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PORTFOLIO MANAGEMENT FOR PUBLIC PARTICIPATION PROJECTS

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The relevance of the topic is due to the need for improvement and further development of methodological support of the portfolio management processes within the portfolio management introduction in the field of project management of local (territorial) self-government, including projects of public participation.

Introduction

The relevance of the topic is due to the need for improvement and further development of methodological support of the portfolio management processes under the circumstance of introduction of the portfolio oriented management in the field of by management projects of local (territorial) self-government, including projects of public participation (PP projects).

The purpose of the study is to improve and further develop the methodology support of the portfolio aligning process group under the conditions of PP projects performing regarding of the developing a concept for aligning of the PP projects portfolio.

The object of the study. Processes of aligning of PP projects sets for implementation.

The subject of the study. Methods and models for aligning of portfolio of projects.

The study's objectives are as follows: 1) to establish base of definitions for research and to identify project management knowledge areas relevant to the research subject; 2) to analyze, as interrelated, methodological approaches to: structuring categories; defining criteria for evaluation, selection and prioritization; optimization of PP project combinations as those presented in portfolios; 3) to formulate and test, using the database of the PP projects of Kyiv city, hypotheses relating to the significance of differences in the sets of the PP projects, separated by thematic directions, which determine the feasibility of presenting projects of thematic areas in the relevant subportfolios of the overall PP project portfolio; 4) to propose the model for optimization of the PP projects portfolio.

The methods of the study the method of scientific identification was applied while forming the base of definitions for the research; the method of comparative contrast analysis was applied in the analysis of methodological approaches to structuring,

definition of criteria (evaluation, selection, prioritization) and optimization of the PP project portfolio; to test the hypotheses of significance of differences in the set of the PP projects, separated by thematic areas, the non-parametric criterion (test) of significance of Kruskal-Wallis was used; while building a model for optimization of the PP projects portfolio, the method of cost-benefit analysis, the time value of money concept, and an integer programming linear method were applied.

Literature review

As is well known, politics and projects are frequently viewed as the main ways of intervention into the economy at the state level and/or at the level of individual territorial communities.

Nearly all industrial markets and markets for specific goods (services) are impacted by macroeconomic policy means that determine the overall economic situation of the nation. These means should, in the first instance, be focused on preventing or resolving general crisis phenomena, stabilizing the economy, and promoting economic growth. When compared to the macroeconomic policy implemented in the nation, the means of economic policy that are implemented at the level of specific territorial communities within the parameters of the rights and obligations assigned to those communities can be seen as additional, or complementary, and as those that have an impact on all aspects of the activity of economic units that belong to these communities, as well as the working and recreational conditions of local residents.

It is important to understand that, when analyzing projects which implementation can be viewed as economic intervention at the level of the state as a whole or local territorial communities, policy tools and projects can act in some situations as interchangeable and in other cases as complementary forms of intervention. We can give the following issues as examples of policy instruments, carried out in the field of transport: taxation; subsidizing; direct (from the state or territorial communities) suppling of transport and related services; legislation and regulation; introducing restrictions on competition; consumer rights protection; pricing; licensing; purchasing (by the state or territorial communities) of transport services; moral influence; conducting research and creating conditions for development; provision of information; regulation of industries that generate input (resource) flows in relation to the transport sector. As we can see, potentially the means of policy have a greater impact in comparison with the expected results of separate projects. As a result, the introduction of new policies is prioritized over the execution of projects that are seen as alternatives.

At the same time, projects and instruments of policy can work together to solve a variety of issues. On the one hand, the policy establishes the necessary structural context, principally in terms of the legal, economic, and, more recently, environmental aspects; it also stimulates the desired responses of economic units and provides the necessary resources, among other things. On the other hand, the outcomes of the implemented projects can influence the formation of political decisions in different areas in the future.

Being aware that intervention in economic processes by the state is necessary due to the imperfection of the market economy, we have to note that it can lead to the desired outcome only when it is an «optimal» one. In the other case, i.e., when such intervention is excessive or insufficient, it fails to reach its goal.

