

Information Systems in Project Management of The Public Sphere

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Summary

Project management is a current trend of management in the public sphere, based on different principles, methods and tools. The tools include information technologies providing control over time, cost, quality and planning process in order to ensure accountability to interested parties. **The goal** of the research was to examine the impact of the integration of information systems in project management of the public sphere on the quality of public governance and administration using the example of infrastructure projects involving the private sector in developing countries. **The methodology** of the research is based on the concepts of “digital-era governance” (DEG), “Information governance” and “project governance” to determine the effectiveness of information systems and technologies in the management of infrastructure projects in the public sphere. The data from the countries with Lower middle income (India, Indonesia, Philippines, Ukraine, Vietnam) and Upper middle income (Argentina, Brazil, China, Colombia, Mexico, Peru, Romania, Russian Federation, Thailand, Turkey) for 1996-2020 were used to study the effects of DEG. **The results** show two main trends in the countries with Lower middle income and Upper middle income. The first trend is the development of digital governance, the concept of “digital-era governance” through information systems and performance measurement of the governance system, forecasting of investment flows of infrastructure projects, measurement of payback and effectiveness parameters for investment management in the public sector, decision support. The second trend is the existence of systemic challenges related to corruption, social and institutional factors through the development of democracy in developing countries and the integration of NPM similar to developed countries. The confidence of interested parties, especially private investors, in public authorities is determined by other factors – the level of return on investment, risks and assignment of responsibility, probability of successful completion of the project. These data still remain limited for a wide range of project participants, including citizens.

Key words:

Information systems of the public sector, public sector project management, “digital-era governance” (DEG), “information governance”, “project governance”.

1. Introduction

Project management is a current trend of management in the public sphere, based on different principles, methods and tools. The tools include information technologies providing control over interested parties (responsibilities, goals, degree of impact) (Olander, 2007), time, cost, quality, planning process (Munns & Bjeirmi, 1996). Information systems (IS) provide significant development in the field of public project management, have an impact on the quality of public services, the level of accountability, “respond to changes in the reform of public administration and ever new tasks and responsibilities which are delegated to municipalities and regions” (Bartošiková, Pitrová & Taraba, 2013). IS are effective in the context of increasing project complexity and management, raising project requirements (Santos & Varajão, 2015). For example, the IS Decision Support Tool of the PrioritEE project helps to systematically inform local authorities of European cities about the current state of energy management of municipal buildings of citizens (Salvia et al., 2021). Thus, technological solutions of the public sphere provide technical information support to state administrations in energy efficiency management.

However, the major importance of information systems in project management of the public sphere consists in the development of e-democracy, especially in developing countries, which need the integration of transparency and accountability tools in connection with the implementation of infrastructure projects. Such projects are usually funded by international institutions or large companies, which act as private investors. These interested parties set requirements for control, transparency, accountability in accordance with the terms of the contract, which is usually concluded on a long-term basis (from 10 to 25 years). Infrastructure projects involving the private sector are complex and indefinite in time. Therefore, project

management using software and IS is actively used in the public sector to ensure accountability and responsibility to investors.

The purpose of this article is to study the impact of the integration of information systems in project management of the public sphere on the quality of public governance and administration using the example of infrastructure projects involving the private sector in developing countries. In addition, in the context of the development of e-democracy, it is important to identify the extent to which the new concept of e-governance ensures the quality of public project management.

2. Literature review

The scientific literature uses the term “Information governance” (Shepherd, Stevenson & Flinn, 2010) or “project governance” (Too & Weaver, 2014) to explain how managing information by public authorities using technologies ensures the increasing level of participation of citizens in political processes, generating confidence in government decisions, ensuring accountability and transparency, access to information, openness and more effective public decision-making (Shepherd, Stevenson & Flinn, 2010). IS transform traditional administrative values and processes and form a new control system (Meyer & Hammerschmid, 2006) based on the concept of e-democracy. Since the late 1990s, project management information systems have been gradually integrated into public administration to support decision-making and system management of information flows in the terms of increasing complexity and number of public projects (Jaafari & Manivong, 1998; Zhang & Cui, 1999). Information technologies have determined critical changes in the concept of “new public management” (NPM), especially in developed countries, which have sought to solve problems of institutional and social complexity through the prosperity of democracy since the early 1970s (Dunleavy, Margetts, Bastow & Tinkler, 2006). “One aspect of New Public Management is a proliferation in performance measurement” (Hall, Holt, & Purchase, 2003). Technologies and digital solutions for monitoring activities of public authorities are actively integrated in order to ensure the performance measurement. “The overall movement incorporating these new shifts is toward “digital-era governance” (DEG), which involves reintegrating functions into the governmental sphere, adopting holistic and needs-oriented structures, and progressing digitalization of administrative processes” (Dunleavy, Margetts, Bastow & Tinkler, 2006). Thus, information technologies in the public sphere in general solve a number of institutional problems by reducing the level of complexity of administrative processes, and in the field of project management – business processes of their

implementation and acceleration of the complex process of accountability.

