



Barriers to the implementation of innovations in information systems in SMEs

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Article history

Received 05.04.2021
Accepted 12.05.2021
Available online 14.06.2021

Keywords

innovation
information management
IT innovation
service management
MSE

Abstract

Information management and information flow is an important element in the strategy of developing and running a company. The need to supervise information makes it necessary to implement numerous innovations that improve the method of information management correlated with the proper reception, selection and analysis - in both external and internal information flow. This paper presents the results of research that allowed for the assessment of barriers that arise during the implementation of innovative solutions in small and medium-sized enterprises (service MSEs). On the basis of the conducted research, it was found that the mental barrier is not always crucial from the point of view of modern technologies implementation. And the determination to implement information management innovations may be forced by the necessity of the document exchange acceleration. The success of innovative solutions e.g. in the financial services industry (in SMEs) is closely related to the technological capabilities of the enterprise - the technological barrier is crucial in this type of enterprises. Especially, taking into account the assumption that employees are highly motivated to implement new products.

DOI: 10.30657/pea.2021.27.20

JEL: L23, M11

1. Introduction

Information is one of the most important factors determining the company's success. Moreover, information can be the company's most important asset. In this context, the true value of information is revealed, which depends to a large extent on its quality, i.e. completeness, clarity, precision, relevance, accuracy and timeliness. The information is the basis for starting a business, running it and choosing a management strategy. Additionally, the management of such information is a serious challenge for any market player. And the ability to a proper information management can increase its value many times over. This is due to the fact that the role (value) of information is relative and depends on the knowledge, skills and competences of the people using it (McDonough et al., 2015). Just the set of external and internal information, their proper flow and analysis in terms of needs, allow to make the right decisions regarding business proper functioning (Hensen and Dong, 2020; Liu et al., 2021; Matusznyi, 2020).

The modern, quick-profit-oriented market is prepared for the management of all types and kinds of information. And the method of information management requires correlating with the proper reception, selection and analysis of information -

this applies to both external and internal information (Ingaldi, 2018). However, taking into account that the implementation of information management in context of innovation is associated with social, economic and technological problems, the analysis and assessment of these factors impact on the information management method seems to be essential. And the purpose of this paper is to assess the strenght of barriers in implementation of innovative solutions in small and medium-sized enterprises (service MSEs).

2. Literature review

2.1. Quality and flow of information

The current situation of limited access caused by the COVID-19 pandemic has largely contributed to the dynamic development of information management and has contributed to building new communication systems at the business-client level (Baryshnikova et al., 2021; Muangmee et al., 2021; Urban and Łukaszewicz, 2021). The previously known models of managing B2B and B2C communication, etc., have gained a lot of momentum in the IT space (Cheng et al., 2021). In many cases, the Internet is the environment for maintaining business contacts. It is easy to observe on the basis of the

strengthening position of internet transactions, which is widely described in the newest world literature (Ahmad et al., 2020; Kock et al., 2020; Lei et al., 2021; Peltier et al., 2020).

In business practice, the quality and flow of information determine the benefits collecting. The need to systematize and streamline the flow of information occurs not only in large and complex organizations, but also in small and medium-sized enterprises (SMEs). There are many tools for monitoring and analyzing the flow of information value stream (both inside the enterprise and in the environment of the enterprise) (Klimecka-Tatar, 2018; Klimecka-Tatar and Ingaldi, 2020; Korpysa, 2021; Meyer et al., 2018). The optimization of information flow in the company is facilitated by the implemented information (IT) technologies - innovations. Due to IT technologies it is possible, among others proper coordination of information transfer (on both direction) at the business-client level (Iden et al., 2020).

2.2. Information technology and management

The information technology used for information management should be understood as an element supporting the transmission, presentation and security with the use of computer hardware and software, combining telecommunications, tools and various technologies related to information (Tkachenko et al., 2021; Żywiołek et al., 2021). Considering the all aspects, the focus should be on the specific type of innovation that reflects the product-service relation. This type of innovation is often overlooked and underestimated, despite the fact that it is becoming more and more important in modern enterprises of various industries. This type of innovation differs from other technological innovations in that it involves a continuous exchange of data between the customer and the service provider (Vendrell-Herrero et al., 2021). Product-service innovation can be found in enterprises that provide financial services to individuals and companies (Ma, et al., 2020; Okur et al., 2021).

