Improving public sector performance by using business process modelling and measurement: a case study analysis

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Abstract

***Purpose of the paper**: The main purpose of the paper is to demonstrate the use of business process modelling and measurement as basic Business Process Management techniques to improve Enterprise Resource Planning systems and existing processes in public sector institutions.*

***Methodology**: The research methodology used is a single case study of a Polish public sector institution. The selected process has been modelled in an as-is and to-be state, i.e. before and after the organisational change and implementation of an ERP system.*

***Results**: The measurement of cost, time, quality and throughput capacity of a process demonstrates specific improvements and thereby proves an increase in the efficiency of public sector institutions. The author indicates that business process modelling and measurement are techniques useful in both the area of design and implementation of IT systems, as well as the design and improvement of an organisation.*

***Research limitations:** The main limitation of this research is the analysis of merely one process in a single institution with virtually no comparative analysis.*

***Practical implications:** The implementation of effectiveness and efficiency indicators as criteria for the public institution evaluation gives rise to the appreciation of the BPM concept as the appropriate management method in the public sector.*

Research results can be used as recommendations for policy makers who plan and evaluate projects to improve the efficiency of public institutions.

***Originality of the paper**: The results of this study can contribute to the existing body of knowledge on BPM in the public sector. The uniqueness of the study arises from the merging of three research areas: improving performance of the public sector; the evaluation of cost-effectiveness IT projects in public administration; and, business process modelling and measurement applied to the aforementioned two areas.*

Key words: business process modelling; measurement of business processes; BPM; public sector; public administration

1. Introduction

A noticeable worldwide trend in the transformation of public administration aims to enhance the efficiency of public units through modern management concepts requiring the use of management methods and techniques common to profit-based organisations. Effective management translates into high quality services provided to citizens and the

efficient use of resource capacity, including human resources and existing IT systems. The approach presented by the New Public Management philosophy advocates a comprehensive, market-oriented system of public administration transformation towards a cost-effective organisation (Supernat, 2003; Izdebski 2006). A similar approach is presented in the concept of t-Government, which is the "ICT-enabled and organisation-led transformation of government operations, internal and external processes and structures to enable the realisation of citizen-centric services that are cost effective and efficient" (Weerakkody and Dhillon, 2008). Thus, the public sector needs concepts, methods and tools which improve performance by reducing costs and enhancing the overall efficiency of public sector institutions, but also, in the context of the digitisation of this sector, introducing new technologies and services to citizens and increasing their satisfaction (Weerakkody and Dhillon, 2008; Weerakkody *et al.*, 2011; Janssen and Estevez, 2013).

The implementation of effectiveness and efficiency indicators as a criteria for the evaluation of the public sector (Kickert, 1997; Krukowski and Siemiński, 2011) gives rise to an appreciation of the Business Process Management concept as the appropriate method of management in the public sector (Gulledge and Sommer, 2002; MacIntosh, 2003; Rinaldi *et al.*, 2015). The introduction of process management to an organisation and building its process maturity requires, in the first step, identifying, understanding and documenting processes using adequate methods and modelling tools (Greasley, 2006; Gabryelczyk and Jurczuk, 2014). In the next step, according to the Business Process Management Lifecycle, processes should be measured, analysed and implemented after their improvement (Macedo de Morais *et al.*, 2014).

Business process models and the results of their measurement can have multiple uses in various projects of organisational change. Generally, they can be used in two main areas: 1. the design and improvement of an organisation, and, 2. the design and implementation of IT systems (Rosemann *et al.*, 2005). This study will prove that the modelling and measurement of processes in public sector institutions will contribute to improving performance in both areas.

The main aim of this paper is to demonstrate the use of business process modelling and measurement as basic Business Process Management techniques to improve existing processes, and, Enterprise Resource Planning systems in a public sector institution. In addition, more specific aims have been set out. The first one is to indicate, based on a case study, that business process modelling and measurement are techniques useful also in the area of design and implementation of IT systems, as well as in the area of organisational design and improvement. The second specific aim is to build a set of process indicators that allow the measurement of process efficiency before and after the change.

The research methodology used is a single case study of a Polish public sector institution. The example provides observations concerning the practical use of process models and measurements in enhancing the organisation's performance, particularly through the better use of the information technology system.

