avec des dispositifs fabriqués par bricolage (Baker, Miner, and Eesley, 2003; Baker and Nelson, 2005) tels que des boîtes pour le stockage de matériel informatique dans les greniers, les paratonnerres et d'autres.

Les réseaux domestiques locaux restaient la forme principale d'accès Internet et de partage de ressources pendant 16 ans à Minsk. Ils comprenaient des milliers de membres et couvrait toutes les zones résidentielles, donnant à leurs utilisateurs un accès Internet pas cher, le partage de ressources en réseau, et des possibilités de communication sociale en ligne et dans la vraie vie.

l'équipement de réseau, construire les liens entre deux bâtiments, etc. Beaucoup de créateurs de LAN domestiques ont réussi à persuader les fonctionnaires de services municipaux que les réseaux créeraient de la valeur sociale et publique, et comme résultat, ils ont eu accès aux locaux. Finalement, lorsque le nombre moyen de personnes dans un réseau a atteint environ 500, les administrateurs de certains LAN domestiques ont contacté les fournisseurs d'accès Internet privés. Ils leur ont proposé un grand nombre d'utilisateurs s'ils développaient un accès Internet abordable (en termes de prix) pour les LAN domestiques.

Initialement, seuls quelques fournisseurs d'accès Internet privés ont convenu à ce sujet et ont même proposé de créer des services spéciaux au sein de leurs organisations destinés à travailler avec des LAN domestiques. Plus tard, d'autres fournisseurs d'accès privés, voyant que cette coopération a été un succès, ont suivi le même chemin. À la suite de cette coopération, les LAN domestiques ont profité d'accès Internet de haute qualité et pas cher en utilisant un même modem pour quelques 30 à 50 utilisateurs et en contre-multipliant donc le canal Internet. Les fournisseurs d'accès privés ont gagné de nombreux utilisateurs individuels qui, auparavant, seraient hors de leur portée en raison du prix inabordable d'accès Internet individuel. En outre, fournisseurs d'accès privés ont proposé un certain nombre de bonus pour les utilisateurs et les administrateurs des LAN domestiques. En règle générale, ils contrôlaient également le service et les innovations technologiques développés au sein des LAN domestiques et les copiaient sur leurs propres plates-formes afin d'attirer de nouveaux utilisateurs. Cette coopération réussie entre les LAN domestiques et les fournisseurs d'accès privés a changé l'équilibre de pouvoirs dans le domaine de manière significative. Comme certains experts reconnaissent, environ 90% d'ordinateurs à domicile à Minsk ont été reliés à l'Internet grâce à la coopération des LAN domestiques et des fournisseurs d'accès privés.

De façon inattendue, en 2006, le fournisseur d'accès gouvernemental s'est joint au marché d'accès Internet individuel en proposant des services Internet de haute qualité et à de prix plutôt abordables. Cela a changé l'interaction agentielle dans le domaine (voir Figure 6.4). En outre, il a également proposé le service du trafic d'accès Internet illimité (abordable uniquement dans la situation de monopole). En conséquence, les fournisseurs d'accès privés ont lancé un mouvement de démonopolisation du fournisseur

d'accès d'État. Ce projet a été accepté en 2008 par le Parlement (mais rejetée plus tard par le Président). En 2008 et puis en 2010, les nouvelles lois gouvernementales ont annoncé les LAN domestiques illégaux et exigé leur liquidation 'volontaire'. Les LAN domestiques différents ont réagi à cela de manière différente : certains LAN domestiques ont suivi cette exigence et cessé leur activité ou sont devenu une partie de l'infrastructure de fournisseurs d'accès privés, certains LAN domestiques se sont transformés en fournisseurs d'accès privés eux-mêmes, tandis qu'un nombre important de LAN domestiques sont entrés dans la clandestinité et continuent de fonctionner en cette forme.

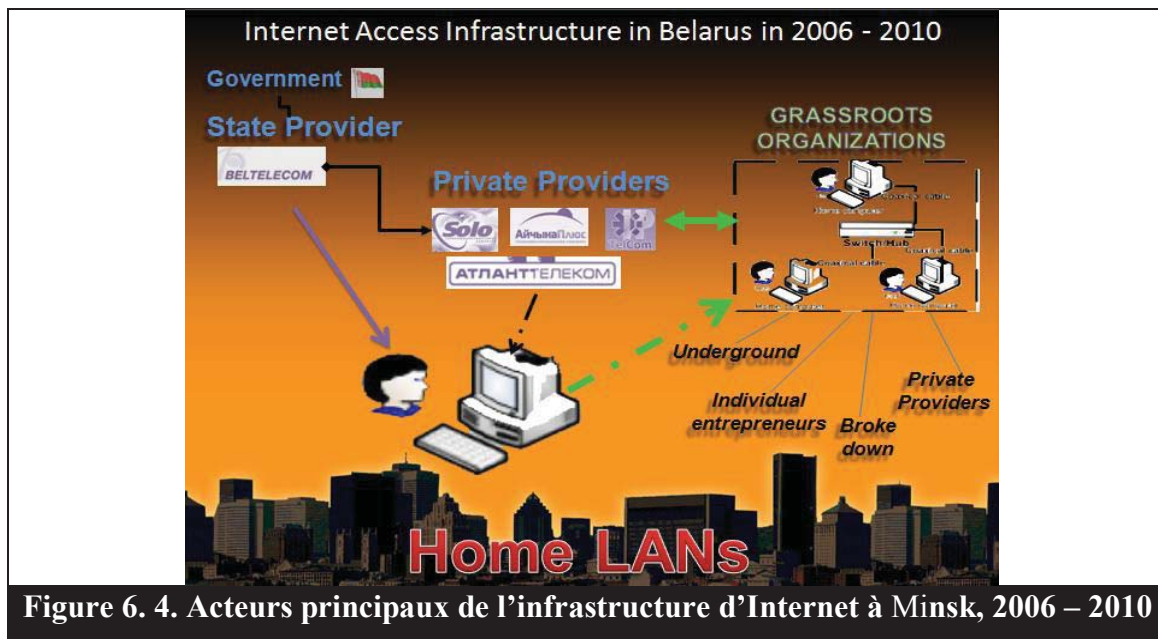


Figure 6. 4. Acteurs principaux de l'infrastructure d'Internet à Minsk, 2006 – 2010

6. 2. 3. Les conditions préalables contextuelles de création des LAN domestiques

La Biélorussie est un pays situé en Europe de l'Est qui possède une population d'environ dix millions de personnes (voir Figure 6.5). Pendant l'époque de l'Union Soviétique, la Biélorussie, à l'origine en manque de ressources minérales riches, a été 'désigné' un des centres stratégiques principaux de mathématique, électronique et informatique de l'Union soviétique. Selon le Rapport Mondial sur l'Externalisation, 'la Biélorussie était une 'usine d'assemblage' de l'ex-Union Soviétique, qui a abouti à une main-d'œuvre expérimentée et très qualifiée, avec un certain nombre d'universités techniques, écoles, laboratoires et institutions scientifiques' (Minevich and Richter,

2005), p.46). En particulier, plus de 50% d'ordinateurs et de composants informatiques dans l'ex-URSS ont été produits en Biélorussie (Radkevitch, 2005).



À Minsk se trouvent plusieurs grands universités spécialisés dans ces domaines et accueillant des milliers d'étudiants : les grands départements de Mathématiques et de Physique Radio de la plus ancienne université du pays – l'Université d'État de la Biélorussie (qui a une forte école de mathématiques, seconde après celle de Moscou), la grande Université Nationale Technique (aujourd'hui Académie Polytechnique) et l'Institut Radiotechnique (aujourd'hui l'Université d'État d'Informatique et Électronique Radio).