Regardless of the type of selected innovations to be implemented, such innovation can be both an opportunity and a threat for a company (Ahmad et al., 2020; Iden et al., 2020). And starting the implementation process as well as innovations implementation in the enterprise always carries a potential risk. Small and medium-sized enterprises, which must overcome numerous barriers on the way to success, are exposed to a particularly high risk.

2.3. Barriers in innovation implementation

According to the literature, the barriers that may determine the failure of the implementation of a given innovation in an enterprise should be mentioned:

- functioning under pressure to maintain the smooth operation of the enterprise,
- lack of support in the managerial staff,
- lack of respect for the achievements of their predecessors,
- reluctance of colleagues,
- low level of involvement of social capital,
- low level of mutual trust between individuals,

- financial constraint,
- insufficient technical and technological support,
- lack of preparation for the initial decline in efficiency e.t.c.

In general, the factors that may contribute to the increased risk of implementing innovation can be divided into three main groups: mental and social barrier, economic barrier, and technological barrier. Table 1 presents a list of factors that are characteristic of building a barrier of a given type.

The emergence of such barriers is particularly noticeable in SMEs, which is the result of all organizational difficulties resulting from the lack of proper (or poorly developed) systemic management. Small and medium-sized enterprises management is particularly difficult, and this is due to a review of the world literature on various management problems (Mueller-Using et al., 2020; Niciejewska et al., 2021; Żywiołek et al., 2021).

Table 1. Set of factors that are characteristic for mental and social barrier, economic barrier, and technological barrier

Barrier type	Set of factors
mental and social	- lack of motivation to implement the facilities, - lack of knowledge in the field of implemented innovation, - lack of support from the managerial staff, - no acceptance of the staff, - lack of understanding on the part of the crew, - reluctance of co-workers, - work under stress and pressure, - aversion to new technologies, - lack of commitment to training and acquiring new competences,
economic	- lack of adequate capital, - no possibility of financing from external funds, - lack of knowledge in the field of acquiring funds for the implementation of innovations, - improperly carried out (or lack) of financial analysis,
technological	- mismatch of technical equipment, - lack of technical equipment, - lack of readiness for new information (and IT) technologies, - no unit in the structure that would be responsible for supporting new information technologies.

First of all, difficulties in management result from relations between employees, awareness of responsibility and positioning the organization structure based on employee competences. Typically, SMEs are also identified with enterprises with smaller financial capital and a poorly developed technological portfolio (Aspiranti et al., 2020; Ciekanski and Wyrębek, 2020; Ulewicz and Mazur, 2019). Thus, in principle, organizational innovations may be the easiest to imple-

ment for SMEs. However, taking into account that the implementation of such an organizational innovation in the field of information management system is associated with investment in IT resources, including hardware and software, the strength of the barrier, both economic and technical, grows significantly. Each time (and especially in the era of a pandemic) it should be emphasized that investments in information technologies increase the level of innovativeness of enterprises. What can be considered on several levels. In the micro scale, for individual economic entities, and in the macro scale for the entire industry sector (Ali Taha et al., 2016).

3. Experimental

As its results form previous research, the most frequently IT innovative solution used in the financial services sector include:

- e-invoices,
- bar codes,
- RFID tags,
- hybrid accounting,
- mashup technology,
- accounting platforms.

With regard to the indicated innovative solutions supporting the management of information systems (in the financial services sector), a simple questionnaire was constructed to illustrate what barriers an enterprise may face in face of implementation.

For the purposes of this research, a questionnaire was constructed. The questionnaire was conducted in electronic form, and this paper presents only the results related to its three parts (6 questions/statements for each barrier).

The first part related to the mental and social barrier in terms of the six listed innovations (S1-6). The second part related to the economic barrier (S7-12), while the third part related to the technological barrier (S13-18).

The questionnaire consisted of 18 questions / statements:

Part 1:

- S1. E-invoices was easily implemented in the company.
- S2. Bar codes was easily implemented in the company.
- S3. RFID tags was easily implemented in the company.
- S4. Hybrid accounting was easily implemented in the company.
- S5. Mashup technology was easily implemented in the company.
- S6. Accounting platforms was easily implemented in the company.

