Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 196 (2022) 183–190

Procedia Computer Science

www.elsevier.com/locate/procedia

CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies 2021

Basic digital competence in Norwegian banking

Julie Norveel[a,*], Rolando Gonzalez[b], Wanda Presthus[b]

[a]*Deloitte AS, Dronning Eufemias gate 14, 0103 Oslo, Norway*
[b]*Kristiania University College, Kirkegaten 24-26, 0153 Oslo, Norway*

Abstract

While the 21st century is crowded with disruptive technologies and ground-breaking innovations, this study will take a step back and explore basic digital competence, such as navigating a spreadsheet or using word processing tools and e-mail to conduct tasks at work. Based on a case study approach where data is derived from iterative testing of 213 employees in the banking sector and 10 semi-structured interviews, we contribute to the literature of information infrastructure and knowledge management by addressing the basic digital level of competence amongst employees. We found that the level of basic digital competence was surprisingly low, especially regarding spreadsheets; however, our analysis revealed that the skills can be quickly improved. The challenge is rather to make employees aware of the possibilities and benefits of improvement. This paper presents insights that should be useful for employees and managers in banks and similar industries. It also reminds researchers within information systems to pay attention to basic digital competence.

Keywords: Basic Digital Competence; Norwegian Banking Sector; Information Infrastructure; Knowledge Infrastructure.

* Corresponding author. Tel.: +47 47 39 00 98; fax: +47 23 27 90 01.
E-mail address: jnorveel@deloitte.no

10.1016/j.procs.2021.12.004

1. Introduction

The information systems discipline has a long tradition of studying comprehensive topics such as technology acceptance [1], IS success [2], diffusion of innovation [3], and information infrastructure [4], as well as large enterprise systems within organisations. But what about basic digital competence? Do we assume that all employees can convert a Microsoft Word® file to an Adobe PDF® or navigate in a spreadsheet? Digital competence was a prominent topic during the late 1990s and early 2000s. The topic became mainstream as information systems became a fundamental part of organisational processes, and today, digital competence is considered both a right and a requirement for an individual's ability to contribute to the knowledge society [5, 6]. While the topic drove streams of literature in various directions, the focus on digital competence amongst employees decreased [7].

Norwegian Statistics estimated the hidden organisational costs caused by absent digital competence amongst employees to be 33.6 billion NOK [8] (approximately 3.36 billion Euro). A comprehensive survey verified that 30% of individuals increase their digital competence to improve performance at work [9]. Van Laar et al. [7] and Oberländer et al. [10] argue that current literature on the topic of digital competence in organisations is narrow and calls for research that presents accurate results of the employees' level. Our response to this call is manifested in the research question: *What is the level of basic digital competence amongst employees, and how can it be improved?*

2. Related Research

Digital competence knows many terms, frameworks, and research fields, culminating in a lack of consistency in the definition [10-12]. The most commonly cited definition in an organisational context reads: *"Digital competence is an individual capacity to use and combine one's knowledge (i.e., know-what), skills (i.e. know-how), and attitude (i.e. know-why) associated with three related competence areas, technological, cognitive, and social, to use new or existing ICT to analyse, select and critically evaluate information to investigate and solve work-related problems and develop a collaborative knowledge base..."* [13 p. 4683]. The initial digital competence frameworks were developed in the 1990s and focused on technical competence [14]. Over time, the frameworks evolved and included concepts such as information management, collaboration, and communication. Today, the frameworks often include ethical awareness, safety, and lifelong learning [7]. Extant research (for example, [13, 15]) is sceptical towards self-assessment of digital competence: *"self-report survey data has significant validity problems"* [7 p. 2190].

The company implements applications, and the employees use them, hence creating new organisational processes and competencies [16]. In other words, this is an employee learning process activated by management, also known as top-down. According to Davenport and Prusak [17], an organisation must stay competitive, and they argue that sustainable competitive advantage comes from internal organisational knowledge. Researchers also claim that the level of digital competence in an organisation will depend on the existing incentive to manage organisational change [13, 18]. Roberts et al. [19] state that an organisation reacts to the external environment by initiating a process that influences the digital competence of employees. Nonaka and Takeuchi build upon this to continuous innovation leading to competitive advantage [20].