The paper has been structured as follows: the background provides the theoretical foundation, explains the conditions of using the process approach in the management of public sector institutions and the need for managerial approach in the public sector. Later, the methodology of the research and analysis framework is described. In the next section, the case study and a disscussion of the findings are presented. In the final part the limitations of the study and plans for future research are stated.

2. The background study and literature review

The background analysis related to this study covers three main areas. The first is the justification of why Polish public sector institutions need to improve their efficiency and how they can achieve this goal. The second is a literature review concerning the use of process management in the public sector. The third area covered are the theoretical foundations of using business process modelling and measurement.

2.1 The need for improving performance in the public sector

The requirement to continually improve performance through the use of methods leading to enhanced effectiveness is imposed on public administration by the Polish Public Finance Act and by new public management policies. Furthermore, the public sector's obligation to efficient operation follows the Public Finance Act of 2009, whose provisions specify that: "public expenditure should be effected in a purposeful and cost-effective manner, following the principle of maximised effects and optimised selection of methods and means to be used to achieve the intended objectives". National activities in this field comply with the Europe 2020 Strategy and the applicable Common Provision Regulations in respect of enhancing institutional capacity of public authorities and stakeholders, and efficient public administration (Regulation (EU) No 1303/2013). Efficiency of public institutions, development of information and communication technologies, and improvement of the quality of human resources in central and local administration are just some of the issues addressed in the "Efficient State 2020" development strategy for Poland (Monitor Polski, 2013), a document presenting an optimum state model (Open Society Foundation, 2011). To implement this strategy in practice, it is necessary to improve the quality of public administration services by means of information technology, and to achieve digital synergy of modernisation projects in the sector of administration. An analysis of the state efficiency in terms of its weak points draws attention to the following aspects: the insufficient efficiency of organisational structures; the insufficient use of modern management tools; delays in the development of ICT solutions and barely initiated comprehensive integration of information technology systems; inadequate IT awareness and competency of administration personnel; and, weak mechanisms for assessment and monitoring (Report Państwo 2.0, 2012).

The requirement of spending public funds in a reasonable and cost-effective manner should also apply to IT system deployment projects in

public institutions, as well as to redesign projects with a focus on the need to review the existing systems, adapt them to the needs of service recipients, and, evaluate their effectiveness and efficiency. Studies on the methods used for the evaluation of IT projects cost-effectiveness in the public administration sector indicate that no common methodology has been developed in this field, so far (Lech, 2007). According to the vision of the Ministry of Administration and Digitisation, the several hundred information technology projects currently being implemented in the public administration sector in Poland should "guarantee the best possible proportion of effect to expenditure, transparency and efficiency" (Report Państwo 2.0, 2012). According to this report, public administration offices and institutions are, and will remain, the most attractive buyer of IT goods and services in Poland in the financial perspective 2014-2020, most probably owing to the EU funds being assigned to, and spent intensely on, the implementation of IT solutions in this sector. Therefore, the subject of measuring the efficiency and effectiveness of ITC implementation is worth discussing in the additional context of proven solutions used successfully by the private sector. These might be referred to as *good practices* when adopting the New Public Management approach and implementing the public administration efficiency improvement plans and strategies in Poland.

Both this diagnosis and provisions of documents establishing the policy, plans and strategies of digitisation of the state make one acknowledge the role of a process approach in developments intended to enhance the performance of public sector institutions. This method should be integrated into state digitisation programmes and projects of ERP-class systems implementation that are already common in Poland.

2.2 Process management in the public sector

Processes are fundamental elements of management systems in all public administration institutions. Processes, logical sequences of repeatable activities leading to a pre-defined outcome, are present in any organisation, regardless of how mature its management system is. Effective process management translates into high quality services provided to citizens, and the efficient use of human, IT and other resources. Methods to be used to reengineer processes are proposed by such classic approaches as Business Process Reengineering (Hammer and Champy, 1993), Business Process Orientation (McCormack and Johnson, 2001), Business Process Change (Harmon, 2007), and, Business Process Management (Jeston and Nelis, 2006). The common ground for these concepts is a comprehensive, holistic, process-based management approach in an organisation that uses information technology, and aligns with the needs and requirements of customers through the processes organisational objectives (Elzinga *et al.*, 1995; DeToro and McCabe, 1997; Jeston and Nellis, 2006).