Based on the aforementioned, it is vital to ask a number of questions before beginning to assess a particular project in detail. Why does not the market in this given situation perform its functions, why are we facing so called «market fiasco»? Is it an outcome of the market imperfection or intervention into economy, which happened to be not perfect? Do we have another way to solve the problem – more effective, efficient, harmonious and directly aimed at this problem – than the implementation of the project under consideration?

Depending on the respond to these questions all projects can be divided into two main groups: projects, aimed at overcoming market imperfection, and projects, which are supposed to correct the consequences of imperfect interventions in economy. The projects of the first group can, hypothetically, serve both as alternatives and supplementary to instruments of policy. It is worth mentioning, that regarding the projects of the second group it is desirable firstly to change policy in the corresponding areas, and then, in the conditions that have undergone the changes, we can consider the feasibility of implementation of the projects of this group.

At the same time, being a form of intervention into economy, at the level of individual territorial communities projects act as a mean of implementation of the development strategy for these territorial communities. This determines the need to direct them towards ensuring the achievement of relevant strategic goals. Aiming to involve local residents in various facets of community life through awareness and decision-making processes, realized in the form of drafting a project, to address local problems in distinct residential communities, districts, cities, etc., public participation projects (PP projects) are gaining increasing recognition in the territorial communities of Ukraine and the rest of the world. At the same time, based on the analysis of requests submitted for the implementation of PP projects, the latter can be divided, in terms of compliance with the established strategic objectives, at least into

two groups. There are projects that clearly cannot be matched with specific strategic objectives, and may even contradict some of them, and projects that clearly meet strategic objectives, demonstrating the applicability of the existing strategy for the local community. Taking into account the significant number of requests for projects from the first group in certain areas, in the future, these areas can be identified as those that require the intervention of local governments through changes in the relevant components of policy and/or strategy.

Currently, we can observe high growth rates in the total number of PP projects and budgets allocated for their implementation. Particularly, in Kyiv, the budget for the PP projects that were approved for implementation climbed from 50 million hryvnias in 2017 to 170 million hryvnias in 2021, while the number of projects approved for implementation increased from 62 in 2017 to 348 in 2022. It is planned to allocate 200 million hrynvias for 393 projects in 2022. In order to address this, management must become more effective and efficient as for PP projects in general, as for their sets in the sphere of healthcare, education, transportation, and so on.

It is widely acknowledged that combining projects and programs into portfolios enables one to obtain a new management quality, increases the overall impact of their implementation, and gradually develops the portfolios themselves into an effective and efficient mechanism for implementing not only strategical goals but also their formation [1, 2]. The increasing importance of portfolio management in the theory and practice of project management is indirectly indicated by the fact that, since 2006, the largest professional organization in the field of project management, the Project Management Institute, PMI, singles out from its basic standard for project management – A Guide to the Project Management Body of Knowledge – develops and communicates to project management professionals a portfolio management standard. At the same time, until now, portfolios have been considered in scientific papers and portfolio management standards mainly in the context of the implementation of strategies by individual, mostly business, organizations or organizational networks.

Thus, the relevance of the scientific topic is due to the need for improvement and further development of methodological support portfolio management processes in the context of the introduction of portfolio-oriented management in the field of project management of local (territorial) self-government, including projects of public participation (equivalent to the term «public projects»).

The PMI has offered so far four versions of portfolio management standard, which were published in 2006 [3], 2008 [4], 2013 [5] and 2017 [6], respectively. Project management is one of those concepts that has many meanings, as was stated in the initial version of this standard. It was only ever affiliated with projects for

a long time. However, today, it is becoming obvious that project management also deals with portfolio and program management, focusing on the thesis of «doing the right work», as opposed to the traditional project management and program management – «doing work right» [3].