An information infrastructure is defined as: *"...a shared, open (and unbounded), heterogeneous and evolving socio-technical system consisting of a set of IT capabilities and their user, operations and design communities"* [4 p. 4]. Hanseth built on the theory of information infrastructure and introduced *knowledge as infrastructure* [21]. He suggested that a transformation process, such as introducing a new Enterprise Resource Planning (ERP) system, will generate a learning process in the organisation. As the single system will be a part of an interconnected system, a researcher should look at the growth of a socio-technical network over time. Hanseth and Monterio [22] argued that such a network consists of technology, users, developers, and work practices. Therefore, research should shift from focusing on a single system implementation towards the network of the organisation. Building on Hanseth, Presthus [23] proposed a framework called Knowledge Infrastructure in Action (Fig. 1).

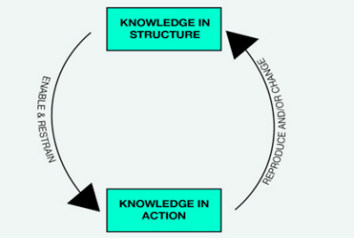

Fig. 1: The Knowledge Infrastructure in Action [23 p. 148]

This framework allows for analysing the evolution of knowledge. The *knowledge in structure* constitutes actors in a company, which can be the systems, employees, and tools, while *knowledge in action* represents how the resources are used by the actors in the company. The *knowledge in action* has two potential impacts: It may either *reproduce* and/or *change* the *knowledge in structure* [23].

According to Davenport and Prusak, knowledge is *"a fluid mix of framed experiences, values, contextual information, and expert insight"* [17 p. 5] and is a foundation for measuring digital competence. Organisational success or failure depends on being aware of the knowledge you have and what you can and cannot do with that level of knowledge. The creation of knowledge in an organisation depends on the employees' and the organisations' continuous process of self-renewal. However, Kispeter [12] found measuring digital competence to be absent except in the employment phase. A study by Lloyds Bank [9] included 2,700 participants on the reasons for improving digital competence. Fifty-three percent answered to improve performance, 30% specified it to be in the context of work, while 26% answered "for no particular reason". It is therefore important to address levels of competence and how it can be improved.

3. Method

Our research is based on a case study approach [24] with one case company in the Norwegian banking sector. The case company was chosen for two main reasons. First, a bank deals with large amounts of data and numerous information systems. Second, this bank had already conducted basic digital competence tests, constructed by a third party called 'Norsk Test'. We could access the test results and interview employees and managers. The bank requested strict confidentiality, so we cannot reveal any further details.

'Norsk Test' provided us with the results of 213 employees' individual level of basic digital competence. The employees in the case company performed the test once, and then they were given an e-learning course before being tested once more. This secondary data (presented in Fig. 2) was used to set the context for the subsequent interviews. First, we interviewed two managers in human relations (HR) and made a field trip to 'Norsk Test' to observe how they performed their tests. We conducted one interview outside the case company with an expert in digital competence training amongst banking employees. This data collection took place in February and March 2020. Second, we interviewed seven employees guided by semi-structured questions. The interviews were conducted by telephone during March 2020. All interviews were tape-recorded with permission. After the transcriptions, the tape-recordings were deleted. The following questions were asked during the interview:

1. How do you define digital competence?
2. What are the benefits of increasing your digital competence?
   For example, does it make you more prepared for learning a new system or digital tool?
3. How does the lack of digital competence influence the work environment?
4. How do you proceed if you, or a co-worker, struggle with conducting a task in a digital tool?
5. What was your overall experience with the test? Would you have taken it if it was not mandatory?

The following steps, based on [25], were used to analyse the data, starting with step 1: generating an overview of the collected data, step 2: systematizing the findings by identifying themes and trends, and step 3: explaining the

findings. The third step includes the theoretical framing. This procedure had multiple iterations. Table 1 sums up our method:

Table 1. Summing up our method

Data collection	Test results of 213 employees (internal documents), 10 semi-structured interviews (2 HR managers, 7 employees, 1 training expert), observation from fieldtrip
Data analysis	The ladder of analytical abstraction [25]
Theoretical framing	Knowledge infrastructure [21, 23]

4. Findings

Existing literature uses various concepts to define digital competence. We compared four frameworks [7, 12, 13, 15] and found that the common concepts were information management, communication, collaboration, and problem solving. The test in this study was divided into five topics: basic use of a computer, word processer, and spreadsheet, and the use of the internet and e-mail (see Fig. 2). The employees were tested at a basic level, with questions such as "How do you attach a file to this e-mail?"; "Which column is highlighted in this Excel sheet?" and "How do you embed a figure into an e-mail?".