The last twenty five years have witnessed the continual development of the process approach, its concept, methods and IT tools enabling business process modelling and improvement intended to enhance an organisation's performance. Yet, literature does not address the subject of

business process improvement in the public sector as often as it does with respect to commercial organisations. There are many reasons preventing innovations in business processes and to organisational structures in the public sector, some of them being of a political nature. Not only in Poland is the implementation of process management in the public sector impeded by numerous reasons, including public organisation culture, a multitude of procedures, the silo structure, personnel lacking awareness and mission, the domination of political stakeholders, and, a turbulent political environment (Saxena, 1996; Halachmi and Bovaird, 1997; Krukowski and Siemiński, 2011).

However, organisational changes in public administration institutions are only partly achievable, and most typically consist of the unification of business processes, automation, and the partial elimination of redundant activities. Therefore, classic process improvement methods and business process redesign need to be adequate for the public sector environment. When enhancing public sector performance, one should combine elements of radical methodology, such as Business Process Reengineering (Hammer and Champy, 1993; Weerakkody *et al.*, 2011) with those based on continual improvement, e.g., Business Process Orientation (McCormack and Johnson, 2001), and Business Process Management (Gulledge and Sommer, 2002; Harmon, 2007). Most process redesign projects fall somewhere between radical and gradual changes (Harmon, 2007). Moreover, some process redesign strategies also propose process modelling with IT tools and process measurement intended to evaluate the effectiveness and efficiency of changes (Rosemann *et al.*, 2005; Scheer *et al.*, 2005).

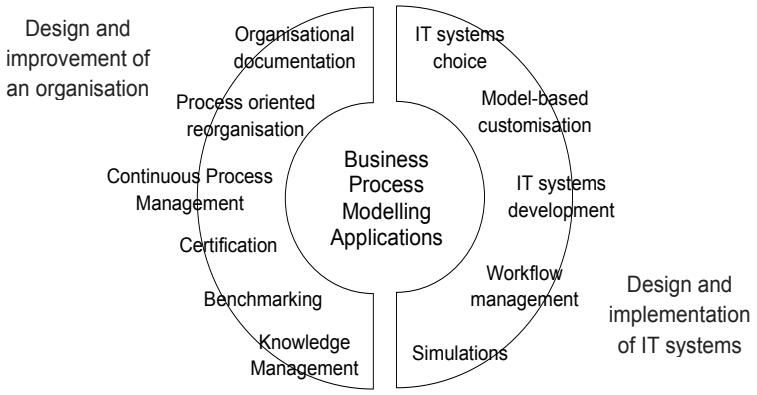
2.3 Business process modelling and measurement

Process identification and modelling is a starting point for building process maturity in various organisations, including public institutions. Business process modelling can be defined as a process of documenting business processes through a combination of text and graphic notation. In the context of business process management, it is most typically defined as a process used for mapping "the real world" (the *as-is* modelling), while being an active creation at the same time, reflecting the potential future states of the organisation or its processes, and suggesting the potential direction of changes (the *to-be* modelling) (Krcmar and Schwarzer, 1994). Process models help define processes and process interfaces, document processes, and present logical and chronological relations between process tasks, thereby enabling analyses, the assignment of agents, identification of information being transformed in the course of the process, and, information received as the process output (Gabryelczyk and Jurczuk, 2014).

Business process modelling is a key element in organisational change management and has many and varied applications, not limited solely to projects intended to develop a process-oriented organisation. Other important areas of business process model application include arrangements preceding the selection or development of an IT system supporting business management (adjusting the system to the organisation, not vice-versa, a common language for IT and Business), the designing of workflow systems, the

documentation of processes in the implementation of quality management systems (including ISO 9001 certification), and process benchmarking or Activity Based Management. The most common applications of business process modelling at a glance are presented in Figure 1. adapted from Rosemann *et al.* (2005). Process measurement allows for the analysis and evaluation of improvements. In the context of the information technology systems implementation, Davenport's thesis, according to which an economic effect is achieved only after business processes are reengineered and information technology is the method enabling process innovation, is also valid for the sector of public administration.