The complexity and uncertainty of projects require effective control and accountability, which can be achieved through information systems (Koppenjan et al., 2011). Investors and donors need to form a special public authority responsible for the project implementation (Landow & Ebdon, 2012). This leads to the reduced level of flexibility and possible errors due to insufficient automation and transparency. “The public sector would take sole responsibility for the risk “Expropriation and nationalization”, and take the majority of responsibility for 12 other risks related to government or government officials and their actions” (Ke, Wang, Chan & Lam, 2010). Thus, the public sphere is the most responsible centre of project implementation, especially with the participation of the private sector.

Too & Weaver (2014) identified four principal components of improving project management in the public sphere, ensuring value formation: 1) project portfolio management, which is focused on the selection of a set of projects and programs within the strategy; 2) project support by sponsors: providing direct communication between executive and project managers with a focus on the project life cycle; 3) enabling strategic accountability through the Project Management Office (PMO); 4) project management software support to measure the performance of the governance system. The last component of public project management reflects the impact of IS on the effectiveness of public governance: the integration of the project management program should ensure greater effectiveness of governance and confidence of interested parties in public authorities. However, in literature there are also examples of failures in the use of information systems in public project management in New Zealand: “ill-planned and managed, large and multifaceted projects are more likely to fail and that contextual issues are highly influential” (Gauld, 2007) due to a significant influence of political and organizational factors. Young, Young, Jordan & O'Connor (2012) note systemic weaknesses of project management, which consist in limiting opportunities to achieve strategic goals. Lee & Yu (2012) note the lack of technological solutions to ensure the project success when it is necessary to integrate information systems in project management based on a specific IS model. “As one of the key IT applications, the project management information system (PMIS) has played a significant role in construction management processes” (Lee & Yu, 2012). Jaafari & Manivong (1998) note the need to develop a specific information system and integration model for a specific project, which leads to the increased cost of the project as a whole, but reduces the risks of non-performance, uncertainty, implementation failures due to neglect of the project features. Jaafari & Manivong (1998) propose a “centralized control” strategy to take into account all

information transactions throughout the project life cycle and targeted management.

Thus, information technologies as a tool for project management in the public sector are increasingly discussed in literature (Rosacker & Rosacker, 2010). At the same time, there are few empirical studies on the potential of using the concept of project management in the public sphere, given their focus on private sector projects (Rosacker & Rosacker, 2010). The question of the impact of IS on the transformation of the concept of “digital-era governance” also remains unclear.

3. Methodology

In this research, we use the concepts of “digital-era governance” (DEG) (Dunleavy, Margetts, Bastow & Tinkler, 2006), “Information governance” (Shepherd, Stevenson & Flinn, 2010) or “project governance” (Too & Weaver, 2014) to determine the effectiveness of information systems and technologies in the management of infrastructure projects in the public sphere. These concepts replace NPM due to digitalization of public administration, but few studies are focused on examining the effectiveness of DEG in the context of overcoming corruption, ensuring transparency and accountability. The data from the countries with Lower middle income (India, Indonesia, Philippines, Ukraine, Vietnam) and Upper middle income (Argentina, Brazil, China, Colombia, Mexico, Peru, Romania, Russian Federation, Thailand, Turkey) for 1996-2020 were used to study the effects of DEG:

1) data of the World Bank (CPIA transparency, accountability, and corruption in the public sector rating (1=low to 6=high); CPIA quality of public administration rating (1=low to 6=high);

2) data of the World Bank for 1996-2020 on the dynamics of the volume of investments in infrastructure projects with the participation of the private sector in countries by income level, country group, project type;

3) ERCAS European Research Centre for Anti-Corruption and State-Building (Index of Public Integrity) for 2015, 2017, 2019;

4) United Nations Department of Economic and Social Affairs Division for Public Institutions and Digital Government E-Government Index for 2005, 2010, 2020.