Les diplômés de ces universités ont été répartis de manière uniforme en les énormes industrie et système éducatif soviétiques. Cependant, même après la fin de l'Union Soviétique, le système éducatif et l'enseignement et les traditions scolaires ont demeuré. Depuis ce temps, la Biélorussie produit un nombre de diplômés plus grand par rapport aux besoins de secteurs domestiques. Même si un nombre important de spécialistes en informatique ont émigré au Canada, aux États-Unis, en Europe occidentale et en Russie, la concentration de personnes ayant une formation d'ingénieur est encore importante en Biélorussie. La situation est particulièrement évidente à Minsk, qui est un lieu de forte concentration d'étudiants en TI / SI, les anciens étudiants et les personnes ayant reçu une formation en TI ailleurs venant également à la capitale à partir d'autres villes biélorusses à la recherche de salaires plus élevés. Par exemple, les

revenus de l'industrie d'externalisation en Biélorussie ont été de 90 millions de dollars en 2004 (pour comparer, en 2003 les revenus des services informatiques exportés s'élevaient à 22 millions de dollars en Pologne, 20 millions de dollars en Hongrie et 26 millions de dollars en République Tchèque) (Radkevitch, 2005). Chaque année, environ 2 000 spécialistes en TI qualifiés arrivent sur le marché (Minevich and Richter, 2005).

Cette infrastructure a abouti à une forte concentration de personnes dont le principal passe-temps et les intérêts ont été structurées autour de l'ordinateur et qui étaient en mesure de participer à la création et au développement de logiciels et de matériel informatique (et qui serait donc potentiellement très intéressés à des prix abordables d'accès Internet). En général, il existait à Minsk une 'culture informatique' spéciale. Par exemple, avant même que les LAN domestiques ont été créés, un nombre important d'utilisateurs et amateurs d'ordinateurs ont déjà été à la recherche des moyens de rendre leurs ordinateurs et les périphériques connexes mieux adaptés à leurs besoins. Ainsi, le mouvement FIDO⁷ et des réunions régulières des administrateurs système dans le centre ville ont été particulièrement populaires à Minsk à la fin des années 80 et au début des années 90. Parmi d'autres exemples on peut donner celui de l'utilisation de disques durs internes en tant que 'clés USB' pour échanger des fichiers en les sortant régulièrement hors des unités centrales d'ordinateurs ; sinon, la pratique courante était d'apporter un PC fixe en entier chez un ami pour jouer à des jeux vidéo ensemble, etc.

Dans le même temps, le contexte d'accès Internet individuel était très contradictoire à l'existence de la culture informatique spéciale et des intérêts particuliers pour les ordinateurs et IT au sein de la population. Ainsi, jusqu'en 2006, Beltelecom, le fournisseur d'accès Internet du gouvernement, proposait uniquement un accès Internet résidentiel de faible qualité (dial-up) et extrêmement coûteux tout en gardant le monopole du canal Internet. Ainsi, les fournisseurs d'accès privés ont été obligés d'acheter des flux du canal Internet uniquement chez Beltelecom et à des prix élevés. En conséquence, leur offres d'accès Internet avaient toutes des prix élevés aussi et étaient

⁷ FIDO est un réseau distribué mondial (WAN) point à point et à stockage intermédiaire de courriers électroniques qui utilise des modems sur le réseau téléphonique directe. Il était populaire et répandu dans le monde pendant les années 1980 et la première moitié des années 1990, avant l'arrivée de la connexion haut débit. La technologie et ses utilisateurs existent encore aujourd'hui bien qu'ils ne sont pas aussi nombreux qu'autrefois. De plus amples détails peuvent être trouvés sur le site officiel de l'organisation FIDO (<http://www.fidonet.org/>).

vendues essentiellement à des organisations et entreprises, tandis que la large majorité de citoyens n'étaient pas en mesure de se permettre un accès Internet sur une base quotidienne.

Au cours de ses 16 ans, le processus de développement de LAN domestiques est passé par une variété et de la dynamique de conditions institutionnelles. Il s'agissait notamment de :

- 1) conditions de vides institutionnels (c.-à-d. une infrastructure d'accès Internet pour des utilisateurs individuels de mauvaise qualité ou littéralement inexistante) ;
- 2) une coopération réussie entre LAN domestiques, fournisseurs d'accès privés et les services municipaux ; and
- 3) un environnement hostile et la pression du gouvernement et des fournisseurs d'accès privés.

De plus amples détails sur la création et le développement de LAN domestiques à Minsk sont fournis dans les trois études (chapitres 2, 3 et 4). La chronologie de 16 ans de création et développement de LAN domestiques à Minsk est illustrée par la Figure 6 (voir section 1. 1. 3).

6. 3. QUESTIONS DE RECHERCHE A L'ETUDE DE LA THESE

Cette thèse est fondée sur l'enquête sous-jacente suivante :

Comment les TIC et les technologies de réseaux sociaux deviennent un fond pour l'innovation par l'utilisateur final et les mobilisations ascendantes de citoyens et comment ces évolutions ascendantes pourraient modifier les infrastructures, institutions et acteurs existants et quelles alternatives elles pourraient créer?

En répondant à cette enquête, la thèse vise à répondre aux sous-questions de la recherche suivantes :

- *Comment la signification et la structure de technologie sont adoptées par les utilisateurs finaux au cours du temps et comment ceci pourrait conduire à une transformation de technologie, à des innovations et des effets transformateurs plus larges à l'échelle d'industrie?*

- *Comment les processus et les résultats des imbrications socio-matérielles de routines et de technologies au sein des organisations sont intégrés dans des enchevêtrements extra-organisationnels plus grands, tels que les structures de terrain et la dynamique institutionnelle?*
- *Comment les organisations dépourvues d'importantes ressources financières et de gestion et fonctionnantes dans des environnements complexes, incertains et défavorables peuvent réussir à créer et à développer des innovations avec succès sur une longue période de temps et même de concurrencer avec des organisations avec un accès plus large aux ressources et une plus grande légitimité?*

Ces questions de recherche sont abordées dans les trois travaux de recherche. La partie conclusive de ce chapitre introductif (chapitre 5) s'appuie sur les réponses que les trois études donnent à ces questions de recherche et résume leurs contributions théoriques et pratiques.

6. 4. FONDEMENTS THEORIQUES DE THESE

Cette thèse vise à comprendre les processus de l'innovation et de co-crédation de technologie par l'utilisateur final tel qu'il est inscrit dans le cadre de plusieurs agents interdépendants et de complexités de l'environnement. Pour ces raisons, les trois articles qui constituent la thèse enquêtent sur le phénomène sous différents angles et à des niveaux d'analyse différents.