Fig. 1: Business process modelling applications



Source: (adapted from Rosemann *et al.*, 2005)

The issues of business process modelling and measurements are most often specified as an element of pre-deployment analysis. The aim of process identification and modelling is to identify an organisation's needs as regards IT system support, occasionally to select a system, and, finally, to implement it at the level of identified and improved processes (Hammer, 1990; Davenport, 1993; Stemberger *et al.*, 2009). Yet, such a scenario is extremely rare in practice in Polish (Sasak and Kożuch, 2011). Furthermore, no studies on IT system implementation in the Polish public administration exist. The system implementation project should be efficient both with respect to the implementation process itself and to its deliverables (Lech, 2007). Reports on the status of ITC and digitisation projects co-financed from European Funds under the Innovative Economy Programme in Poland in the years 2007-2012 seem to confirm the diagnosis that those responsible for the operation of Polish public institutions still underestimate the significance of projects intended to enhance the performance of public administration institutions in terms of their effectiveness and efficiency (Report Państwo 2.0, 2012).

Business process measurement can constitute an element of various methods used for the evaluation of major, national-scale IT projects, as well as tasks undertaken by individual public institutions. When the

efficiency of an IT project is evaluated prior *to* and *after* its implementation, the extent of automation can be measured, as well as the resultant benefits, such as time gains, cost reduction and quality improvement. The prerequisite to developing a system for measuring process performance and determining criteria for the performance indictor use, is knowledge of the process architecture. Process duration, cost and quality are most frequently referred to as measures of benefits gained as a result of process improvement (Davenport, 1993; Murphy, 2002; Kaplan and Norton, 1996; Harmon, 2007). These measures can be both quantitative and qualitative, may deliver both *hard*, fully measurable results, as well as *soft* ones - relative, difficult to specify and evaluate, but giving a better frame of reference. Shorter process durations achieved through the elimination of redundant activities translate into, for example, a lower cost of the process or enhanced customer satisfaction, and may improve the financial effect, while the elimination of errors in operational processes reduces the value of losses and process automation cuts the overall cost level owing to employment reduction. The purpose of measuring the quality of processes is to reduce the cost of repairs, to eliminate weak points in the process flow, thereby continually enhancing the satisfaction of process deliverable recipients. When analysing the process flow in terms of adding value, it is worth paying attention to how much time is spent on activities adding value the customer is willing to pay for.

In public administration, it is the process architecture level (Scheer *et al.*, 2005; Krukowski and Siemiński, 2011) and the process type that determine how these measures are structured and what they refer to. Cost is the basic performance indicator, although it is seldom measured in public administration, being often allocated to the fixed cost category. Duration reflects the level of process organisation and its degree automation (Davenport, 1993; Peppard and Rowland, 1995). Process quality is determined by the number of errors and the resultant amount of work that needs to be repeated (Gabryelczyk, 2000). According to the new public management concepts, quality should not only be pursued to satisfy the citizen, but also, the administration officer - a recipient of the process deliverables.

The literature on this subject points out that the operating cost reduction achieved owing to the administration service process improvement should be regarded as the greatest benefit of adopting the process approach in public administration (Bugdol, 2008; Zaheer *et al.*, 2008). The implementation of the process approach in the public sector, despite many diagnosed differences in features and measures of processes in comparison to the private sector (Krukowski and Siemiński, 2011; Stemberger *et al.*, 2007), is usually carried out using the same concept methods and tools (MacIntosh, 2003; Greasley, 2006; Stemberger *et al.*, 2007). Regardless of the methodology for the implementation of a process approach in each phase there is a diagnosis of the current state of processes (*as-is*) and the phase of the target state processes (*to-be* or *can-be*) (Rosemann *et al.*, 2005; Harmon, 2007; Scheer *et al.*, 2005). A similar approach is used in administration offices (Weerakkody *et al.*, 2011; Stemberger *et al.*, 2007; Gulledge and Sommer, 2002). The measurement of costs, lead times and quality processes can occur in both phases.