Part 2:

- S7. The implementation of e-invoices did not require a large financial contribution.
- S8. The implementation of bar codes did not require a large financial contribution.
- S9. The implementation of RFID tags did not require a large financial contribution.
- S10. The implementation of hybrid accounting did not require a large financial contribution.

- S11. The implementation of mashup technology did not require a large financial contribution.
- S12. The implementation of accounting platforms did not require a large financial contribution.

Part 3:

- S13. Technical equipment and IT support is sufficient for the efficient functioning of e-invoices.
- S14. Technical equipment and IT support is sufficient for the efficient functioning of bar codes.
- S15. Technical equipment and IT support is sufficient for the efficient functioning of RFID tags.
- S16. Technical equipment and IT support is sufficient for the efficient functioning of hybrid accounting.
- S17. Technical equipment and IT support is sufficient for the efficient functioning of mashup technology.
- S18. Technical equipment and IT support is sufficient for the efficient functioning of accounting platforms.

The research was conducted in the 3rd and 4th quarter of 2020. Only 73 companies were admitted to the survey. Because only enterprises meeting the pre-selection conditions were admitted to the research. The companies were admitted in the case of meeting the conditions in the field of activity (financial service), size (SMEs) and maturity in applying innovative technologies (at least 3 of the indicated innovations have been implemented).

The respondents rated the questions on a Likert scale (from 1 to 5), where 1 mean "I completely disagree" and 5 mean "I completely agree". All obtained data was analyzed using statistical program.

On the basis of the obtained data, analysis of the correlation matrix was also performed. The analysis covered mainly the dependencies between the questions that correspond to the indicated technologies. Correlation expressed by the correlation coefficient, r - a number representing the degree to which the variables are interdependent. The correlation coefficient ranges from -1 (complete negative correlation), through 0 (no correlation) to $+1$ (complete positive correlation). The analysis assumed (due to the social nature of the study) that the correlation coefficient $> |0.6|$ indicates a strong correlation, while $\leq |0.6|$ a weak correlation.

4. Results and discussion

Table 2 presents numerical (statistical) characteristics of the responses obtained in the study.

Based on the data presented in Table 2, a chart was created representing the average value of the marks for individual questions (including the error). As can be seen from the data presented in Table 2 and Fig 1, the highest mean score in:

- Part 1 was obtained for S1 - *E-invoices was easily implemented in the company.*
- Part 2 was obtained for S11 - *The implementation of mashup technology did not require a large financial contribution.*
- Part 3 was obtained for S13 - *Technical equipment and IT support is sufficient for the efficient functioning of e-invoices.*

Whereas, the lowest mean score in:

- Part 1 was obtained for S6 - Accounting platforms was easily implemented in the company.
- Part 2 was obtained for S12 - The implementation of accounting platforms did not require a large financial contribution.
- Part 3 was obtained for S18 - Technical equipment and IT support is sufficient for the efficient functioning of accounting platforms

Therefore, it can be concluded that for companies providing financial services it is easiest to implement e-invoices, while it turned out accounting platforms seem to be difficult to implement. The employees agreed that the implementation of mashup technology did not require too much financial contribution, while the implementation of the accounting platforms requires a large financial contribution. Additionally, it can be noticed that IT support in the discussed enterprises is sufficient to work with e-invoices, but unfortunately not sufficient for the efficient functioning of accounting platforms.

Additionally, in part 1 of the study it was noted that the majority of respondents for e-invoices, bar codes, RFID tags, hybrid accounting did not use the full scale of notes. And the average ratings for the implementation of these innovations

were high. This may indicate a high determination to implement IT innovations in financial services.

Thus, the mental barrier is not crucial from the point of view of implementing modern technologies in financial services. Which from the point of view of modern technologies is quite unusual, because e.g. Ingaldi and Klimecka-Tatar (2020) in their research proved that it is the mental barrier that is the most difficult to deal with – usually caused by the lack of motivation to implement the facilities (Ingaldi and Klimecka-Tatar, 2020). The determination to implement information management innovations in financial services may also be forced by the necessity to introduce limitations in direct communication caused by the COVID-19 pandemic. Which confirms the statement that the pandemic under certain conditions accelerated the development of companies in the field of implementing IT innovations (Baryshnikova et al., 2021). Additionally, it can be suggested that companies providing financial services are preparing for much larger changes that are coming with the new principles of sustainability management, Industry 4.0 or Industry 5.0 (Aspiranti et al., 2020; Iden et al., 2020; Ingaldi and Ulewicz, 2020; Lazar et al., 2021; Pietraszek et al., 2020; Urban et al., 2020).