Article I : opère au niveau intra-organisationnel du phénomène. Elle examine comment une infrastructure Internet alternative d'un million d'utilisateurs a été élaborée par les citoyens eux-mêmes en tant que résultat de la co-évolution mutuelle de l'artefact TI et de l'interaction entre ses significations pragmatiques et symboliques. Nous montrons comment cette co-évolution dynamique était (ré)façonnée en fonction de la dynamique de la communauté d'utilisateurs et le jeu des acteurs externes de l'infrastructure Internet. Dans la tentative de comprendre ceux-ci, nous combinons les idées de la théorie de l'activité, la théorie de l'interaction symbolique et la théorie d'adoption de technologie par l'utilisateur, chacune ayant une contribution spécifique à

la compréhension des processus d'adoption et de transformation de technologie par l'utilisateur. La théorie de l'activité se penche sur le processus d'adoption de technologie par l'utilisateur final comme un outil pour trouver des réponses à une question spécifique (Leontiev, 1978; Rabardel, 1995). Son point fort principal est qu'elle fournit des comptes rendus détaillés sur le rôle des utilisateurs, c'est-à-dire la communauté de l'enquête, et permet de les traiter comme un acteur collectif (Dewey, 1938; Lorino, 2006; Peirce, 1955). La théorie de l'adoption de technologie proposée par (Orlikowski, 1992) met l'accent sur la structure de la technologie dans le processus de l'adoption par l'utilisateur. En particulier, elle fait valoir que la structure de la technologie n'est pas intrinsèquement prescrite et est adoptée de manière dynamique dans le processus d'utilisation de technologie. Enfin, la théorie de l'interaction symbolique fournit de précieuses indications sur le sens de l'artefact technologique dans le processus d'adoption. En particulier, elle fait valoir que le sens de la technologie ne peut pas être prescrit a priori dans la structure de la technologie. Plutôt, ce sens est en évolution dynamique lors de l'interaction avec la technologie en pratique.

S'appuyant sur ces trois théories, nous regardons comment les trois éléments – les utilisateurs, la structure de technologie et le sens de technologie – sont co-construits dynamiquement en pratique et conduisent à l'innovation technologique et à la co-création dans les LAN domestiques.

Article II : met l'accent sur la dynamique et l'interaction entre les niveaux extra- et intra-organisationnels du phénomène de LAN domestiques et s'appuie sur les théories institutionnelle et de sociomatérialité. L'étude examine la façon dont les imbrications sociomatérielles de LAN domestiques et les modèles de premier plan dans les technologies et les routines de LAN domestiques sont formés en étant enchevêtrés avec les dynamiques institutionnelles, les caractéristiques de terrain et les complexités.

La sociomatérialité est une nouvelle perspective ontologique qui suppose que la matière et le sens, le matériel et l'humain, le technique et le social sont ontologiquement inséparables (Barad, 2003; Barad, 2007; Orlikowski and Scott, 2008). Il fait valoir que les agences humaines et matérielles ne possèdent pas de qualités préétablies, de forme et de limites définies a priori par eux-mêmes, mais acquièrent celles-ci uniquement en pratique lors de leur enchevêtrement continu qui forme un assemblage sociomatériel. En

conséquence, les entités humaine et non humaine ont l'agence et sont égaux dans leur 'capacité de faire la différence' (Latour, 2005) et la possibilité de tracer des frontières multiples entre l'humain et le matériel possibles dans le même assemblage sociomatériel (Barad, 2007). La sociomaterialité fournit une optique prometteuse qui permet d'étudier les processus organisationnels, les changements dans la technologie et les routines, et la nature contemporaine de la technologie (décrite dans l'introduction de cette thèse). Cependant, malgré quelques rares exceptions (Scott and Orlikowski, 2009), les études sur la sociomaterialité se concentrent sur le niveau d'analyse intra-organisationnel et ont tendance à négliger les dynamiques extra-organisationnelles, telles que l'ancrage institutionnel des processus organisationnels. Pour ces raisons, nous proposons de réunir la sociomaterialité et les points de vue institutionnels.

La théorie institutionnelle fait valoir que le comportement organisationnel (y compris le changement ou la stabilité dans les technologies et les routines organisationnelles) sont étroitement couplés à la dynamique des structures extra-organisationnelles ré-saillantes sociales (par exemple «institutions») (Berger and Luckmann, 1967; Greenwood, Raynard, Kodeih, Micelotta, and Lounsbury, 2011; Meyer and Rowan, 1991; Powell and DiMaggio, 1991; Scott, 2001; Scott, 2008). Agissant par l'intermédiaire des schémas, normes et règles établis, les institutions aident aux organisations qui satisfont aux logiques institutionnelles dominantes dans le domaine de s'établir comme des lignes directrices faisant autorité, ainsi que leur fournissent un ensemble spécifique de principes d'organisation (Friedland and Alford, 1991; Scott and Meyer, 1994). Institutions donc à la fois contraignent et activent le comportement organisationnel (Scott, 2001). Cependant, la théorie institutionnelle est critiqué comme sapant le rôle de la matérialité dans le processus de changement institutionnel et le rôle de la technologie dans le changement institutionnel (Arjaliès, 2011; Knorr-Cetina, 1997a; Miller, 2008; Spee and Jarzabkowski, 2009), ainsi que pour sa tendance de séparer la matérialité de la technologie de la dynamique institutionnelle de base (Orlikowski, 2009; Scott and Orlikowski, 2009). Peu de travaux de recherche montrent comment les institutions peuvent influencer le design, le développement et les effets de technologie et (au sens large) la matérialité dans les organisations (Scott and Orlikowski, 2009). L'étude fait valoir que la combinaison de

ces deux théories fournit des indications précieuses sur les processus de formation de stabilité et de changement dans la technologie et les routines.

Article III : se concentre sur le processus organisationnel de développement et de création en innovations de LAN domestiques. En particulier, l'article vise à comprendre comment les organisations peuvent innover et se développer avec succès dans des environnements très restrictifs à des ressources insuffisantes. Le document s'appuie sur les théories de l'innovation organisationnelle, l'improvisation, et l'apprentissage expérientiel.

Ainsi, malgré que l'innovation a été l'un des sujets les plus étudiés de manière intensive dans les domaines des études d'organisation et de gestion, et des systèmes d'information, son phénomène reste encore la 'boîte noire' (Fagerberg, Movwery and Nelson, 2004). Analyse de littérature sur l'innovation révèle trois principaux éléments déclencheurs de la création d'une innovation réussie : environnement organisationnel, improvisation, et apprentissage organisationnel.

D'un côté, les recherches sur l'innovation et la création de TIC font valoir que son succès nécessite des conditions particulières favorables (Ein-Dor, Myers, and Raman, 1997; Heavin, Fitzgerald, and Trauth, 2003; Trauth, 2000) ; d'autre travaux mettent l'accent sur l'importance de ses dépendances particulières du parcours historique et sociale (Avgerou, 2003; Hobday, 2000) ; mais tous les chercheurs sont d'accord sur le fait que le contexte organisationnel et l'environnement jouent un rôle crucial dans le processus. Ainsi, l'environnement organisationnel agit à la fois comme un arrière-plan dynamique et un catalyseur d'innovations organisationnelles. Premièrement, il fournit une source d'information et des ressources nécessaires pour que l'activité organisationnelle combinatoire innovante, ainsi que l'exploration puissent se produire (Cohen and Levinthal, 1990; Cook and Yanow, 1995; Fagerberg, Movwery and Nelson, 2004; Schumpeter, 1950). Deuxièmement, il agit comme un système d'impulsion-rétroaction dans le processus d'apprentissage organisationnel, un processus crucial pour qu'une innovation réussie se produise (Kolb, 1984).

L'improvisation organisationnelle est considérée comme une partie importante du processus d'innovation (Cunha, Cunha and Kamoche, 1999; Eisenhardt and Tabrizi, 1995; Moorman and Miner, 1998b). L'improvisation a un potentiel d'accroître

l'innovation organisationnelle réussie car elle aborde un nombre de défis de la création d'innovation : manque de circonstances prévisibles et planifiées (Ciborra, 1996; Crossan and Sorrenti, 1996; Moorman and Miner, 1995; Weick, 1993, 1998) ; génération efficace d'une *nouvelle combinaison de ressources, routines et structures* ; exploitation des connaissances tacites (Yanow, 2001) ; des réponses rapides dans un environnement changeant et turbulent, etc. (Cunha, Cunha, and Correia, 2001).