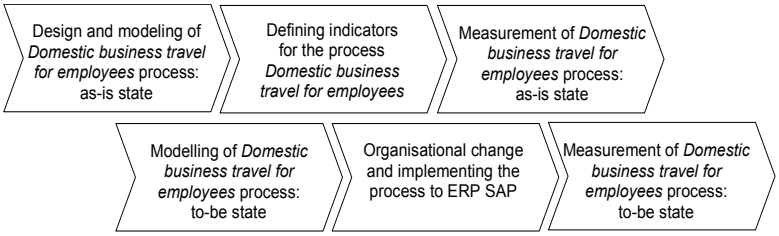
3. Research design and methodology

A single case-based research methodology was chosen for this study. The business process modelling and measurement exercise was conducted in an institution representing the public finance sector - an entity providing services and logistical support to the state authorities. According to Yin (2013), this kind of research copes with technically distinctive situations and is aimed at illustrating certain topics in an easy-to-understand way preserving the most important advantage - they present real-life context. According to the single case study methodology (Yin, 1994), the analysis of the institution may also act as a pilot project, the first step taken to show other institutions the method of measuring the potential for improvements, which has been used by commercial organisations for years. However, the case study allows, but only to a limited extent, the generalisability of the findings.

The choice of public sector institutions to be studied was dictated by a practical consideration, namely, the availability and access to information on organisational changes in said institutions. Furthermore, in the process of implementation of these changes, the co-authors of the presented study were also involved.

For the purpose of evaluating the process improvement potential of the institution representing the public finance sector, the process of *Domestic business travel for employees* was defined, modelled, measured, analysed, and improved according to the conceptual model presented in Figure 2.

Fig. 2: Flow diagram of the case study analysis



Source: Own elaboration

The choice of the process of *Domestic business travel for employees* for analysis as a case study stems from the fact that in 2015 the implementation of the SAP Travel Management (TM) module occurred in the examined institution. This circumstance allowed the modeling and measurement of the process before and after the implementation in SAP system (according to Figure 2).

We modelled and measured business process diagrams of *Domestic business travel for employees* together with their sub-processes. Initial diagrams reflect the as-is state (version 1.0) of the process prior to system ERP SAP implementation. The final diagrams presents the *to-be* state (version 2.0) of the process after organisational change and implementation to the system. The collection of data such as activities allocations, responsible roles, sub-processes interfaces, costs, process

durations, and, process quality data was undertaken by the authors through interviews with employees of the organisation, observations and analysis of the documentation of the ERP SAP system. Interviews were conducted with employees responsible for arranging domestic business travel for employees in the Financial Department and in 9 functional departments that send employees on business trips. According to Figure 3 and 4, interviews were carried out with the Chief Financial Officer in the studied institution, 2 specialists in financial settlement, and with 9 secretaries responsible for the preparation of business travel reports in 9 different functional departments.

The authors collected data for the study in April and May, 2015, being the period before the implementation of the SAP Travel Management (TM) module, and in November, 2015, during the implementation of the TM module, which was launched later in April, 2016.

For business process modelling, Business Process Model and Notation (BPMN) notation was used. BPMN is a graphical representation for specifying business processes in a business process model. BPMN is the global standard currently maintained by the Object Management Group (OMG, 2011).

The measurement of the *Domestic business travel for employees* process and their sub-processes was carried out with the use of indicators of cost, time, quality and *throughput* capacity. Changes in value were compared between versions *as-is (1.0)* and *to-be (2.0).*

4. Findings of the case study analysis

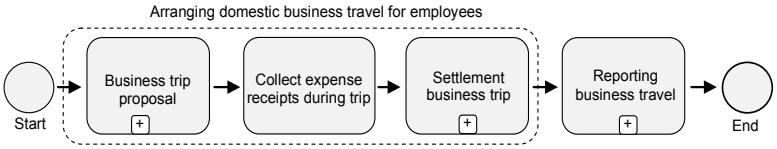
The case study demonstrates the use of business process modelling and measurement to change existing processes and Enterprise Resource Planning systems in a public sector institution. The institution is subject to the Public Finance Act and its regulations in respect of an obligation to ensure the cost-effective expenditure of public funds. These regulations should also be adhered to when implementing ICT projects. The institution uses an ERP SAP system implemented mainly to integrate insular solutions and upgrade IT tools. The institution's management considered the implementation project to be the "IT department's business" and has not defined any indicators that might demonstrate performance improvements. There has been no pre-deployment analysis, process analysis or analysis of the organisational changes required; no methodology has been used to reduce the risk associated with the choice of technology in the context of the institution's needs. The potential for the institution's performance improvement is to a great extent based on increasing the volume of services without increasing the level of cost. The institution's annual expenses on the SAP system remain, in practice, at an unchanged level and stem mainly from the number of ERP licences used by the system users. The institution has been able to use all of the SAP ERP functionalities since 2010, therefore the activation of any new functionalities or module is not associated with any new licence cost of the system itself. It would, therefore, be a case of mismanagement not to utilise what the system offers, given that all IT projects financed from public funds should be subject to evaluation for

cost-efficiency and effectiveness. When co-financing any projects, the EU requires these to be evaluated according to the applicable standards and guidelines. The direction of changes shown in the case study presented below is based on the process modelling and measurement used to ensure effective cost management in a public institution.