These indicators make it possible to link the level of digitalization of public administration and the progress of implementation of infrastructure projects as a strategic benchmark of the development of countries in the development of e-democracy and accountability. This study is limited by the inconsistency of some indicators over time, due to the lack of data (for example, limited data of E-Government Index and Index of Public Integrity). Correlation analysis was used to identify the link between the digitization of public administration and the effectiveness of project management through information systems.

4. Results

Over the past twenty years, project management of the public sphere has been significantly transformed due to the need of interested parties in the accountability of public authorities on the implementation of infrastructure projects. Projects in countries with Lower middle income and Upper middle income are a common development practice supported by international donors and investors, who need control over the flow of investment resources and responsibility for their own funds. During 1996-2020, 9,135 projects worth \$ 1,858,208.213 million were implemented with the participation of the private sector (from 1% to 100% of participation), in particular in China 1,832 projects (12% of the amount of investments in projects), Brazil 1,819 (23%), India 1,163 (15%), Mexico 340 (5%), Turkey 265 (8%), Colombia 236 (2%), Argentina 221 (1%), Russian Federation 203 (4%), Peru 185 (2%), Thailand 171 (2%), Philippines 147 (3%), Indonesia 137 (3%), Vietnam 137 (1%), Ukraine 128 (0.4%) and Romania 122 (1%). In general, during 1996-2020, the dynamics of investments into projects of countries with Lower middle income was negative, and growth was observed in 2010 due to the increase in the number of projects in India in 2006-2010.

Table 1. Private Participation in Infrastructure (PPI) (Total Investment) by Country Income Group, 1996-2020 (million dollars)

Country	Total Investment						
	1996	2005	2010	2018	2019	2020	Total
Lower middle income	10600,20	2608,24	55315,18	22230,80	15439,36	3080,72	409627,60
India	2625,60	2287,64	50005,97	11229,15	7368,28	1762,12	271088,78
Indonesia	5840,60	32,00	2300,00	6638,15	372,38		59664,12
Philippines	1914,00	3,40	1822,25	48,58	1817,82	88,25	48221,33
Ukraine		100,00	88,91	669,22	1409,01	15,00	6805,57
Vietnam	220,00	185,20	1098,05	3645,70	4471,87	1215,35	23847,80
CPIA transparency, accountability, and corruption in the public sector rating		2,89	2,87	2,92	2,93	2,92	-

CPIA quality of public administration rating		2,95	2,99	2,94	2,93	2,94	-
Upper middle income	25909,51	28986,27	41170,20	62814,42	62685,60	11925,77	1104796,87
Argentina	1743,69	0,00	30,60	1151,82	2060,40	160,00	23989,55
Brazil	8121,30	4633,55	16281,72	6161,34	18623,82	3542,95	422718,71
China	7966,22	9205,59	1112,67	32744,38	29284,08	2858,72	227288,07
Colombia	1669,10	318,98	2594,02	2140,74	2810,20	531,73	43962,89
Mexico	810,60	1471,30	2692,10	4740,02	2977,21	4014,70	83707,49
Peru	589,80	463,20	1333,80	647,60	54,00	229,00	34025,15
Romania		1240,75		731,10	129,25	1,60	15067,59
Russian Federation	210,90	343,30	10620,20	4428,12	4055,95	79,62	75788,25
Thailand	2538,70	1850,60	745,36	2049,89	1653,34	212,80	34178,61
Turkey	2259,20	9459,00	5759,73	8019,41	1037,35	294,65	144070,56
CPIA transparency, accountability, and corruption in the public sector rating		3,27	3,42	3,59	3,64	3,61	-
CPIA quality of public administration rating		3,40	3,38	3,18	3,18	3,18	-
Total	36509,71	31594,51	96485,38	85045,22	78124,96	15006,49	1514424,47

Source: World Bank (2020).

In the countries with Upper middle income there was a point growth in infrastructure projects, in particular due to investments into projects in Brazil, China in 1997-2000, Turkey in 2005, 2013-2015, Brazil in 2007-2008, 2011-2014, Mexico in 2007, Russia in 2007-2008, 2011. At the same time, the level of transparency and accountability, corruption of these countries remained at the same level, and the quality of public administration even decreased in both groups of countries. This means that digitalization as a whole could provide accountability, but the management of funds and investment flows could not be directed to the project implementation. Countries of Latin America and the Caribbean and East Asia have the largest shares in the volume of investments into infrastructure projects with the

participation of the private sector and the public sphere (Figure 1). In terms of income, the countries with Low income implemented projects worth \$ 24,208.49 million (1.30%), countries with Lower middle income – \$ 581,174.662 million (31.28%), countries with Upper middle income – \$ 1,252,825.061 million (67.42%) for 1996-2020. 96.49% of projects are at the implementation stage (Active), 2.49% are Cancelled, 0.13% - Concluded, 0.89% - Distressed. This means that projects are long-term and need effective management and control. It also indicates that gradual digitalization does not affect the speed of project implementation and does not determine the quality of management and control.