La perspective d'apprentissage expérientiel fournit une optique utile pour étudier les processus d'innovation organisationnelle et d'improvisation et comprendre comment celles-ci ont été façonnées de manière dynamique. En particulier, l'apprentissage expérientiel met un accent particulier sur le processus d'apprentissage et de création de connaissances comme l'opposé des théories d'apprentissage plus traditionnelles (basées sur des modèles cognitives et de comportement) insistant sur ses résultats (Kolb, 1984). Dans cette optique, la perspective de l'apprentissage expérientiel est précieuse car elle permet de mieux comprendre non seulement les solutions innovantes mais aussi pour les processus de leur création. En outre, elle met l'accent sur le rôle du contexte de fournir des impulsions pour l'apprentissage et les innovations organisationnelles et soutient l'idée du caractère mutuellement transformatif des enchevêtrements apprenant-environnement qui agissent comme des impulsions pour l'apprentissage organisationnel additionnel (Dewey, 1938; Kolb, 1984). Ce dernier est conforme à l'idée principale de cette étude – co-évolution et co-crédation – et en résonance avec les optiques et les conclusions de deux autres études.

Nous utilisons les idées colligées des points de vue ci-dessus pour procéder à une étude de cas multiples inductive visant à comprendre comment les LAN domestiques ont réussi à innover et à se développer avec succès pendant une longue période de temps en restant en manque important de connaissances techniques et de gestion, de ressources financières et opérationnelles, de légitimité, etc.

6. 5. PROCESSUS DE RECHERCHE ET METHODOLOGIE

6. 5. 1. Focus et position épistémologique

L'importance du contexte et de la mise d'accent sur le processus de création de LAN domestiques décrits ci-dessus crée des conditions nécessaires qui pourraient être mieux abordées avec une étude de cas (Pettigrew, Woodman, and Cameron, 2001; Yin, 2009) et des méthodologies de données du processus (Langley, 1999).

Étude de cas est une approche utile pour enquêter sur un phénomène contemporain complexe dans un contexte de vie réelle, en particulier lorsque les frontières entre le phénomène et le contexte ne sont pas claires (Yin, 2009). La méthodologie de données du processus (Langley, 1999; 2007) nous permet de considérer les phénomènes de manière dynamique – en termes de mouvement, activité, événements, changement et évolution temporelle. En contraste avec les théories de 'variation' (Mohr, 1982), théories de processus :

fournissent les comptes temporellement intégrés qui nous permettent de comprendre comment [les motifs systémiques de relations autour de phénomènes organisationnels] apparaissent (Langley, 2007, p.4).

Ainsi, à la fois les études de cas et les méthodologies de données de processus fournissent des comptes précieux pour la compréhension du phénomène de création et de développement de LAN domestiques, ainsi que pour aborder les questions de recherche de cette thèse décrites plus haut.

La recherche dans cette thèse est une enquête qualitative qui enquête sur les processus et les résultats des innovations grassroots par l'utilisateur final. Ainsi, suivant la suggestion de (Yin, 2009), lorsque la recherche est basée sur les données qui ne peuvent pas être facilement convergées vers des valeurs numériques, et présentée dans des dimensions nominales, de perception et d'attitudes décrivant les événements en temps réel, une étude qualitative doit être utilisée. En outre, la logique sous-jacente de l'enquête qualitative coïncide avec la logique de la méthodologie du processus décrite ci-dessus. En particulier, les questions de recherche de la thèse (c.-à-d. les questions 'comment'), ainsi que le besoin de nuances et d'interprétations, et la nouveauté du phénomène étudié justifient une approche qualitative. L'approche qualitative permet au chercheur de découvrir des nuances, des détails, des significations, la prise de sens et des relations complexes entre les concepts. La recherche actuelle est basée sur la compréhension, les significations et les attitudes de pratiques de travail, les concepts

d'imbrications et assemblages sociomatériels, etc. qui ne peuvent pas être mesurés ou utilisés pour faire des prédictions, mais sont utiles dans la production de connaissances sur le processus et les motifs de relations qui entourent le phénomène de LAN domestiques.

Cette thèse est basée sur un raisonnement logique abductif et inductif. Ainsi, le raisonnement abductif a façonné la logique de l'Article I et l'Article II. Le raisonnement abductif est le processus par lequel les explications utiles sur un nouveau phénomène sont mises au point par une étude de faits et une élaboration de théorie pour les expliquer simultanées (Kelle, 1995; Peirce, 1955; Richardson and Kramer, 2006).

Finalement, en faisant une enquête sur le processus de 16 ans du phénomène de la co-crédation de technologie et d'infrastructure Internet de LAN domestiques à partir des grassroots, cette thèse représente une étude qui est principalement rétrospective. Des études de processus rétrospectifs sont bien établies dans les disciplines de gestion (Langley, 2009).

6. 5. 2. Procédures de sources de données et de collecte de données

Avant que le cercle principal de collecte de données a débuté en juillet 2010, une étude pilote a été menée en décembre 2009 – janvier 2010. L'objectif de l'étude de cas était de trouver des questions de recherche pertinentes et d'aider l'auteur dans l'élaboration d'un plan de recherche approprié, des protocoles d'interviews, etc. Le cercle principal de collecte de données a débuté en juillet 2010 et terminé en avril 2011. Durant cette période, les quatre types de données suivants ont été recueillis : entretiens, documents, données d'archives et observations sur le terrain. Des détails sur chacun de ces types de données ainsi que les procédures de collecte de données sont fournis ci-dessous. Notablement, l'auteur elle-même était un utilisateur de l'un des plus gros réseaux de LAN domestiques à Minsk pendant trois ans.

1) Entretiens sur le terrain

Au total, 72 entretiens ont été conduits. Il s'agit notamment des entretiens de 56 représentants de LAN domestiques (33 entretiens d'administrateurs et 23 entretiens d'utilisateurs) et 16 entretiens de fournisseurs d'accès Internet privés et publics. Tous

les entretiens étaient semi-structurés et ouverts afin de s’assurer que le maximum d’informations sur le phénomène de LAN domestiques soit obtenu. La majorité des entretiens (environ 80%) ont été enregistrés si les personnes interrogées ont convenu à cet égard. Chaque entretien a duré environ 40 minutes en moyenne avec des variations d’une demi-heure à 2 heures par entretien. Les entretiens ont été guidés d’abord par les questions structurées développées à l’avance dans les questionnaires en fonction du type de l’informateur (notamment, administrateur d’un LAN domestique; utilisateur d’un LAN domestique ; fournisseur d’accès Internet privé ; et fournisseur d’accès Internet d’État), puis d’autres questions ont été posées en fonction de l’expérience pertinente et du profil de l’informateur. Les questionnaires pour la partie structurée des entretiens sont présentés en Annexe 1.

2) Documents

Les documents comprenaient les pages Web et les intranets de LAN domestiques ; les cartes interactives de leurs infrastructures internes ; et des documents internes de LAN domestiques. Ceux-ci comprennent des statuts et des caudexes de LAN domestiques (documents élaborés collectivement par les utilisateurs qui décrivent l’objectif principal et l’organisation du réseau, droits et responsabilités des utilisateurs, les procédures d’inclusion et d’exclusion d’utilisateurs, etc.)