In the Standard for Portfolio Management, the terms «portfolio» and «portfolio management» act as initial points of reference. Comparing the definitions of portfolio in different versions of the Standard for Portfolio Management of PMI, Table 1, we can come to a conclusion, that in the first three versions [3–5] a portfolio is considered as one, that includes projects, programs. and also other work, which is not included into previously mentioned components – projects and programs. At the same time, starting from the end of 2000, in the second edition of the Standard for Portfolio Management [4] and in some other standards of PMI the last one started to use the term «highest level portfolio», which, except for projects and programs, by definition may contain lower level portfolios. During the same time period, the professional community observes that in practice there is a tendency in any large portfolio to appear more or less stable groups of projects sporadically, and sometimes systematically. We can refer to these project groups as subunits (or subdivisions) of a single portfolio as long as they are just there to make management easier. However, when we start to allocate resources separately for a group and rank projects within such a group, we deal with singling out a portfolio of a relatively lower level within a portfolio of a relatively higher level. We can apply all the techniques and tools of traditional portfolio management to these new «units» [7]. These practices were taken into account to define a portfolio in the fourth edition of the PMI Standard for Portfolio Management through the introduction of subsidiary portfolios as portfolio components [6].

In the fourth version of the PMI Standard for Portfolio Management, developing the definition of the term «portfolio», PMI connects the existence of a portfolio to the adoption of specific strategies and the accomplishment of specific goals of the organization or business units [6]. At the same time, a portfolio assumes the existence of both current components and those that will be added in the future. It is obvious that the presence of multiple strategies and goals can result in a single organization having more than one portfolio. New project and program initiatives are included in existing or new portfolios. In addition, relatively bigger portfolios may include subsidiary portfolios. We may observe mainly hierarchical structuring. Portfolios can exist at different organizational levels, including the organization as a whole, a department, a business unit, or a function [6]. They can also be internal or external to the organization.

Table 1

Definition of Portfolio and Portfolio Management
in the versions of The Standard for Portfolio Management, published by PMI in the period from 2006 to 2017

Edition (version) of the PMI Standard for Portfolio Management	The definition of a portfolio	The definition of portfolio management
1	2	3
The first edition, 2006 [3]	A portfolio is a collection of projects (temporary endeavors undertaken to create a unique product, service, or result) and/or programs (a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually) and other work that are grouped together to facilitate the effective management of that work to meet strategic objectives.	Portfolio management is the centralized management of one or more portfolios, which includes identifying, prioritizing, authorizing, managing, and controlling projects, programs, and other related work, to achieve specific strategic objectives. It is an approach to achieving strategic goals by selecting, prioritizing, assessing, and managing projects, programs and other related work based upon their alignment and contribution to the organization's strategies and objectives. Portfolio management combines (a) the organization's focus of ensuring that projects selected for investment meet the portfolio strategy with (b) the project management focus of delivering projects effectively and within their planned contribution to the portfolio.
The second edition, 2008 [4]	A portfolio is a collection of projects or programs and other work that are grouped together to facilitate effective management of that work to meet strategic business objectives.	Portfolio management is the coordinated management of portfolio components to achieve specific organizational objectives. Portfolio management is also an opportunity for a governing body to make decisions that control or influence the direction of a group of portfolio components (a subportfolio, program, projects, or other work) as they work to achieve specific outcomes. An organization uses the tools and techniques described in the standard for portfolio management to identify, select, prioritize, govern, monitor, and report the the contributions of the components to, and their relative alignment with, organizational objectives. Portfolio management is not connected with component management. Its aim is to ensure, that an organization is «doing the right job» rather than «doing the job right».

Table 1 continued

1	2	3
The third edition, 2013 [5]	A portfolio is a component collection of programs, projects, or operations managed as a group to achieve strategic objectives.	Portfolio management is the coordinated management of one or more portfolios to achieve organizational strategies and objectives. It includes interrelated organizational processes by which an organization evaluates, selects, prioritizes, and allocates its limited internal resources to best accomplish organizational strategies consistent with its vision, mission, and values. Portfolio management produces valuable information to support or alter organizational strategies and investment decisions. Portfolio management provides an opportunity for a governing body to make decisions that control or influence the direction of a group of portfolio components as they work to achieve specific outcomes. An organization uses the processes, tools, and techniques described in the standard to identify, select, prioritize, govern, allocate resources, monitor, and report the contributions of the portfolio components to, and their relative alignment with, organizational objectives. Portfolio management balances conflicting demands between programs and projects, allocates resources based on organizational priorities and capacity, and manages so as to achieve the benefits identified.
The fourth edition, 2017 [6]	A portfolio is a collection of programs, projects, subsidiary portfolios, and operations managed as a group to achieve strategic objectives.	Portfolio management is the centralized management of one or more portfolios to achieve strategic objectives. It is the application of portfolio management principles to align the portfolio and its components with the organizational strategy. Portfolio management can also be viewed as a dynamic activity through which an organization invests its resources to achieve its strategic objectives by identifying, categorizing, monitoring, evaluating, integrating, selecting, prioritizing, optimizing, balancing, authorizing, transitioning, controlling, and terminating portfolio components.