Table 2. Statistical (numerical) characteristics of the obtained results - based on the assessments of 73 employees from small and medium-sized enterprises dealing in financial services - services provided using the 6 most common information management innovations (e-invoices, bar codes, RFID tags, hybrid accounting, mashup technology, accounting platforms).

	Part 1						Part 2						Part 3					
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18
Mean	4.23	4.08	3.52	3.25	3.04	2.53	3.40	3.14	2.70	3.33	3.62	2.38	3.85	3.66	3.48	3.34	2.96	2.30
Standard error	0.11	0.10	0.10	0.10	0.09	0.11	0.17	0.15	0.12	0.11	0.12	0.17	0.15	0.15	0.15	0.17	0.15	0.13
Standard deviation	0.98	0.81	0.82	0.88	0.81	0.94	1.41	1.28	1.01	0.91	1.02	1.42	1.30	1.30	1.31	1.47	1.31	1.08
Variance	0.96	0.66	0.67	0.77	0.65	0.89	1.99	1.65	1.02	0.83	1.05	2.02	1.69	1.70	1.73	2.17	1.71	1.16
Kurtosis	0.21	1.93	-0.47	-0.29	1.82	0.87	-0.94	-0.97	-0.14	0.12	0.70	-0.71	-0.45	-1.10	-0.83	-1.26	-0.80	0.38
Skewness	-1.13	-1.27	0.17	0.50	0.58	0.56	-0.56	-0.51	0.39	-0.71	-1.09	0.81	-0.89	-0.41	-0.65	-0.24	0.12	0.88
Min	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Max	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

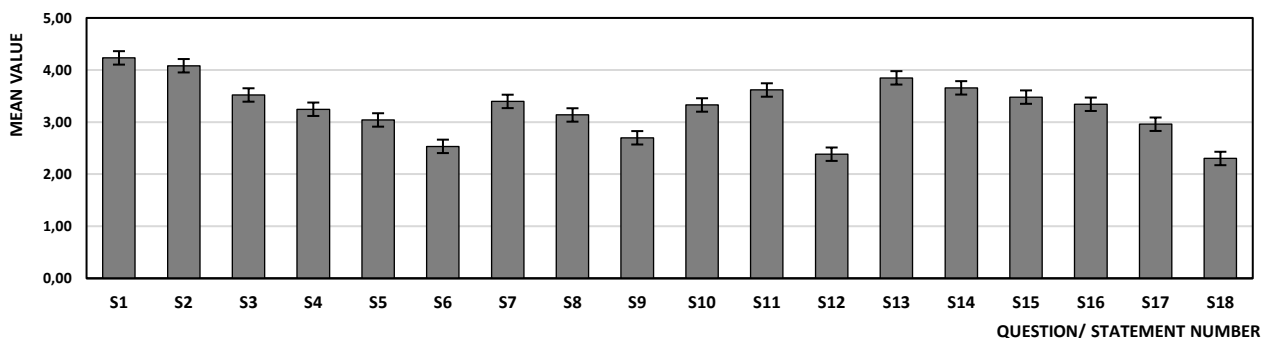


Fig. 1. The average value of the individual questions / statements assesment - based on the assessments of 73 employees from small and medium-sized enterprises operating in financial services - services provided using the 6 most common information management innovations (e-invoices, bar codes, RFID tags, hybrid accounting, mashup technology, accounting platforms).

Based on the assessments of 73 employees from small and medium-sized enterprises operating in financial services a correlation analysis between individual questions / statements was also performed. The correlation matrix is presented in Table 3. The values of all matrix elements belong to the interval $<-1, 1>$ (because they are correlation coefficients), all elements in the main diagonal of this matrix are equal to 1 (this determines the degree of correlation of the variable with itself). The analysis assumed (due to the social nature of the

study) that the correlation coefficient $> |0.6|$ indicates a strong correlation, while $\leq |0.6|$ a weak correlation.

In further considerations the correlation of questions from Part 1, 2 and 3 for each innovation (e-invoices, bar codes, RFID tags, hybrid accounting, mashup technology, accounting platforms) was analyzed – table 4.