3) Données d’archives

Les données d’archives comprenait des opinions d’experts en LAN domestiques documentées et filmées parues dans la presse ; des articles de journaux et revues ; plus de 30 pages de portails IT nationaux sans but lucratif qui publient des actualités sur une base quotidienne (<http://it.tut.by>, <http://www.interminsk.com/>, <http://providers.by/>, <http://techlabs.by/>) ; lois gouvernementales au sujet du développement des services nationaux d’Internet et de télécommunications ; discussions connexes sur des sites Web ; et analyse des matériaux du site Web du réseau LAN domestique national, homenet.tut.by.

4) Observations directes

Les notes de terrain ont été élaborées à partir d’observations directes de la façon dont les utilisateurs interagissent avec leurs technologies et services de LAN

domestiques lorsqu'ils me les montraient et décrivaient 'comment ça marche'. Ces observations avaient généralement lieu dans les appartements d'utilisateurs où ils font la connexion à leurs LAN domestiques.

6. 6. VUE D'ENSEMBLE DES ARTICLES DE LA THESE

Cette étude donne un aperçu des trois articles présentés dans leurs grandes lignes dans la Section 1.1. Premièrement, elle présente le synopsis de l'étude et un tableau récapitulatif des articles de la thèse. Ceci est suivi par un bref aperçu de chaque article. Le synopsis de l'étude est fourni en Figure 8 au section 1.5. Le tableau 1 résume les trois articles en termes de leurs questions de recherche, données et théories utilisées (voir section 1.5). Les paragraphes qui suivent donnent un aperçu et des détails sur chacun des trois articles.

Article I. Co-Création ascendante : Adoption transformative des technologies par l'utilisateur final et sa signification dans les organisations à base communautaire

Vue d'ensemble

L'article ouvre l'étude des technologies et des pratiques de LAN domestiques dans cette thèse en présentant le phénomène de la co-création de technologie par l'utilisateur final. Il examine la façon dont le sens et la structure de technologie sont adoptées et co-crées par des utilisateurs finaux dans le temps et la façon dont les processus de ces adoptions sont incorporés dans le sens de technologie. Nous argumentons que ces processus sont profondément ancrés dans le sens de la technologie (et plus particulièrement, dans l'interaction entre sa signification pragmatique permettant l'exécution de routines et pratiques organisationnelles et sa signification symbolique somme saisissant l'interaction contextuelle et sociale plus large).

Unité d'analyse

Adoptions de structure et de sens de technologie par des utilisateurs comme intégrées dans la pratique organisationnelle (signification pragmatique) et dans une interaction contextuelle et sociale plus large (signification symbolique).

Contribution

L'article a plusieurs contributions. Premièrement, il fournit des comptes rendus détaillés sur la façon dont le sens et la structure de technologie sont adoptés par les utilisateurs au fil du temps et comment ces adoptions conduisent à des transformations organisationnelles plus générales et à la création d'une innovation collective. Deuxièmement, il propose un cadre pour l'adoption et le changement par utilisateur final. Troisièmement, l'article montre que les significations symbolique et pragmatique de la technologie jouent des rôles importants dans l'évolution d'adoptions de technologie par utilisateurs et d'innovation à partir des grassroots. L'article fournit donc des contributions à l'étude de développements grassroots, aux théories d'adoption, conception et utilisation de technologie, organisations collaboratives en réseau, et développements de nouvelles formes organisationnelles.

Article II - Comment la sociomaterialité et les institutions s'enchevêtrent : Une étude de cas de communautés d'utilisateurs finaux et de développement de l'infrastructure Internet

Vue d'ensemble

L'article examine comment les motifs de premier plan du changement dans les technologies et routines de LAN domestiques sont formés et (ré)configurés étant intégrés dans la dynamique contextuelle de logique institutionnelle, les caractéristiques de terrain et l'interaction d'acteurs différents. Ce faisant, la recherche utilise la théorie de sociomaterialité et les théories institutionnelles et illustre comment des processus extra- et intra-organisationnels s'entrelacent pour former des imbrications sociomatérielles de technologies et routines. Grâce au processus de 16 ans de développement de LAN domestiques, nous illustrons comment des caractéristiques différentes de terrain institutionnel influencent les processus d'imbrications

sociomatérielles de routines et de technologies au sein de LAN domestiques. Nos résultats indiquent que la dynamique et les complexités de terrain institutionnel jouent des rôles importants dans les processus d'enchevêtrements organisationnels sociomatériels formés par les motifs de premier plan des agences humaines et matérielles.

Unité d'analyse

Enchevêtrements sociomatériels de technologies et de routines et motifs de premier plan de changement des agences humaines et matérielles comme intégrées dans la dynamique institutionnelle et les caractéristiques de structure de terrain.

Contribution

L'article fournit des contributions aux études de la sociomaterialité en développant des idées comment les processus et les motifs de premier plan d'imbrications sociomatérielles sont intégrés dans les dynamiques et les complexités institutionnelles plus grandes et en fournissant un cas rare de sociomaterialité dans un pays en développement. Il contribue également à des études de la théorie institutionnelle en mettant en évidence le rôle des objets, tels que la technologie, dans le processus de changement institutionnel (Arjaliès, 2011; Knorr-Cetina, 1997b; Spee and Jarzabkowski, 2009) et en fournissant une compréhension de la façon dont les technologies et les pratiques liées à la technologie sont intégrées et mises en forme par des influences institutionnelles plus larges (Avgerou, 2008; Lamb and Kling, 2003; Orlikowski and Barley, 2001). En particulier, l'article témoigne sur le fait que dans les domaines où il existe des exigences contradictoires sur les moyens *et* les objectifs, les imbrications organisationnelles sociomatérielles vont changer par une adoption d'agence humaine (par rapport à l'adoption simultanée d'agences humaines et matérielles dans un domaine où il existe de logiques contradictoires sur les moyens uniquement). En outre, le papier présente l'un des rares cas de recherche sur la sociomaterialité de technologies et routines organisationnelles dans un pays en développement.

Article III - Succès des innovations avec des maigres ressources : Pratiques d'improvisation et apprentissage expérientiel dans les organisations communautaires créées par des utilisateurs

Vue d'ensemble

L'article examine comment les activités d'improvisation et l'apprentissage expérientiel pourraient permettre la création d'une innovation réussie dans les environnements avec des ressources restreintes et limitées. La recherche s'appuie sur les théories de l'innovation, l'improvisation et l'apprentissage expérientiel. Nos résultats indiquent que les LAN domestiques ont réussi à être efficaces et durables dans les conditions restrictives en se basant sur : a) improvisation et spontanéité, plutôt que des pratiques prévues ; et b) apprentissage expérientiel qui s'est produit en enchevêtrement serré avec l'environnement organisationnel.

Unité d'analyse

Les processus d'improvisation et de création d'innovations réussies dans les environnements restrictifs imposant des 'défis de gestion', 'défis financiers / relatifs aux ressources', 'défis organisationnels' et 'défis politiques / de légitimité'.

Contribution

Nous illustrons comment les organisations ascendantes de citoyens ont créé des innovations réussies et développé leur valeur unique en utilisant l'approche de l'apprentissage expérientiel et des techniques d'improvisation dans leurs pratiques. En particulier, en utilisant les optiques de l'improvisation organisationnelle et de l'apprentissage expérientiel, la recherche donne un aperçu de la compréhension *des processus* de création et développement d'innovations réussies dans les conditions d'environnements complexes, incertains et restreints. Les contributions principales de l'étude se situent dans les domaines de développement et mise en œuvre de l'innovation, improvisation organisationnelle, apprentissage expérientiel, ainsi que celui des nouvelles recherches sur l'innovation axée sur l'utilisateur et l'activisme de technologies à base communautaire (Powell, 2008a; Powell and Meinrath, 2008).