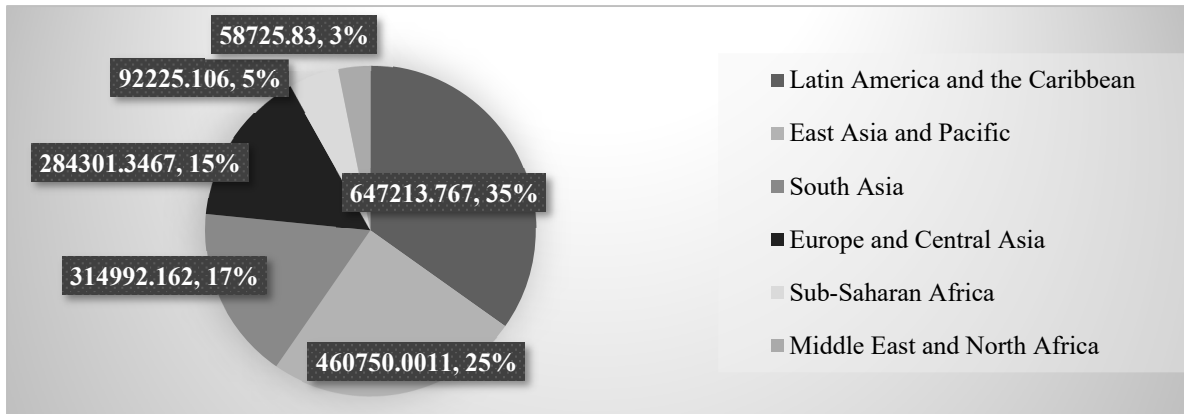


Figure 1. Private Participation in Infrastructure (PPI) (Total Investment) by Country Group, 1996-2020 (million dollars and %) Source: World Bank (2020)

The rate of investments into projects with the participation of the private sector and transparency, accountability, level of corruption of the public sector in low-income countries are negatively related, which means a decline in investments due to poor quality of public administration and possible risks of investment management by public authorities. In the countries with lower middle and upper middle income, there is a higher negative relation between project investment and the level of transparency, corruption

and accountability. At the same time, the level of correlation between the rate of investments into projects in low-income countries and the quality of public administration is high positive (0.876), in countries with lower middle income – insignificant positive (0.147), in countries with upper middle income – high negative (-0.820). This is indicative of high risks of investing in developing economies, so there is a slowdown in investment into projects of middle-income countries.

Table 2. Correlation between total Investment in PPI and quality of public administration, transparency, accountability, and corruption in the public sector

	TI_Low income	TI_Lower middle income	TI_Upper middle income	CPIA_T&A_PS_Low income	CPIA_T&A_PS_Lower middle income	CPIA_T&A_PS_Upper middle income	CPIA_quality_PA_Low income	CPIA_quality_PA_Lower middle income	CPIA_quality_PA_Upper middle income
TI_Low income	1,000								
TI_Lower middle income	0,252	1,000							
TI_Upper middle income	0,364	-0,007	1,000						
CPIA_T&A_PS_Low income	-0,188	0,245	0,580	1,000					
CPIA_T&A_PS_Lower middle income	-0,057	-0,598	-0,122	-0,372	1,000				
CPIA_T&A_PS_Upper middle income	0,042	-0,509	-0,470	-0,829	0,508	1,000			
CPIA_quality_PA_Low income	-0,297	0,191	0,323	0,876	-0,367	-0,812	1,000		
CPIA_quality_PA_Lower middle income	-0,089	-0,194	-0,105	0,000	0,147	0,373	0,045	1,000	
CPIA_quality_PA_Upper middle income	-0,192	0,262	0,286	0,736	-0,527	-0,820	0,843	-0,129	1,000

Source: World Bank (2020).