Table 3. Correlation matrix for 18 questions in the questionnaire - based on the assessments of 73 employees from small and medium-sized enterprises operating in financial services - services provided using the 6 most common information management innovations (e-invoices, bar codes, RFID tags, hybrid accounting, mashup technology, accounting platforms).

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S16	S17	S18
S1	1.00																	
S2	0.94	1.00																
S3	0.82	0.92	1.00															
S4	0.61	0.84	0.86	1.00														
S5	0.62	0.83	0.87	0.89	1.00													
S6	0.88	0.89	0.71	0.68	0.68	1.00												
S7	-0.32	-0.33	-0.09	-0.46	-0.46	-0.56	1.00											
S8	-0.69	-0.63	-0.32	-0.38	-0.38	-0.64	0.46	1.00										
S9	-0.58	-0.51	-0.20	-0.27	-0.27	-0.77	0.56	0.71	1.00									
S10	0.40	0.61	0.44	0.79	0.79	0.63	-0.82	-0.59	-0.49	1.00								
S11	0.53	0.71	0.56	0.83	0.83	0.71	-0.67	-0.62	-0.55	0.94	1.00							
S12	0.03	0.19	0.24	0.39	0.39	-0.02	-0.21	-0.15	0.14	0.27	0.25	1.00						
S13	0.96	0.90	0.78	0.58	0.58	0.84	-0.28	-0.66	-0.56	0.38	0.46	0.15	1.00					
S14	0.91	0.96	0.79	0.75	0.75	0.92	-0.51	-0.77	-0.63	0.67	0.72	0.19	0.93	1.00				
S15	0.90	0.92	0.90	0.89	0.81	0.87	-0.27	-0.62	-0.59	0.56	0.69	0.18	0.88	0.91	1.00			
S16	0.78	0.90	0.78	0.81	0.80	0.95	-0.63	-0.55	-0.64	0.79	0.83	0.15	0.73	0.89	0.88	1.00		
S17	0.79	0.10	0.71	0.82	0.87	0.94	-0.65	-0.56	-0.64	0.78	0.84	0.15	0.75	0.87	0.89	0.98	1.00	
S18	0.75	0.75	0.56	0.55	0.55	0.95	-0.70	-0.54	-0.62	0.59	0.55	0.08	0.82	0.81	0.67	0.82	0.82	1.00

Table 4. Group of questions from Part 1, 2 and 3 for each innovation (e-invoices, bar codes, RFID tags, hybrid accounting, mashup technology, accounting platforms). Parts 1, 2 and 3 of the questionnaire refer to the barriers respectively: mental & social, economic, technological

		Barriers		
		mental & social	economic	technological
		Part 1	Part 2	Part 3
Innovations	e-invoices	S1	S7	S13
	bar codes	S2	S8	S14
	RFID tags	S3	S9	S15
	hybrid accounting	S4	S10	S16
	mashup technology	S5	S11	S17
	accounting platforms	S6	S12	S18

With reference to Table 4, the obtained results are illustrated in Fig. 2. According to the combination (Fig. 2), it is easy to notice that the questions / statements from Part 1 of the questionnaire (regarding the mental and social barrier) strongly correlate with the questions from Part 3 (regarding the technological barrier).

The value of the correlate coefficient (r) ranges from 0.81 to 0.96, which proves a very strong dependence (positive correlation). On this basis, it can be clearly stated that the success of implementing innovative solutions in the financial services industry (in SMEs) is closely related to the technological capabilities of the enterprise. The greater the technical support, the greater effectiveness of information management innova-

tions in the financial services branch. However, taking into account the earlier assumption that employees were highly motivated to implement new products, it can be stated that it is the technological barrier that is significant in this type of enterprises.

There is also a strong correlation between the technological and economic barrier for innovation:

- bar codes - negative correlation, $r = -0.77$;
- hybrid accounting - positive correlation, $r = 0.79$;
- mashup technology - positive correlation, $r = 0.84$.

Such values of the correlation coefficient for innovation hybrid accounting and mashup technology indicate that ensuring adequate (effective) technological support did not require a large financial contribution.