The management at the case company had decided on an 80% benchmark for passing the test. As shown in Fig. 2, all 213 employees scored just above 70% on the topics on Test 1, except for the internet test. Spreadsheets were the weakest point, scoring less than 40%. However, the online course before Test 2 led to an improvement of over 10 percentage points on most of the topics and over 30 percentage points on spreadsheets.

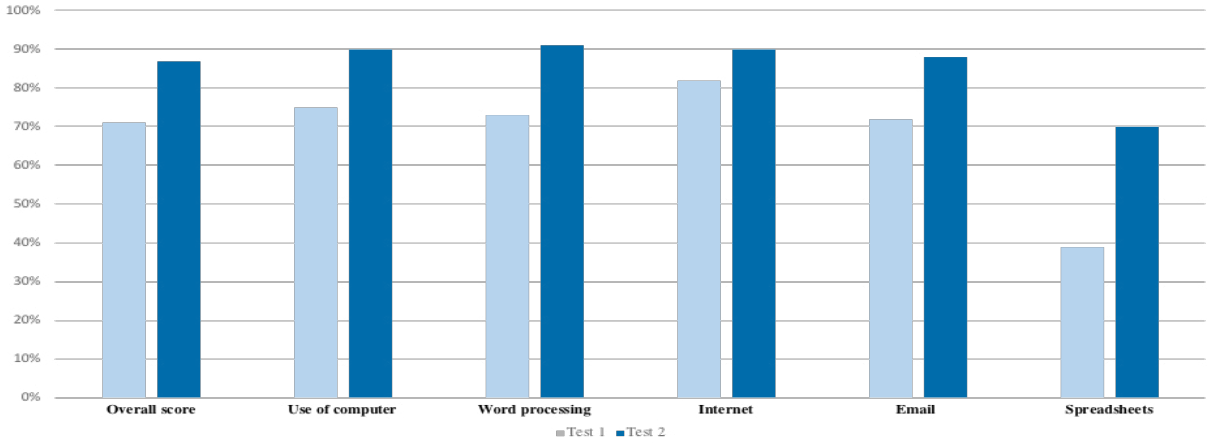

Fig. 2: Overview of results from Test 1 and Test 2 by topic (Norsk Test, 2019, internal document)

Based on the interviews with the managers from the bank and 'Norsk Test', we clustered the findings into three main topics:

i) The management is very satisfied with the outcome of the second test.

ii) The management asks whether the employees are now more prepared for new systems or tools.

iii) The employees were given two months to prepare for the second test (but no time to prepare for the first test). The aim was to increase the individual level of basic digital competence, not to keep score of the test itself.

Regarding the interviews with the employees, we found that each participant defined digital competence influenced by their tasks at work. One participant answered: *"I think basic digital competence is the ability to perform your tasks at work and use digital tools for personal reasons"*. Another participant saw a connection between their competence and the world: *"What one should know to do a good job in an increasingly digitalized world"*.

On the question of benefits of increasing basic digital competence, all but one participant expressed the benefit of being more effective. Some employees also saw benefits such as independence, a sense of mastering, and fun. They acknowledged that a lack of digital competence would be negative on efficiency and time, and their ability to guide and advise their customers.

Regarding the question of how the employees would proceed when struggling with a digital tool, we saw two groups of answers. The first group would go directly to support, while the second group would approach the issue by trying themselves, discussing with a colleague, and searching the internet.

The participants were asked to discuss their personal experience with the test. All but one said they would have taken the test also if it was not mandatory. All the participants perceived a positive value on the organisational level. However, when it comes to value on a personal level, the respondents fell into two groups. The first group saw no value for themselves. The other group utilized the test to evaluate personal abilities and how they could use the results to their advantage in their current role. In addition, we asked them if they thought the test would strengthen their ability to learn a new system or tool. The respondents were again split into two groups with one group not seeing any relation, while the other saw a relation.

Another interesting finding from the interviews was that some employees had taken the first test alone, while others had taken it together with colleagues. Some respondents mentioned that this could be due to fear of exposure to the management. One participant stated: *"Many sat together not to reveal weakness. I think there was an underlying fear of lacking competence."*

We find that the topics of the test are covered by other test frameworks identified by [7, 12, 13, 15]. However, we find no discussion on the level of benchmarks in the literature. The results from the test verified that the level of competence of the 213 participants was not consistent with the management's expectations of 80%. What were the employees' expectations? The interviews disclosed identical answers: the ability to conduct tasks assigned at work. In other words, the level is limited to getting the job done. One participant said: *"I think it is easy to become comfortable in the rhythm of the daily tasks at work and only focus on what you have in front of you"*. Furthermore, six of the participants perceived the expected benchmark and the topics as difficult.