The modern sources of information in our opinion carries out a certain ambiguity of using the terms: «portfolio», «portfolio management», and others related terms. It's interesting to differentiate between the following two primary interpretations of «portfolio» in the context of this research.

In its first meaning a portfolio is put on a par with a project and a program, in the sense of temporary, i.e., such that has a limited duration in time, activity (actions, a set of activities, etc.). To a certain degree it seems that portfolio is considered, least partially, this way, for example, in the system model, which was proposed in the research paper [8]. One of the reasons to reach such a conclusion is the of life cycle phases, presented in the model as management objects for both projects and programs, as well as for portfolios. The same applies to the management processes [8].

We can note the use of the term «portfolio» as a time-limited activity in particular in resources on financial management, partly in project analysis, managerial accounting, etc. The research works of this direction deal with the issue of the conditions for project interaction – their components in portfolios – independent projects or dependent, i.e. substitutive or complementary by benefits and/or expenditures; peculiarities of application of NPV, payback period, IRR and other methods to access project efficiency not by separate projects but as a set of the specified project-components. We can see this interpretation of the term «portfolio» in certain context also in some versions of the PMI standard for portfolio management [3–6]. Therefore, in accordance with this first interpretation a portfolio is a certain totality (set) of components, in the capacity of which particular projects and programs are considered, and portfolio in this interpretation lasts for a limited period of time.

The second interpretation of the term «portfolio», which is separately dealt with in the Tab. 1, which we can see widely used in the contemporary theory and practise of project management, in regard to portfolio management, is connected with the interpretation of portfolio management as a regular, i.e. continuous, or operational activity. According to this interpretation, the phases of the portfolio's life cycle were either not singled out at all in the first three editions of the PMI portfolio management standard – or, according to the fourth edition [6], they were singled out in a different way than the phases of the project's life cycle. In other words, a portfolio serves within an organization as a permanent «shell» for projects and programs in a certain area. As it is highlighted in the work [7], an organization is able to operate with several portfolios at once in compliance with the PMI portfolio management standard. Although projects and/or programs

within a portfolio may last only during a certain period of time, but the portfolio itself continues to function as an operational «shell» for projects and programs of a certain type.

In work [7], it was noted that, in contrast to the project life cycle, the portfolio life cycle is by its very nature cyclical, that is, repeated. For instance, this was brought up when the authors of this work assessed the first two versions of the PMI portfolio management standard. However, there is disagreement over whether it is generally reasonable to single out the various phases of the portfolio's life cycle or what content should have each phase. Some researches advocate such «reason ability», for example, mentioned above [7], while others share the view point of the first of the PMI portfolio management standard, in accordance with which a portfolio should be considered as a typical operational activity which includes a set of continuously performed processes. It means that the general process of portfolio management does not end. The only exceptions could be the cases when an organization refuses to employ portfolio-oriented management practice in general or an organization ceases to exist altogether. Simultaneously, in the first three versions of the PMI portfolio management standard the term «portfolio management process cycle» was developed [3–6]. But in the fourth version of the PMI portfolio management standard the term «portfolio life cycle» was introduced with description of content for each and their interaction.

The portfolio life cycle is considered as the ongoing processes and functions that occur to a set of portfolios, programs, projects, and operations within a continuous time frame [6].