*TI – Total Investment in PPI, growth (2005-2019 data); CPIA_T&A_PS_ – CPIA transparency, accountability, and corruption in the public sector rating (1=low to 6=high); CPIA_quality_PA_ – CPIA quality of public administration rating (1=low to 6=high)

The development of information systems in project management of the public sphere can be assessed on the basis of sub-indices Index of Public Integrity according to the ERCAS European Research Centre for Anti-Corruption and State-Building, which assesses the ability of the society to control corruption and ensure that public resources are spent without corruption activities. E-Citizenship indicates the development of e-citizenship, Budget Transparency –

the transparency of public budgets. In 2015, the Index of Public Integrity averaged 5.942, budget transparency – 7.196, development of e-citizenship – 5.023, in 2017, the index averaged 6.145, budget transparency – 7.265, development of e-citizenship – 5.217, in 2019, the index averaged 6.404, budget transparency – 7.265, development of e-citizenship – 5.211. Thus, the level of public control over corruption in countries slightly increased due to increased budget transparency and e-citizenship.

Table 3. Index of Public Integrity, 2015, 2017, 2019

Country	2015			2017			2019		
	IPI	Budget Transparency	E-Citizenship	IPI	Budget Transparency	E-Citizenship	IPI	Budget Transparency	E-Citizenship
Argentina	6,226	7,859	7,132	6,457	7,859	7,314	6,789	7,859	6,956
Brazil	5,405	8,071	5,976	5,827	8,071	6,186	6,262	8,071	6,301
China	4,306	1,212	3,638	4,543	1,000	4,125	5,218	1,000	4,099

Colombia	6,368	9,357	5,780	6,394	8,502	6,013	6,499	8,502	5,882
India	5,330	5,931	2,294	5,596	5,931	2,539	6,254	5,931	2,634
Indonesia	5,832	7,429	3,062	6,039	6,786	3,348	6,287	6,786	3,733
Mexico	6,302	7,435	5,499	6,685	9,139	6,215	6,772	9,139	6,047
Peru	6,622	9,497	5,171	6,701	8,844	5,398	6,610	8,844	5,226
Philippines	6,322	7,011	6,287	6,653	8,933	5,441	6,611	8,933	5,344
Romania	7,576	8,714	6,006	7,731	9,145	6,049	7,686	9,145	6,006
Russian Federation	5,681	9,357	4,955	5,796	8,714	5,168	6,268	8,714	5,010
Thailand	6,518	9,139	5,342	6,571	8,926	5,599	6,779	8,926	5,785
Turkey	6,315	8,071	5,967	6,339	8,277	5,992	6,522	8,277	5,822
Ukraine	5,966	7,210	3,693	6,238	7,422	3,977	6,547	7,422	4,230
Vietnam	4,367	1,643	4,541	4,609	1,431	4,895	4,957	1,431	5,091

Source: ERCAS European Research Centre for Anti-Corruption and State-Building (2020).

Despite the insignificant increase in budget transparency and the development of accountability through accountability information systems for citizens and interested parties, the problems related to corruption remain challenges for infrastructure projects. Therefore, we can assume that the development of the concept of “digital-era governance” does not provide solutions to complex social and institutional problems, only simplifying interaction with citizens. Problems in public project management remain unsolved.

In the structure of project types, the following three main groups prevail: Build, operate, and transfer (\$ 614,196.8527 million or 33%) with ownership of public sector assets, Build, own, and operate (\$ 434,657.514 million or 23%) with ownership of the project company, Build, rehabilitate, operate, and transfer (\$ 379,533.91 million or 21%) with ownership of the public sector (Figure 2). Partial projects were invested in the amount of \$ 161,775.2656 million (9%), Rehabilitate, operate, and transfer (\$ 77,436.4473 million or 4%), Full \$ 60,405.9742 million (3%).