6. 6. CONCLUSION

Le chapitre cinq résume et regroupe les résultats présentés dans cette thèse. Il le fait en s'appesantant sur les conclusions établies dans chaque article et en mettant en évidence les implications potentielles de cette étude et ses contributions théoriques. Le chapitre est structuré comme suit. Nous présentons d'abord le résumé de la thèse, puis discutons son implication principale et ses contributions théoriques.

6.6.1. Résumé de la thèse

Cette thèse contribue à notre connaissance sur le phénomène de l'innovation par l'utilisateur final. Grâce à ses trois essais de recherche, cette thèse montre comment la technologie adoptée par les utilisateurs finaux devient un fond pour l'innovation par l'utilisateur final et des transformations organisationnelles, sociales et institutionnelles plus larges. En particulier, elle fait valoir que la création et le développement des innovations par l'utilisateur final est le résultat de l'interaction contingente des acteurs de nature différente : humaine et non humaine ; citoyens, fournisseurs d'accès Internet d'État et organisations non-gouvernementales ; utilisateurs et administrateurs; logiques institutionnelles, caractéristiques de terrain, culture locale et conditions historiques, etc.

La thèse s'appuie sur le cadre de la recherche d'un pays en développement, la Biélorussie et sa capitale Minsk, où une infrastructure Internet locale a été élaborée par la mobilisation ascendante de citoyens et la création de réseaux communautaires, appelé réseaux domestiques locaux (LAN). Le cadre de la recherche fournit un fond fructueux pour l'étude du phénomène de l'innovation par l'utilisateur et des transformations reliées plus larges. En particulier, il suit le processus de 16 ans de développement de l'infrastructure Internet par les citoyens reliant éventuellement leurs ordinateurs à la maison avec des fils à l'infrastructure mûre d'un 'million d'utilisateurs' de LAN domestiques, accompagné du développement d'une série d'innovations de services acceptés comme des prototypes de services nationaux Ethernet des par les fournisseurs d'accès Internet.

Chacun des trois articles qui constituent la thèse prend garde le phénomène de l'innovation par l'utilisateur final dans les LAN domestiques d'un point de vue différent.

Article I examine comment la structure et la signification de technologie dans les LAN domestiques ont éventuellement co-évolué avec les communautés de leurs utilisateurs, et enquête sur l'interaction entre la signification de technologie comme un outil (c.-à-d. dans le sens pragmatique) et comme un symbole (c.-à-d. dans le sens symbolique). Article II se penche sur les motifs de premier plan de changement dans la technologie et les routines de LAN domestiques qui s'enchevêtrent avec la dynamique institutionnelle et les caractéristiques de terrain plus larges, et l'interaction d'autres acteurs d'Interne. Finalement, Article III examine comment les innovations réussies de LAN domestiques étaient possibles dans les conditions de ressources très limitées et une variété de défis. L'article argumente que ces innovations ont réussi parce que les LAN domestiques étaient axés sur l'improvisation et l'apprentissage qui mettaient l'accent sur le processus, l'expérience et la co-évolution avec l'environnement plutôt que sur des actions planifiées, des solutions standardisées et une concentration sur le résultat.

6. 6. 2. Implications de la recherche

La thèse a deux grands domaines d'implication : l'innovation par l'utilisateur final et l'activisme communautaire de réseautage / technologie aidé par les TIC.

Innovation par l'utilisateur final

L'innovation et la co-crédation de technologie par l'utilisateur final est un phénomène qui a joué un rôle important dans le développement de nombreux importants artefacts technologiques contemporains (notamment, téléphone, Internet, ordinateurs personnels) (Castells, 2002; Dutton, 2008; Fischer, 1992; Kraut, Mukhopadhyay, Szczypula, Kiesler, and Scherli, 1999; Von Hippel, 2009a, b).

Avec le cas de développement Internet grassroots de LAN domestiques, cette thèse montre que les processus de l'innovation par l'utilisateur final se produit non pas isolément mais en s'enchevêtrant étroitement et en co-crédant avec d'autres acteurs. Ce point de vue diffère de et contribue à la compréhension du phénomène de l'innovation par l'utilisateur tel que proposée par Eric von Hippel (Flowers, Eric von Hippel, Jeroen de Jong, and Sinozic, 2010; Oliveira and Hippel, 2009; von Hippel, 2005, 2009a, 2010), – peut-être, la référence principale dans le domaine de l'innovation par

l'utilisateur. En particulier, von Hippel (von Hippel, 2005) affirme que l'existence d'une communauté innovante, c.-à-d. une coopération informelle de type utilisateur à utilisateur, et des utilisateurs 'chefs de file' sont les principales forces motrices de l'innovation par l'utilisateur. Nos résultats confirment bien l'importance des communautés innovantes (à savoir, des communautés d'utilisateurs de LAN domestiques avaient, en effet, un rôle crucial dans la création et le développement des innovations de LAN domestiques). Cependant, nos résultats vont également au-delà de la limite de la communauté et l'utilisateur principal. L'étude de la thèse témoigne que le phénomène des innovations par l'utilisateur dans les LAN domestiques était seulement possible en raison de l'interaction serrée et des co-enchevêtrements d'une variété d'autres acteurs : fournisseurs d'accès Internet publics et privés, pilotes institutionnels, la culture, agences non humaines comme des fils, plates-formes, modems, etc. Ainsi, cette interaction a permis la création d'enchevêtrements sociomatériels de différents niveaux (c.-à-d. 'macro' et 'micro'), de significations symboliques et pragmatiques, et de pratiques d'improvisation et de bricolage – tous essentiels pour la création et le développement de l'innovation par l'utilisateur dans les communautés de LAN domestiques. Dans cette optique, cette constatation étaye les arguments de (van Oost et al., 2009) faisant valoir que les utilisateurs peuvent agir en tant que force motrice à *toutes les phases* du processus d'innovation.

6. 6. 3. Réseautage communautaire

La nature changeante de la technologie contemporaine (Internet, réseaux sociaux, technologies de Web 2.0) modifie la portée et la nature de la communication en fournissant des opportunités croissantes pour le réseautage et la communication des acteurs qui, autrement, resteraient sans lien et immobilisé. Ce phénomène a lieu partout dans le monde et demeure juste dans le contexte développé comme dans celui en développement. Par exemple, le phénomène semblable au cas de LAN domestiques en Biélorussie a eu lieu au Canada où des communautés de citoyens locaux ont mis au point une alternative à l'infrastructure Internet traditionnelle sans fil de type descendant à partir des grassroots afin de répondre à une fracture numérique, créer de nouvelles

opportunités de participer à la vie civique, des solutions pour les travailleurs indépendants, et créer un ‘bien public’ (Powell, 2008b; Powell and Meinrath, 2008). Un cas similaire de développement d’une communauté d’utilisateurs finaux sans fil est examiné par (van Oost et al., 2009) qui a étudié la ‘Wireless Leiden’, une infrastructure de réseau local sans fil dans la ville néerlandaise de Leiden initiée, conçue et maintenue par une communauté locale d’utilisateurs. D’autres exemples comprennent les projets de ‘Paris sans fils’ (<http://www.freenews.fr/spip.php?article5062>, (Rees, 2007)), France ; ‘Voisins en ligne’ ayant lieu dans les villes de St.Paul et de Minneapolis, Etats-Unis, (<http://blog.e-democracy.org/posts/1430>) ; et le ‘Village électronique de Blacksburg’ donnant un exemple de lien local communauté – université (<http://www.bev.net/>).