Of course, it is hard to imagine a portfolio in which all process of its management will be performed evenly through the year, as it was noted in the research [7]. We can predict a correlation between a portfolio and cyclic activity of an organization. This cyclic activity can differ for various organizations and types of portfolio (a year, a quarter, a month, a week). However, certain portfolio management processes will be more typical for certain time periods, while others will be for others. As we saw above, the same opinion is fully presented in the fourth version of the PMI portfolio management standard [6]. This version reflected the above-mentioned preliminary considerations of the professional community regarding the interpretation of the life cycle of a portfolio, including those presented in the research [7]. This version specifically mentions that a portfolio has a life cycle, just like programs and projects do. A portfolio lasts comparatively longer than programs and projects, which are by definition marked by a limited duration in time. When a portfolio is no longer necessary

due to the fact that portfolio goals have been met, or because some of its components have been halted or transferred to another portfolio, we can observe a portfolio being closed down. Portfolios can be united or divided to bring the benefits to the maximum [6].

In accordance with the fourth version of the PMI standard for portfolio management [6] a continuous portfolio life cycle includes: initiation, planning, execution, and optimization. Just as a portfolio evolves through its life cycle, so do information and decisions move between these phases. Although continuous, it need not always be sequential. For instance, a portfolio might go through a number of iterations of the planning phase and then move to execution at short notice. All phases, including initiation, are adaptive, flexible, and variable.

In our research, we use the definition of a portfolio and portfolio management in correspondence with their meanings provided in the fourth edition of the PMI Standard for Portfolio Management, Table 1, unless otherwise specified.

The current study focuses on the comparison and contrast of portfolio management processes vision, particularly the aligning process group, in accordance with various versions of the PMI Standard for Portfolio Management [3–6]. The aligning process group was singled out in the first version of the PMI Standard for Portfolio Management [3]. According to this version, the processes of this group are mostly realized by the organization during the period of review of its strategic goals, plans, and budgets, as a rule, at the end of a fiscal year. Some organizations have a shorter planning cycle. Furthermore, the necessity of these processes also arises when we observe sharp changes for conducting business [7]. The following processes were included in this group: identification of components; categorization of components; evaluation of components; selection of components; prioritization of components (determining the degree of priority, sometimes the term «rating» is used); balancing portfolio, and authorization (approval) of portfolio components [3].

In the second version of the PMI Standard for Portfolio Management the aligning process group retains its previous name and cited-above list of processes. At the same time, it is mentioned that the basis of these processes is formed by such portfolio management knowledge area as the portfolio governance. Meanwhile, the following processes: identification portfolio risks, analysis portfolio risks, and development portfolio risk responses were added to the cited-above list of processes. The basis of these new processes is formed by such portfolio management knowledge area as the portfolio risk management [4]. Also communication portfolio adjustment process was added. The knowledge area for this process is the portfolio governance.

In the third version of the PMI Standard for Portfolio Management the aligning process group is presented as one, which includes processes aimed at management and optimization of a portfolio. This group determines how portfolio components will be categorized, evaluated, selected for inclusion, modification, or elimination, and managed in the portfolio [5]. Within this group the following processes are pointed: manage strategic change, the basic of which is such portfolio management knowledge area as portfolio strategic management; optimize the portfolio – the portfolio governance management knowledge area; manage supply and demand – the portfolio performance management knowledge area; manage portfolio value – the portfolio performance management knowledge area; manage portfolio information – the portfolio communication management knowledge area; manage portfolio risks – the portfolio risk management knowledge area [5]. It is important to note that the defining process group, was introduced in the third version of the PMI Standard for Portfolio Management. It is a relatively new process group in the third version compared to the previous two versions of the PMI Standard for Portfolio Management. This group, as we can see, has partially overtaken some processes, which were considered as a part of the aligning process group in the previous versions of the PMI Standard for Portfolio Management. At the same time, if we link the groups of processes with portfolio management knowledge areas, we can notice that «traditional», as for the first, as for the second versions of the PMI Standard for Portfolio Management [3, 4], processes of aligning process group are studied within the portfolio governance management knowledge area. In particular, it is applicable to identification, categorization, evaluation, selection, prioritization, and balancing (hereinafter, optimization).