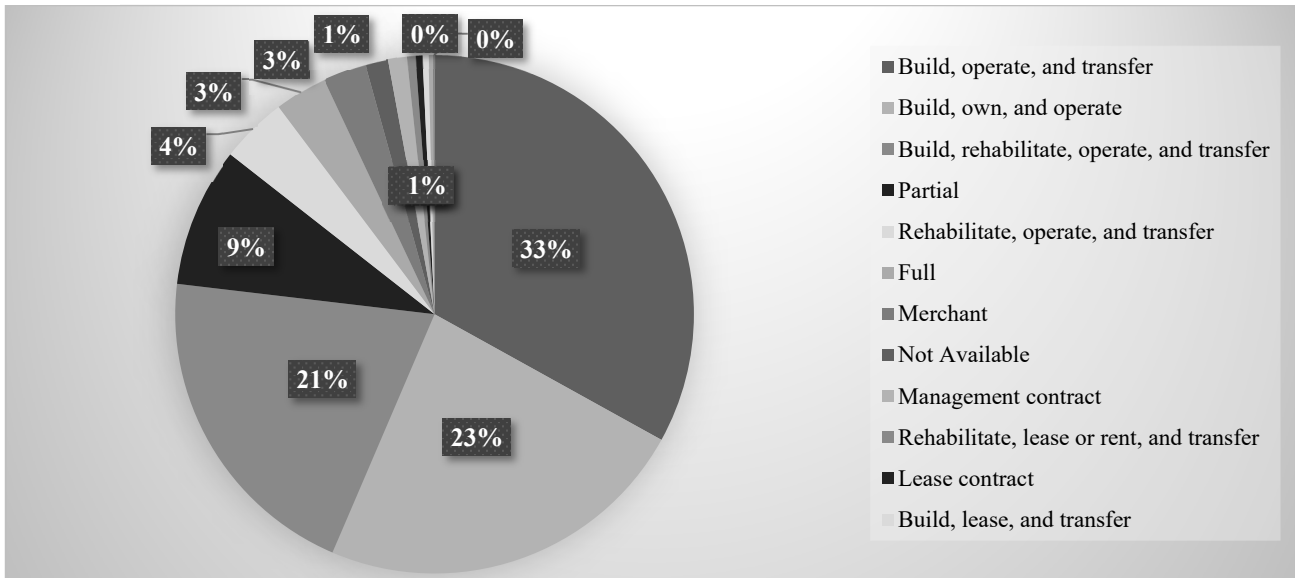


Figure2. Private Participation in Infrastructure (PPI) (Total Investment) by Type of Project, 1996-2020 (%)

Source: World Bank (2020).

This distribution of projects means the transfer of responsibility to the public sector for the fulfilment of conditions of contracts for infrastructure projects financed including by the private sector. Therefore, the use of information systems to simplify project management processes is important in the context of common practice of asset ownership after the completion of the project by public authorities.

5. Discussion

Information systems in project management of the public sphere not only provide forecasting of investment flows of infrastructure projects, payback and effectiveness parameters, but are an important element of responsibility

to the private sector for the provided investment resources. The development of project evaluation systems for investment management in the public sector supports decision-making based on different models and algorithms according to the given type of project. IS provide a rapid analysis of project data volumes and are based on analytical methodologies, include investment forecasting models in order to distribute them between projects (Zhang & Cui, 1999). IS provide performance measurement through technologies and digital solutions for monitoring activities of public authorities (Hall, Holt, & Purchase, 2003). As a project management tool in the public sphere, programs ensured the development of digital governance and performance measurement of the governance system (Too & Weaver (2014). However, problems related to corruption and transparency remain challenges for countries with different income levels. IS in project management affected the effectiveness of public governance through a greater level of potential control of citizens and investors through digital services, but the confidence of interested parties, especially private investors, in public authorities is determined by other factors – the level of return on investment, risks and assignment of responsibility, probability of successful completion of the project. In fact, IS simplify processes of measuring investment flows within a portfolio of projects for interested parties. However, the concept of “digital-era governance”, which was expected to replace NPM, did not solve the same institutional and social problems of democracy in developing countries. “Information governance” (Shepherd, Stevenson & Flinn, 2010) or “project governance” (Too & Weaver, 2014) is used to explain how the performance of the direct function – managing information by public authorities using technologies – is ensured, including to increase the level of participation of citizens in political processes, generate confidence in government decisions, ensure accountability

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and transparency, access to information, openness (Shepherd, Stevenson & Flinn, 2010). However, the effectiveness of public decision-making remains at the same level, taking into account the indicators of budget transparency, corruption control.

6. Conclusion

The conducted research indicates two main trends in the countries with Lower middle income and Upper middle income. The first trend is the development of digital governance and performance measurement of the governance system, forecasting of investment flows of infrastructure projects, measurement of payback and effectiveness parameters for investment management in the public sector, decision support. This means the development of the concept of “digital-era governance” through information systems in the public sphere. The second trend is the existence of systemic challenges related to corruption, social and institutional factors through the development of democracy in developing countries and the integration of NPM similar to developed countries. These challenges complicate the uncertainty of project implementation in the public sphere, despite the simultaneous increase in transparency and accountability to interested parties on the part of public authorities. The problems related to corruption and transparency remain challenges for countries with different income levels. The confidence of interested parties, especially private investors, in public authorities is determined by other factors – the level of return on investment, risks and assignment of responsibility, probability of successful completion of the project. These data still remain limited for a wide range of project participants, including citizens.

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