Ce réseautage aidé par les TIC a un potentiel dynamique transformatif : non seulement il assure la connexion et l’autonomisation de nouveaux acteurs, préalablement déconnectés et invisibles, mais aussi il fournit des solutions alternatives et locales aux institutions et acteurs déjà existants, ainsi que fait le maillage et rebranche des anciens et des nouveaux acteurs, à savoir l’industrie et les grassroots (Castells, 1996; Dutton, 2009; Dutton and Eynon, 2009).

Dans cette optique, la compréhension des processus de la façon dont la technologie devient un fond pour les mobilisations d’utilisateurs finaux, le réseautage et le développement communautaires, comme illustré dans cette thèse par le cas de LAN domestiques, est logique. En particulier, la connaissance de la contribution principale de cette thèse – que les processus décrits ci-dessus ne se développent pas dans des communautés d’utilisateurs isolées, mais sont étroitement enchevêtrés avec une grande variété d’acteurs, y compris ceux de la nature non-humaine, fournit de précieuses indications.

6. 6. 4. Limites de la présente étude

Cette recherche souffre de plusieurs limites. Tout d’abord, nous présentons une histoire condensée de développement de LAN domestiques comme un phénomène qui a commencé vers 1994-1996 et a diminué ou s’est caché en 2010.

Deuxièmement, bien que notre analyse de données a montré des points communs importants à travers la diversité de LAN domestiques, chaque réseau avait bien son histoire individuelle et unique. Par exemple, certains LAN domestiques ont été créés en 1995 tandis que d'autres ont été créés en 1998 ou 2002.

Enfin, en raison de l'absence de descriptions historiques et de comptabilité claires, nous ne considérons pas les fusions entre les LAN domestiques comme un événement de changement particulier dans les limites de la communauté d'utilisateurs. Au lieu de cela, nous avons examiné les variations du nombre d'utilisateurs sans chercher à expliquer leurs origines. Cependant, les fusions ont été des événements importants et nécessaires dans le développement de LAN domestiques, en particulier ceux qui regroupaient des centaines et des milliers d'utilisateurs. Le but de cette recherche, cependant, n'était pas de décrire l'ensemble de la population et les particularités de LAN domestiques, mais de révéler des points communs importants dans les façons dont les technologies, leur signification et pratiques d'utilisation ont co-évolué dans les communautés de LAN domestiques et se sont structurés autour de la technologie initiale d'ordinateurs personnels.

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APPENDIX

INTERVIEW QUESTIONNAIRES

APPENDIX A. QUESTIONNAIRE FOR ADMINISTRATORS OF HOME LANs

1. First name, age, education, gender
2. Name of the home network and its area in Minsk
3. How did it happen that you became an administrator of a home network?
4. When did it happen?
5. How many users there are in the network now?
6. How many users there were in the network in the time of its best development?
7. What is the structure of users' population (i.e. age, gender, education, occupation, etc.)?
8. What are your main motivating factors to administrate a network?
9. Where does your knowledge of how to administrate the network come from?
10. Have you participated in the process of network's creation ('flinging overhead cable', constructing cable network, putting up notices and advertisements)?
11. What were your main motivating factors to create (and administrate) a network?
12. Please tell me the story how you created the network (practices, ideas, processes)?
13. How did you build the network? (organizational aspects of the process)
14. Could you provide some illustrating examples of how the process went through?
15. What materials and what equipment do you use when building a network and linking-up?
16. What is the cost for a new user to link-up?
17. Do you take some money for linking-up (to compensate your time and work investments) or is it free of charge?
18. How did you counted and planned what the cost of linking up will be? What was the basis for the price?
19. Could you provide some interesting examples of how the process of linking up went through?
20. Do you have a subscriber fee in the network? Is it on the regular basis?
21. How is the payment process for the subscriber fee organized?
22. Was the Internet access initially created in the network or did it appear as a later service?
23. What services, except for the Internet, do you have in the network?
24. Where do those services come from (please tell more)
25. Where these designed and created in the network, imitated from other home LANs or from the Internet providers?
26. What were the programs that you used for these services?
27. Where did those programs come from
 - a) Created and developed by users,
 - b) Downloaded from the Internet
 - c) Downloaded from the Internet and modified by administrators (please tell more)
28. How did new services appear in your network?

29. How are important decisions taken in your home LAN (please tell more me about the process)
30. Were these a) taken by the administrator (s); b) taken by voting of users at the special common gatherings; c) Other
31. Have you ever participated in the social 'on-live' activities of the networks ('network beer', 'network meetings', etc.)?
32. Could you please tell some more about how were those meetings organized, how many people joined, what was discussed?
33. Were those meetings held on the regular basis?
34. Do you think those meetings were important for users (i. e. to find new friends, establish new contacts, etc.) and for the network further development?
35. What is a min and average and max Internet cost in your network?
36. How is the payment process for Internet organized?
37. How is the network architecture organized? (cable and network architecture type)
38. How is the process of sharing media files organized? (program names or process description)
39. How many Internet providers are you working with?
40. Who and on what basis chooses the Internet providers?
41. Whom did the initiative come from?
42. Do you receive some special bonuses from your Internet providers?
43. What are those bonuses: a) salary; b) income percent from the users' money spent for the Internet, c) points for Internet-access; d) other (please tell more)
44. Have you ever had problems with local municipalities when building or administrating the network?
45. What is your opinion on the situation of home LANs and the state policy and laws about them?
46. What do you plan to do with your home LAN further?
 - a) Develop and legalize it as an official home LAN;
 - b) Sell it the a private Internet-provider;
 - c) Develop it in a private Inter-providing organization;
 - d) Wait until the situation will change (see what will be)while maintaining the home LAN existence
 - e) Stop this activity and leave the network as it is.
 - f) Other (please tell more me about it)
47. Please provide your reasoning and feelings on your plans as a home LAN administrator.

APPENDIX B. QUESTIONNAIRE FOR USERS OF HOME LANS

1. First name, age, education, gender
2. Name of the home network and its area in Minsk
3. How did it happen that you became a user of a home network?
4. So, your main motivating factors to join the network were....
5. When did you join to the network?
6. How many users were in the network at the time when you joined it?
7. How many users there are in the network now?
8. How many users there were in the network in the time of its best development?
9. What is the structure of users' population (i.e. age, gender, education, occupation, etc.)?
10. Was Internet already in the network when you joined?
11. What services, except for the Internet, do you have in the network?
12. How often do you use network?
a) often; b) from time to time (please tell more about this)
13. What do you use the network for?
a) for both Internet and other services (chat, online and network games, radio, media files exchange, etc.); b) for Internet mainly; c) for network services (chat, online and network games, radio, media files exchange, etc.) mainly
14. Have you ever participated in the social 'on live' activities of the networks ('network beer', 'network meetings', etc.)?
15. Could you please tell some more about how were those meetings organized, how many people joined, what was discussed?
16. Were those meetings held on the regular basis?
17. Do you think those meetings were interesting and useful for you (i.e. to find new friends, establish new contacts, etc.)? (please tell more about this)
18. Have you ever participated in the process of network's creation ('flinging overhead cable', constructing cable network, putting up notices and advertisements)?
19. What were the reasons for you to participate in the above mentioned activities?
20. Could you provide some interesting examples of how the process went through?
21. How would you characterize your administrator (in terms of age, gender, education, etc.)?
22. How often do you use his technical support? (please tell more about this)
23. How much did you pay for the network link-up?
24. Do you have a subscriber fee in the network? Is it on the regular basis?
25. How is the payment process for the subscriber fee organized?
26. How much do you usually pay for Internet in your network?
27. How is the payment process for Internet organized?
28. How is the network architecture organized? (cable and network architecture type)
29. How is the process of sharing media files organized? (program names or process description)
30. What Internet provider do you have in the network and used to have previously?