5. Analysis Using the Knowledge in Action Framework

This section demonstrates how the *knowledge in structure* and *knowledge in action* developed during the two tests in the bank. Fig. 3 illustrates the evolution of digital competence.

5.1. First Iteration of Digital Competence: In the Wake of Test 1

The management of the case company informed us that one reason for organizing the test was to prepare for the implementation of a new enterprise system. The *knowledge in structure* presents the tangible and intangible assets and resources that exist in the bank. The assets in our case company are, for example, software such as word processing, e-mail, spreadsheets, in addition to user support and e-learning. The employees were *enabled* and *restrained* by the background, roles, knowledge, and experience of using these tools.

None of the 213 employees passed the first test with an average 80% benchmark. However, if we see the test as *knowledge in action*, it made the employees become aware of the expectancy of the company. Our respondents fell into two groups because they differed in their opinion of whether the competence was necessary for their role in the company. The perceived value made some participants take action to increase (thus *change*) their current competence, while others *reproduced* their current level.

5.2. Second Iteration of Digital Competence: In the Wake of Test 2

The *knowledge in structure* had grown after one iteration. The participants' experience and results from the first test *enabled* and *restrained* their actions on the second test. More specifically, their attitude towards the relevance of topics and expected level impacted their efforts in increasing their levels.

The *knowledge in action* increased significantly in digital competence across the majority of the 213 employees after Test 2. The overall scores improved, and strengthened the background and experience of employees, which

further impacts the *knowledge in structure*. All participants saw the value of the test for the organisation. The participants who expressed personal gain changed the *structure* by increasing motivation for other systems and tools.

The implementation of the tests and customized e-learning course proved to grow the *knowledge in structure* in the case company. The raised level of digital competence points to an expanded knowledge base and the ability to utilize standard tools to a greater extent.

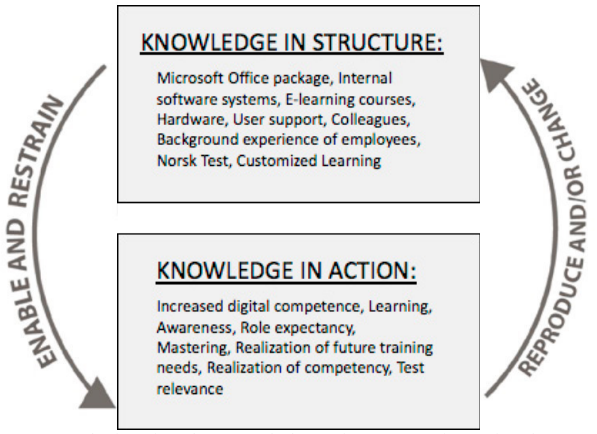

Fig. 3: Our analysis using the Knowledge Infrastructure in Action framework

6. Discussion

Hanseth reflects on the phenomenon where a particular tool or system increases in value as more people apply it [21]. The organisational culture had a significant impact on the employees' learning curve. One participant stressed that when they need help to solve a task, they try to find the most capable colleague. While organisational culture may *restrain* an appropriate level of digital competence, we were surprised and happy to discover that the lack of digital competence also *enabled* a good culture. One participant described a great work environment, where asking for help was easy. However, many participants were also concerned about the absence of digital competence to be associated with weakness. Our interpretation of this conflicting scenario is that employees are not afraid of exposing a weakness amongst each other, but to the management.

When asking the participants about possible transfer value to new information systems, six of the seven employees were positive. Implementing a new system will generate a new learning process [21], and this basic test may have granted a head start for the case company. The expert interview confirmed that when a person's competence stops at the minimum of required abilities, it is more difficult to follow the wave of digitalization.

Who handles maintaining digital competence in an organisation? Most initiatives, like the one presented in this paper, come from the management, as found by Crossan et al. [16]. Should the employee be able to recognize shortcomings? Existing research [7, 13, 15] does not say so, and the results of this paper indicate that the employee may be unaware of their (low) level.