The *as-is* modelling of the *Domestic business travel for employees* process included the business process diagram identification (Figure 3) and the modelling of their sub-processes: *Business trip proposal, Settlement business trip, and Reporting business travel.* The first 2 processes create an overriding process that can be named *Arranging Domestic business travel for employees*. A task *Collect expense receipts during the trip* indicates the necessary work to be performed in order to settle the process of *Domestic business travel for employees*. The process *Domestic business travel for employees* on a general level of description is the same in the versions *as-is (1.0)* and t*o-be (2.0)*. The differences in the process versions appear only on the level of the sub-processes modelling. In this case, all employees in the institution are process clients and agents. The modelling was performed using the Business Process Management tool Adonis CE and the BPMN process modelling notation.

Data for process models and measurement were sourced from interviews with process participants from the institution's financial department and from other departments that have registered the most business trips. The data was also collected using the observation method, examinations of the SAP ERP system reports, as well as from legal regulations referred to in the institution's applicable instructions.

Fig. 3: 'Domestic business travel for employees' - Business process diagram (BPMN 2.0)



Source: Own elaboration

Process performance indicators for measuring process duration, cost and quality were determined based on the literature and a review of the *Domestic business travel for employees* process *as-is* models.

The institution does not have any process measurement system. For the purpose of the *as-is* and *to-be* analysis of processes in the case study, performance indicators were defined in the category of process *cost, time, quality* and *throughput capacity* (Table 1), based on data available for the exercise. These indicators can be used for measuring the effects of the analysed process automation, as well as for the assessment of organisational changes in the process itself.

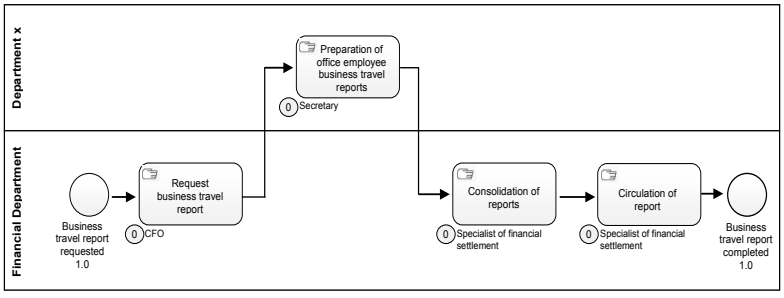
Tab. 1: Performance indicators for the process of 'Domestic business travel for employees'

Category	*Indicator*	*Definition*
Cost	Mean personal cost	Cost based on the taxable monthly salary averaged by positions of individuals performing the functions
Time	Waiting time	Average time of waiting for the possibility to perform the function
	Execution time	Average time of function processing – performing the real work
	Resting time	Average time of rest, waiting for transport
	Transport time	Avarage time of transport
	Total time	Average total time of process
Quality	Number of interfaces between organisation's units	Number of border crossings between organisation's units at the office level
	Number of functions	Number of functions performed by process participants without using the ERP SAP system
	Number of SAP functions	Number of functions performed automatically by the ERP system (the so-called SAP transactions)
	Number of SAP ERP data base uses	Number of SAP ERP uses in order to enter data (but the same SAP functions may be used for the registration of data in further steps of the process)
Throughput capacity	$\left(\frac{\text{Execution time}}{\text{Total time}}\right)*100\%$	Share of time in the process spent on value adding activities

Source: Own elaboration

To indicate a sample of an as-is and to-be model, the *Reporting business travel* sub-process has been selected. Figure 4 presents a diagram of this process before the change in the *as-is* version (1.0), while Figure 5. shows the changes in the process after the implementation to the SAP system, the *to-be* version (2.0).