31. Is the Internet operator ‘fixed’ by the administrator of the network or can you choose your own Internet operator?

**APPENDIX C. EXAMPLE OF QUESTIONNAIRE FOR PRIVATE INTERNET PROVIDER
(ADAPTED TO THE 'SOLO' COMPANY PROFILE AND HISTORY)**

- 1) Solo is one of the oldest Internet providers in Belarus. What is the exact date of the company creation?
- 2) What kind of Internet-access technologies did the company offer then? Where these services available for individual users and and or organizations?
- 3) Since when does the company offer the Internet –access for individual users?
- 3) Since when does the company offer ADSL-access?
- 4) What are the main strategic episodes of technology development in the company? (for example, ADSL -> ADSL + Ethernet services...)?
- 5) Solo was one of the first companies that started cooperating with home LANs. Could you please tell in details how and why this was decided on?
- 6) Was this decision a strategic decision or a forced investment (taking into account the Beltelecom monopoly)?
- 7) Was the company cooperation with home LANs profitable in terms of financial and material and human investments?
- 8) How were the technologies and services for home LAN users different from the usual individual users? Had the company change its usual services, working practices, technologies when working with home LANs? For example, in the system of technology support for users, payment systems, etc.
- 9) Since when does the company offer Ethernet services for its users?
- 10) Why does the company emphasize the priority of internal resources and Solo and Ethernet services?
- 12) What is the company user orientation concept: service personalization and technical support of individual users or package agreements for the groups of users?
- 11) How was the structure of internal services and innovations developed by the company? What was the home LAN influence on the process?
- 13) What are the company comments and position concerning the project of Beltelecom de-monopolization and the law on home LAN liquidation?
- 14) In one of the article interviews you [Vladimir Ivashkevich, the company founding director, A.Z.] mentioned that the company is ready to 'help home LANs in the projects of their legalization'. What is an approximate sum that the company is ready to invest in this project? Has the company already had an experience of this kind?
- 15) What do you consider to be main successful factors and strategies for a private internet provider taking into account the company monopoly and ever changing (diminishing) prices for the Internet access? What is the company mains strategy of survival in these conditions?

16) In one of the article interviews the director of 'Solo', Vladimir Ivashkevich, mentioned that his work and his hobby coincide. Where does the idea of the company creation come from? Do you have a professional background in your 'hobby'?

APPENDIX D. QUESTIONNAIRE FOR THE BELTELECOM TELECOMMUNICATION COMPANY

- 1) Reasons and social and organizational conditions of the company creation in 1995?
- 2) Technological and organization condition of the dial-up technology creation and implementation?
- 3) Strategic stages of the Internet computing technology development? How did the development from dial-up -> ADSL-access for organizations->ADSL-access ('Byfly' trade mark) for individual users-> 'Byfly unlim' -> WiMax technologies evolved?
- 4) What changes did the company had to make on the side of architecture and services, organizational structure, etc.?
- 5) How many users did the company have at each stage of the technology?
- 6) Did the company provided the ADSL access before the 'Byfly' introduction?
- 7) 'Byfly' was a serious stage in the Beltelecom Internet services. Why was this realized?
- 8) According to the information at the Beltelecom website, before introducing 'Byfly' the company studied 'the experience of other providers and organizations'. Could you please provide details on the process?
- 9) Why the 'unlim' from Beltelecom was launched?
- 10) Does the company cooperates with other Internet-organizations, private Internet providers?
- 11) Does the company cooperates with home LANs?
- 12) Project of Beltelecom demonopolization: details?
- 13) How was the structure of the Ethernet services formed in Beltelecom? Was it influenced by other organizations (private providers, etc.)?
- 14) What is the structure of the Ethernet serves provided by 'Byfly'?
- 15) Why does the company, government monopolist on the Internet-access, put the emphasis on the development of the Ethernet services accompanying the Internet-access?

**TECHNOLOGY AND INFRASTRUCTURE CO-CREATION FROM THE BOTTOM-UP:
INSTITUTIONAL, SOCIOMATERIAL, IMPROVISATIONAL AND SYMBOLIC
ACCOUNTS FROM THE FIELD
THE CASE OF GRASSROOTS INTERNET INFRASTRUCTURE DEVELOPMENT IN
BELARUS**

ABSTRACT

This dissertation is a multi-perspective inquiry into the phenomenon of grassroots end-user innovation. It focuses on the processes of end-user innovation and technology co-creation and investigates how these developments are embedded in the context of environmental complexities and the interplay of existing actors, institutions and infrastructures. The research setting is based on the 16-year Internet infrastructure development by residential citizens as an alternative to the government and private providers' inaction. The phenomenon included millions of users, innovations and public value creation from the grassroots, and successful cooperation with private organizations. The dissertation mainly comprises three research papers each taking a separate perspective on the phenomenon. Methodologically, the dissertation builds on the qualitative case-study approach and abductive and inductive reasonings. The dissertation provides theoretical and practical contributions to the understanding prerequisites, process and consequences of end-user innovation, co-evolution of the technology meaning and structure, grassroots links with industry, as well as organizational change in routines and technologies as embedded in larger institutional dynamics and complexities.

Key-words: technology co-creation, post-adoption technology use, sociomateriality, institutional theory, symbolic meaning of technology, improvisation, innovation, qualitative case study

RESUME

Cette thèse est une investigation multi-perspective du phénomène des innovations créées par les utilisateurs finaux. Elle est focalisée sur les procès des innovations et de co-crédation des technologies venu du niveau des utilisateurs finaux, c'est-à-dire sur les procès qui sont appelé dans des publications anglophones 'grassroots technologies'. Nous considérons comment ces développements se plongent dans le contexte des complications d'environnement et de ses interactions avec des acteurs déjà en jeu, i.e. institutes et des infrastructures déjà existants. Notre recherche est fondée sur le développement d'une infrastructure d'Internet, évoluant pendant 16 ans, dont est élaboré par des particuliers comme alternative à l'inaction du gouvernement et des fournisseurs d'Internet. Le phénomène a réuni millions des utilisateurs, création des innovations et des biens publics par des particuliers, ainsi que coopération fécond avec des organismes privés. La thèse comprend trois articles de recherche, chacun prenant une perspective différente du phénomène. Du point de vu de la méthodologie, ce travail est appuie sur l'approche avec les études qualitatives des cas et les raisonnements abductifs et inductifs. La thèse fournit contributions théoriques et pratiques pour compréhensions des conditions préalables, procès et conséquences des innovations par des utilisateurs finaux, la coévolution du sens et de la structure de la technologie, lien entre le niveau des innovations par des utilisateurs finaux et l'industrie, ainsi que le changement en routines et technologies quand ces dernières sont plongés dans l'ambiance de la dynamique institutionnelle et des complexités.

Mots clés: co-crédation des technologies, utilisation de technologie après adoption, sociomaterialité, théorie institutionnelle, sens symbolique de technologie, improvisation, innovation, étude des cas qualitative