In the fourth version of the PMI Standard for Portfolio Management portfolio management processes act as those which are grouped according to the stage of the portfolio life cycle, identified in this version – as stages of the portfolio management process – initiation, planning, implementation, and optimization, as well as monitoring and control, if it is envisaged to separate this stage of the management process, which is not considered as a separate stage of the portfolio life cycle [6]. The processes of aligning process group, in the interpretation of the first three versions of the PMI Standard for Portfolio Management [3–5], and, in part, the processes of defining process group, which were introduced in the third version [5], mainly correspond to the process of initiation and planning group [6]. It is worth noticing that optimization (previously called balancing) as it is interpreted in the first three cited-above versions [3–5], occurs according to the

fourth version not only at the optimization stage, but also to a large extent at the planning stage, in particular, at its beginning, and is also possible at the stage of implementation [6].

It is obvious that if we try to apply portfolio-oriented management methodology to the project management of local (territorial) self-government, including PP projects, we need in certain adaptation. In our work we do not set an aim to substantiate the necessity to single out certain processes, which may make up a group of processes for the aligning of a PP project portfolio, and accordingly, to define the content of these processes as the main actions that are supposed to be taken, as well as input and output data for each process in correlation with portfolio life-cycle stages as the stages of the portfolio management process. At the same time, for any structuring of portfolio aligning process group, it is of interest to investigate the problem of elaborating the methodological approaches considered in the relationship to: structuring – as separating of categories; definition of criteria for evaluation, selection, and prioritization; optimization of PP project sets – such as those presented in portfolios. At the same time, the research gap is identified as the absence of methodological support for the development of the above-mentioned approaches.

Concept for aligning of the PP projects portfolio

In general, the process of evaluation and selection of PP projects for implementation is as follows. Requests for PP projects must undergo a preliminary selection procedure at the relevant executive structures of the territorial community. Then, those of the requests that have successfully passed the preliminary selection are offered for consideration to the residents of the territorial community. Each resident, as a votes, receives a specific predetermined amount of votes. The definition of «a resident of the territorial community» may differ.

Additionally, projects are evaluated, selected, prioritized, and optimized in accordance with preset criteria depending on the amount of votes obtained as a distinct indicator or in a predetermined combination with other indicators. The group of projects created in this manner is then transferred for implementation.

The generalized vision of the concept for aligning of the PP project portfolio offered by the authors is presented in Figure 1.

Let us consider in detail the interrelated approaches to the PP portfolio aligning. These approaches were identified in the above concept, Figure 1.