The expert interview provided a broader perspective about the norms in the banking sector. For example, an employee often stays in the banking sector for their entire working career. Large banks, such as this case company, tend to retain grounded legacy systems, and this will challenge the implementation of new systems. Thus, the likelihood for these employees to be exposed to new technologies might be limited. This was not the case in this study. The motivation for the case company for mapping basic digital competence was to prepare for a new information system. It would be interesting to follow the bank post implementation, and study whether the increased level of basic digital competence has a positive effect regarding Hanseth's theory [21].

The participants were surprised by the test benchmark of 80% and their own low scores. Cap Gemini and EY portrayed the immense hidden costs of lack of digital competence [8], and our case company might have discovered the same. The tests decreased the gap between management's expectations and employees' performance, but what does this generate? Mapping levels of competence in an iterative manner makes the employees endure a learning process, rather than just being lectured in basic competence without before-and-after assessment. However, this comes

with a warning: we learned from the 'Norsk Test' that if the tests are not mandatory, only the people that already possess a favourable level will take them. In other words, we witness a *reproduction* of skilled people becoming more skilled. In sum, we find that the actions mostly lead to a *reproduction*, rather than *change*.

7. Contributions and Limitations

This study makes a small contribution to the digital competence and knowledge infrastructure literature. We applied the *Knowledge Infrastructure in Action* [23] and found the framework useful when analysing basic digital competence. Table 2 sums up our insights and presents implications for practice.

Table 2. Insights from this study

Insight	Implications for organisation	Implications for employees
Level of digital competence	The organisation may assume that basic digital competence among employees can be improved, especially regarding spreadsheets. The employees are more reluctant to reveal their level of competence to the management than to colleagues.	The employees should be able to map their own level of digital competence, perhaps anonymously.
How to improve	Organising tests and basic training courses will easily increase the level of digital competence. Allow collaboration between employees.	Take the tests and training courses. Cooperate with colleagues.
Consequences of increased competence	If the employees master basic digital competence, they may be more receptive to further technology adoption.	Increasing digital competence enables a sense of accomplishment and can make the tasks more enjoyable.

This study has several limitations, which are also suggested for future research. First, due to the confidentiality agreement with the bank, we could not investigate the employees' roles and demographics. It would have been interesting to map variables such as age, gender, and education against the test results. Additional interviews with more employees would also have strengthened our study, but the bank would only let us talk to seven employees.

Second, the existing literature says a lot about defining digital competence, but less about what constitutes an acceptable level amongst employees. Our case company stipulated an 80% benchmark for passing the test. The employees stated this to be too high, but they nonetheless successfully reached it. Also, the test in question was highly influenced by Microsoft Office, and more research is needed on other vendors.

Third, we acknowledge that the information and knowledge infrastructure theory require study over time, and we have only made a snapshot in this paper. The aftermath of the testing process is worthy of further research. Can the case company point to any quantitative results of increased performance? Does the increased level of basic digital competence make the implementation of other, more complex enterprise systems smoother?

Fourth and finally, a new question arising from this paper is responsibility. Who is responsible for basic digital competence? The employee? The organisation? The society, with embedded education in high school? Current literature disapproves of the commonly used self-assessment method. Our study supports this, as our participants were surprised by their low scores post testing; however, more research should address whether there is a need for a top-down management approach or if there are other solutions.

8. Conclusion

This paper addresses the research question: *What is the level of basic digital competence amongst employees, and how can it be improved?* Existing research calls for more accurate measures of digital competence amongst employees, and this study of a Norwegian bank contributes by presenting solid test measures of 213 employees, in addition to qualitative data from ten interviews. Our contribution of three insights is:

(1) The digital competency level was lower than expected. The employees were tested in the basic use of a computer, word processing, spreadsheets, and the use of the internet and e-mail. Overall, the employees scored just slightly over 70% on the first attempt. Regarding spreadsheets, the score was below 40%. Repeating the test after training increased the level with more than 10 percentage points overall and over 30 percentage points regarding spreadsheets. (2) Improving the level can be executed easily by offering training courses and by establishing a work

culture where helping each other is encouraged. (3) The consequences of increased competence can make the tasks more enjoyable for the employee and perhaps be more positive towards further technological adoption.

Acknowledgements

We thank all participants pertaining to the anonymous bank as well as Norsk Test. Gratitude also goes to the reviewers at CENTERIS 2021 for raising the quality of this study.