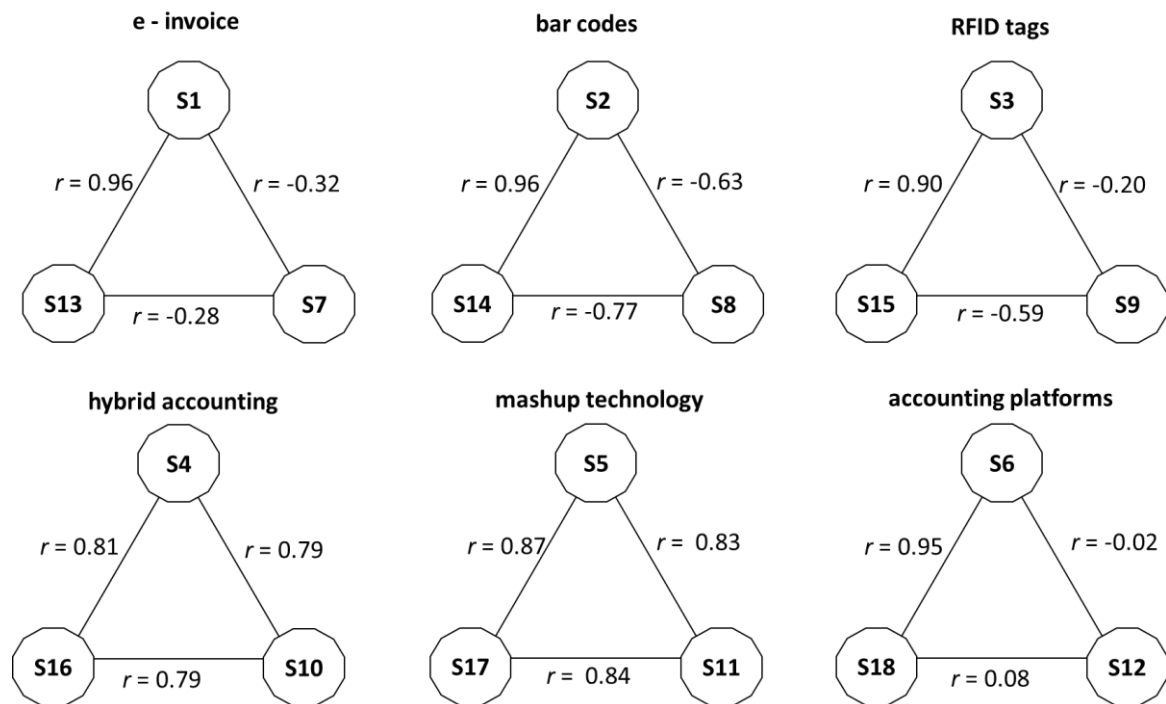


Fig. 2. Dependence and correlation between barriers for a selected innovation (e-invoices, bar codes, RFID tags, hybrid accounting, mashup technology, accounting platforms).

5. Summary and conclusion

The conducted research studies supplemented with a statistical analysis and an analysis of correlation in the area of individual information management innovations implemented in SMEs providing financial services allowed for the formulation of conclusions:

- the mental barrier is not crucial from the point of view of implementing modern technologies in financial service. The determination to implement innovations in financial services may be forced by the necessity in the context of acceleration of document exchange or the need to adapt financial services to the new principles of sustainability, Industry 4.0 or Industry 5.0;
- the success of implementing innovative solutions in the financial services industry (in SMEs) is closely related to the technological capabilities of the enterprise. Taking into account the assumption that employees are highly motivated to implement new products, it can be stated that the technological barrier is crucial in this type of enterprises;
- not all innovations implemented in financial services require a large financial contribution to operate well and effectively.

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中小企业实施信息系统创新的障碍

關鍵詞

创新
信息管理
IT创新
服务管理
微软

摘要

信息管理和信息流是公司发展和运营策略中的重要元素。监督信息的需求使得有必要实施众多创新，以改善与内部和外部信息流中正确接收，选择和分析相关的信息管理方法。本文介绍的研究结果有助于评估在实施中小型企业（服务MSE）的创新解决方案过程中出现的障碍。在进行的的研究的基础上，发现从现代技术实施的角度来看，心理障碍并不总是至关重要的。而且，由于需要加快文档交换速度，可能会迫使实施信息管理创新的决心。创新解决方案的成功，例如金融服务行业（中小型企业）中的技术与企业的技术能力密切相关-技术壁垒对于此类企业至关重要。特别是，考虑到员工极有动力实施新产品的假设。