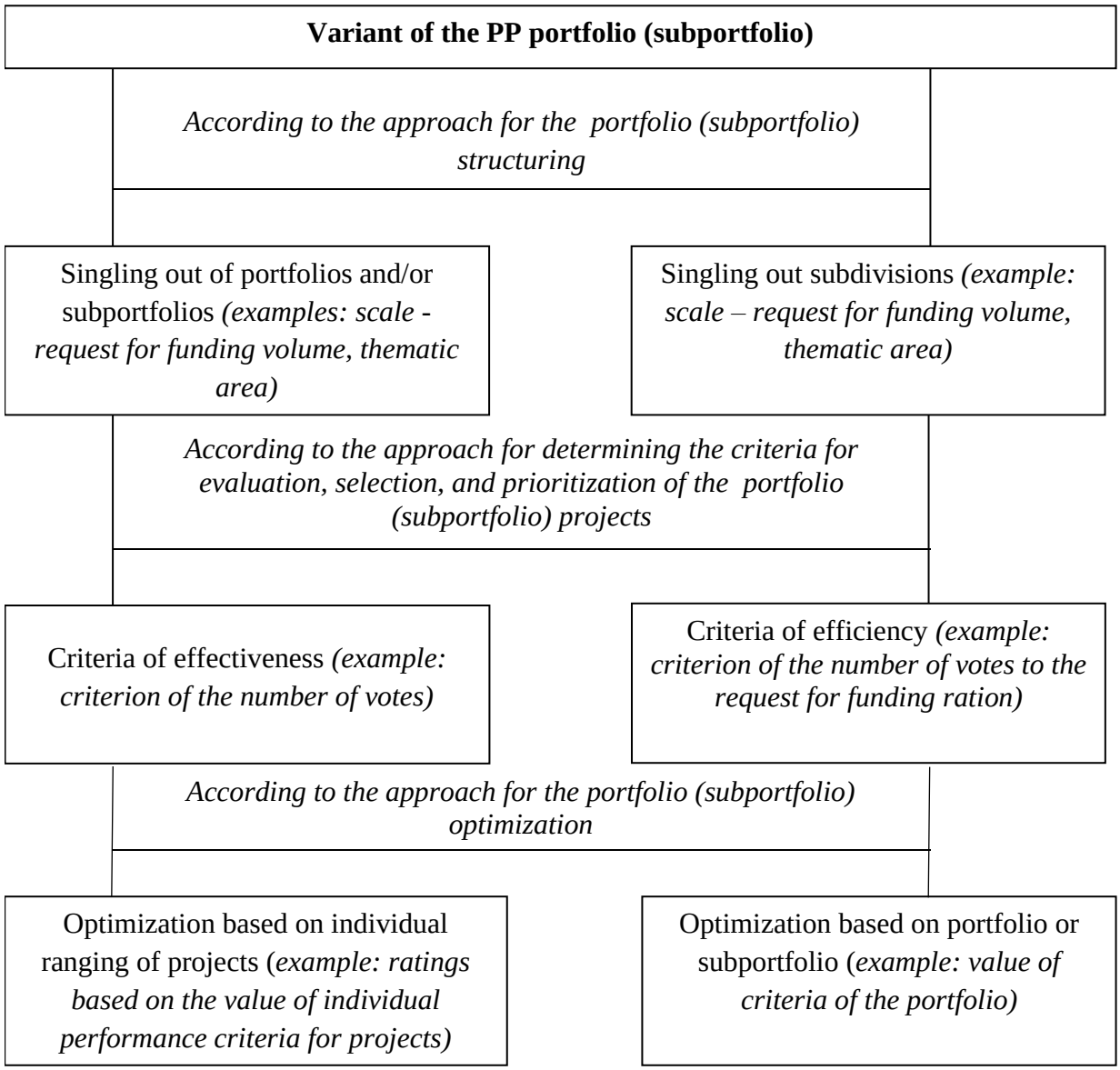

Fig .1. The concept for aligning of the PP projects portfolio

The analysis of existing practices regarding to the aligning processes of a set of the PP projects for implementation, which is considered in this paper as a portfolio, gives us grounds to distinguish at least two different approaches for structuring this portfolio. The first approach does not provide for a separate preliminary allocation (fixation) of budget regarding any component of the PP portfolio. Projects that differ in the parameters that these projects characterize, for example, by thematic focus, request for funding volume, etc., receive their rating within the general list, according to which they can later be prioritized within the thematic list, and a joint budget is allocated to them. Accordingly, following the interpretation of the portfolio or subportfolio provided in the review, we can only deal with the subdivisions of the portfolio, which are singled out in most cases only for ease of management. We can provide as example public projects in Kyiv, according to

which it is proposed to single out the following ten thematic areas for implementation in 2022: roads, transport; ecology; housing (utilities, energy efficiency); health; information technology (IT); culture, tourism; youth, sports; education, civil society; social security, inclusion; interthematic, innovation. In particular, for each project, the city working group on public budget, if the localization of the project is citywide, or district working group on public budget, in the case of district localization of the project, appoints a person responsible for project appraisal. There are other aspects of PP projects management in Kyiv, the conditions for which depend on the thematic direction of the PP project [9]. At the same time, allocation of separate budgets for each thematic area is currently not provided for.

According to the second cited-above approach for structuring the PP projects portfolio, in contrast to the first, a separate rating and budgeting of projects that differ significantly in the values of certain defined and selected for categorization parameters are provided. If we deal with public projects in Kyiv for 2022, two categories are singled out: small and large projects, as it was in previous years. The group of small PP projects accepted for implementation in Kyiv in 2022 includes projects with a budget (expenditure) of 100 000 to 999 900 hryvnias, and the group of large projects includes those with a budget of 1 000 000 to 3 000 000 hryvnias [9].