Fig. 4: 'Reporting business travel' - Business process diagram (BPMN 2.0) – as-is (1.0)

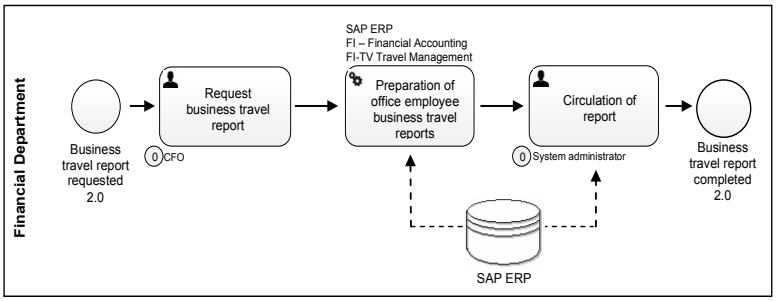


Source: Own elaboration

The changes visible in the models (Figure 4 and 5) relate to automating functions that were previously performed manually. In the *to-be* version (2.0)

all functions have been implemented in the Travel Management module (TM) in the SAP system. However, to allow the integration of information, it is also necessary to use the Financial Accounting module. This improved process involves less human resources.

Fig. 5: 'Reporting business travel' - Business process diagram (BPMN 2.0) - to-be (2.0)



Source: Own elaboration

The cumulated values of the *Business trip proposal, Settlement business trip*, and *Reporting business travel* process performance indicators were used to compute the percentage difference between the *as-is (1.0)* and *to-be (2.0)* performance indicator values.

For the purpose of process improvement, the *Domestic business travel for employees* process model included an analysis of the mean personal cost of personnel, time (waiting time, execution time, resting time, transport time), resources (including SAP system) and engagement of the organisation's units. The process in version *as-is (1.0)* was found to be time-intensive, with the vast majority of activities performed manually without using the SAP system. The *as-is (1.0)* models of the *Domestic business travel for employees* process revealed that very little of what SAP offers was used and that printed paper documents prevailed in the institution's operation. Very few insular solutions based on the system were not integrated into the chain of process operations. The analysis resulted in a proposal to automate the process of *Domestic business travel for employees* in SAP ERP and to modify its organisation with regard to the standardisation required. The changes proposed were modelled in Adonis CE so as to develop *to-be* process models and compute the target performance indicators.

To illustrate the effects of changes, Tables no. 2 and no. 3 specify differences between the *as-is* and *to-be* indicator values expressed in as a percentage calculated using the following formula:

$$\frac{\text{as-is (1.0)} - \text{to-be (2.0)}}{\text{as-is (1.0}} * 100\%$$

As a result of the SAP-based automation of the *Domestic business travel for employees* process and following changes in the process flow, a definite improvement in the process performance indicators was observed (Table 2).

Tab. 2: Change in the value of the 'Domestic business travel for employees' process cost and time indicators expressed in percent

		Costs	*Time*				
	Process	Mean personal cost	Waiting time	Execution time	Resting time	Trans-port time	Total time
		Change in percent					
1	Business trip proposal	↓81%	↓29%	↓ 22%	↓ 79%	↓ 60%	↓ 62%
2	Settlement business trip	↓ 14%	↓ 7%	↓3%	↓4%	↓ 20%	↓22%
3	Reporting business travel	↓ 93%	↓ 100%	↓ 94%	↓67%	↓50%	↓90%
	Total	↓ 41%	↓ 14%	↓ 12%	↓ 60%	↓52%	↓45%

↓ - decrease of x %

Source: Own elaboration

The SAP-based automation involved an increased use of the system databases and functions (Table 3). Changes to the process organisation involved improvements to the process flow, a reduction of paper documents, the delegation of authority and implementation of SAP. Neither the obvious benefits of deploying SAP on a fuller scale than earlier, nor the measurement of the entire project effects are being discussed here now.

Tab. 3: Change in the value of the 'Domestic business travel for employees' process quality indicators expressed in percent

		Quality			
	Process	Number of interfaces between organisation's units	Number of functions	Number of SAP functions	Number of SAP ERP data base uses
		Change in percent			
1	Business trip proposal	↓25%	↑13%	↑100%	↑300%
2	Settlement business trip	↓50%	↑14%	↑100%	↑150%
3	Reporting business travel	↓100%	↓ 25%	↑ ∞	↑100%
	Total	↓50%	↑ 5%	↑ 200%	↑ 175%

↓ - decrease of x %; ↑ - increase of x %

Source: Own elaboration

The measure, which allows to assess the share of value-adding activities in the process duration, is *throughput capacity* (Peppard and Rowland, 1997). The indicator was calculated according to the formula presented in Table 1, and the results summarised in Table 4. We see that the greatest potential for improvement lies in the *waiting time, rest time*, and *transport time* components of the process. The share of process time spent on value adding activities is higher. The *Reporting business travel* subprocess is the only one where the indicator decreases due to the strong improvements of all types and times of the construction of this indicator.