References

1. Davis, F.D. (1989) "Perceived usefulness, perceived ease of use, and user acceptance of information technology." *MIS Quarterly* **13 (3)**: 319–340.
2. DeLone, W.H. and E.R. McLean. (2003) "The DeLone and McLean Model of Information Systems Success: A Ten-Year Update." *Journal of Management Information Systems* **19 (4)**: p. 9-30.
3. Rogers, E.M. (2003) Diffusion of Innovations. 5 ed. The Free Press.
4. Hanseth, O. and K. Lyytinen, (2010) "Design theory for dynamic complexity in information infrastructures: the case of building internet." *Journal of Information Technology.* **25:** 1-19.
5. Ananiadou, K. and M. Claro. (2009) "21st century skills and competences for new millennium learners in OECD countries." *OECD Education Working Papers*, **41**, 1-34.
6. Ferrari, A., Y. Punie, and C. Redecker. (2012) "Understanding digital competence in the 21st century: An analysis of current frameworks." in *European Conference on Technology Enhanced Learning*. Springer.
7. van Laar, E., et al., (2018) "21st-century digital skills instrument aimed at working professionals: Conceptual development and empirical validation." *Telematics and Informatics* **35 (8)**: 2184-2200.
8. Cap-Gemini-&-EY (2001) *Estimation of Hidden Computer Costs within the Norwegian Population*. Oslo: Norway.
9. Lloyds-Bank, UK Consumer Digital Index 2018: Benchmarking the digital and financial capability of people in the UK. Lloyds Bank, 05/2018. Available at: https://www.lloydsbank.com/assets/media/pdfs/banking_with_us/whats-happening/LB- Consumer-Digital-Index-2018-Report.pdf. 2018.
10. Oberländer, M., A. Beinicke, and T. Bipp. (2020) Digital competencies: A review of the literature and applications in the workplace. Computers & Education **146:** 103752.
11. Bassellier, G., B.H. Reich, and I. Benbasat (2001) Information technology competence of business managers: A definition and research model. Journal of management information systems **17 (4)**: 159-182.
12. Kispeter, E., What digital skills do adults need to succeed in the workplace now and in the next 10 years. Warwick Institute for Employment Research. [Electronic resource]. https://assets. publishing. service. gov. uk/government/uploads/system/uploads/attachment_data/file/807831/What_digital_skills_do_adults_need_to_succeed_in_the_workplace_now_and_in_the_next_10_years_. pdf (accessed: 20.05. 2020), 2018.
13. Vieru, D., et al. (2015) "Digital competence: A multi-dimensional conceptualization and a typology in an SME context." in 2015 48th Hawaii International Conference on System Sciences. IEEE.
14. Gilster, P. (1997) *Digital Literacy*. New York: Wiley.
15. Van Laar, E., et al. (2017) The relation between 21st-century skills and digital skills: A systematic literature review. Computers in human behavior, **72** 577-588.
16. Crossan, M.M., C.C. Maurer, and R.E. White. (2011) "Reflections on the 2009 AMR decade award: do we have a theory of organizational learning?" *Academy of management Review* **36 (3)** 446-460.
17. Davenport, T.H. and L. Prusak. (1998) *Working Knowledge. How Organizations Manage What They Know*. Harvard Business School Press.
18. Harison, E. and A. Boonstra. (2009) "Essential competencies for technochange management: Towards an assessment model." *International Journal of Information Management* **29 (4)**: 283-294.
19. Roberts, N., et al., (2012) Absorptive capacity and information systems research: Review, synthesis, and directions for future research. MIS Quarterly: **xx (x)**: 625-648.
20. Nonaka, I. and H. Takeuchi (1995) *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press.
21. Hanseth, O. (2004) "Knowledge as infrastructure", in Chrisanti Avgerou; Claudio Ciborra & Frank Land (ed.), *The Social Study of Information and Communication Technology. Innovation, Actors and Contexts.* Oxford University Press.
22. Hanseth, O. and E. Monteiro (1997) "Inscribing behavior in information infrastructure standards." *Accounting, Management & Information Technology* **42 (4)**: 385-391.
23. Presthus, W. (2013) "Knowledge Infrastructure in Action. A case study of Business Intelligence in Higher Education." *NOKOBIT - Norsk konferanse for organisasjoners bruk av informasjonsteknologi*: 145-158.
24. Yin, R.K. (2014) *Case Study Research. Design and Methods.* 5 ed. SAGE Publications, Inc.
25. Miles, M.B. and A.M. Huberman. (1994) *Qualitative Data Analysis*. Thousand Oaks: Sage Publications.