Tab. 4: Troughput capacity and change in the value of the 'Domestic business travel for employees' process expressed in percent

		Troughput capacity	
	Process	*as-is (1.0)*	*to-be (2.0)*
1	Business trip proposal	4.76%	9.85%
2	Settlement business trip	11.21%	13.98%
3	Reporting business travel	50.00%	28.57%
4	*Total*	8.73%	12.47%

Source: Own elaboration

In this study, process modelling allowed the measuring of the benefits of organisational changes and of the *Domestic business travel for employees* process implementation to the SAP system. The aim of the study is to draw attention to the process measurement system as an element of system evaluation and operation, as well as a quantitative measure of the potential for improvements. The institution's contracts with SAP provide for access to the entire functionality of the system, without any extra charges in excess having been paid so far. Under these circumstances, not to use the system's potential in full would be a case of mismanagement. The scale of this mismanagement is clearly reflected in the value of the *Domestic business travel for employees* process performance indicators.

5. Conclusions

The case study presented in this paper provides arguments for using business process modelling and measurement in the public sector,where the ERP systems are overloaded by the existing organisational structures and processes. The research shows that through defining, modelling and measuring selected processes it is possible to evaluate the potential for improvements in the processes that have only been partly automated following the ERP system deployment.

Although BPM and particularly process modelling and measurement are frequently applied and verified in the private sector, they are still uncommon in the public sector. Thus, the contribution of this study to the existing body of knowledge results from the merging of 3 research areas: 1) improving performance of the public sector, 2) the evaluation of IT projects cost-effectiveness in public administration, and, 3) business process modelling and measurement applied to the aforementioned 2 areas. To the best of our knowledge, this combination of research areas and the reasoning behind them took place only in earlier papers by the authors: Gabryelczyk and Rakowska (2015).

Managerial contribution mainly concerns the implementation of business process indicators as effectiveness and efficiency criteria for public institution evaluation, particularly in the case of IT implementation. Results of this study give rise to the appreciation of the BPM concept as the appropriate management method in the public sector.

Research results also can be used as recommendations for policy makers who plan and evaluate projects improving the efficiency of public institutions. An institution's obligations stemming from the Public Finance Act require it to operate in a cost-effective manner and to use the best methods to achieve these objectives. Similarly, the New Public Management guidelines (Kickert, 1997; Supernat, 2003; Izdebski, 2006; Krukowski and Siemiński, 2011) and the t-Government concept (Weerakkody *et al.*, 2011) emphasise the need for public administration to adopt methods and techniques which guarantee the best benefit-to-cost ratio. To follow the principles of a cost-effective operation, an institution should optimise the use of its resources, including the already deployed SAP system. To discuss cost-effectiveness, one needs to measure both costs and benefits (Hammer, 1990; Davenport, 1993; Lech, 2007, Stemberger *et al.*, 2009; Sasak and Kożuch, 2011). Process modelling and measurement, according to Business Process Redesign concepts, enable one to evaluate the quality of system implementation, reveal the potential for more extensive deployment, and indicate, the directions of changes for a public institution which is expected to meet the statutory requirements in respect of the efficient spending of public funds.

6. Limitations and future research

The main limitation of this research is the analysis of only one process in a single institution with virtually no comparative analysis. One similar study of a public sector institution, presented by Gabryelczyk and Rakowska (2015), arrived at the same results. It is difficult to make a comparison of the findings obtained during the analysis of business processes in an institution representing the public finance seector because of the lack of comparable data. Taking into account the paucity of studies on the adoption of the process approach in public administration institutions, the purpose of this case study was to expand the existing case descriptions into this area.

Currently, public institutions are looking for transformational change by through radical improvement. Future research work on the process approach implementation, including, in particular, the aspects of process modelling and measurement in public administration institutions in Poland, should focus on the development of recommendations and the identification of best practices for projects intended to enhance performance through process improvement.

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