Thus, now, in the «language» of portfolio-oriented management, we can interpret the set of PP projects in Kyiv for 2022 as a portfolio, which includes two categories: the category of small and the category of large projects as its subportfolios. As it was mentioned above, we can deal with the subdivisions of the PP project portfolio or subportfolio, for example, in the case of Kyiv, in accordance with thematic areas.

As criteria for evaluation, selection, and prioritization of projects for implementation mostly two criteria are used as alternatives. These are the criterion «number of votes» received by the PP project for support (hereinafter – the criterion of the number of votes) and the criterion of the ratio of the number of votes received by the project for support to the request for funding volume for the PP project (hereinafter-the criterion of the ratio of the number of votes to the request for funding). Carrying out a comparative and contrast analysis of the two outlined approaches for determing the criteria for evaluation, selection, and prioritization of the PP projects portfolio, we can point out that an advantage of the first approach is that, first of all, it «equalizes» in the community's vision all projects in their quest to be implemented at the expense of the PP budget (the term «public budget» is used as a synonymic term). This, to the greatest extent, corresponds to the essence of the development of the «movement» of PP projects as such. At the same time,

this apparent «equality» can end up being a myth. This is partly because initiatives that match specific criteria are occasionally, a priori, comparatively more likely to receive more votes. Nevertheless, they may not necessarily have higher social or financial performance when viewed objectively. For example, this is observed for relatively significantly larger projects than others in the relevant list, which is reflected in the request for funding. If we stick with the previous example, large projects tend to «lose» when a different criterion for evaluation, selection, and prioritization of projects for implementation is chosen – the ratio of the number of votes to the request for funding. It is important to keep in mind that by selecting this criterion, which enables us to consider efficiency, we have, in some ways, violated in the eyes of citizens who participate in these projects the concept of «equality», in one way or another – which is based on the number of votes received – real or imagined – by PP project.

When we are going to optimize the PP projects portfolio (subportfolio) we have at least two ways for formulating of tasks for the optimization. We are to decide whether the optimization will be applied exclusively based on individual ranking, gained by project according to chosen criteria as a result of voting, or wheather the optimization will concern portfolio (subportfolio) as a whole, Figure 1.

Structuring of the pp projects portfolio

Research questions

Within the given research, we have carried out an investigation, the main questions of which sounded the following way.

Q 1: Do the requests for funding volume of public projects submitted in 2019 and those waiting for implementation in 2020 in Kyiv differ significantly in regards to singled out thematic areas in the singled out categories (subportfolio) of small projects?

Q 2: Do the requests for funding volume of public projects submitted in 2019 and those waiting for implementation in 2020 in Kyiv differ significantly in regards to singled out thematic areas in the singled out categories (subportfolio) of large projects?

In order to test the null hypotheses about the significance of the difference between the PP projects that were submitted in the categories of small and large projects as defined by request for funding volume, those questions were addressed in the study. We analyzed, accordingly, a database of projects that were the subject of voting in 2019 [10].

It is important to note that the «threshold» that distinguished between small and large categories of projects during this time was lower, at 399 900 hryvnias. At the same time, the lower limit was not actually set, while the upper limit for the category of large projects corresponded to the existing one – 3 000 000 hryvnias. The singled out thematic areas were also somewhat different: security; roads, transport; culture, tourism; ecology; education; health care; social security; sport; IT (information technology); civil society; utilities, energy saving; public space; other.

Our research aimed to show whether a signification difference in the requests for funding volume for projects in various thematic areas within one category existed, and thus, we could assume, it was area specific. It could in its turn indicate "inequality" during their ranking together on the basis of the ratio of the number of votes to the request for funding. This criterion is used in the case of Kyiv. Projects in spheres (thematic areas) with fewer requests for funding volume within a relevant category as subportfolio (small or large) will gain higher ratings in comparison with others, with a slight difference in the votes and, maybe, not in favour. Thus, these spheres (thematic areas) will gain hidden preferences in the form of an increased number of projects accepted for implementation in comparison with other spheres (thematic areas).

Research methodology

To test our hypotheses, we applied a nonparametric criterion, the Kruskal–Wallis test of significance, which is a multidimensional generalization of the Wilcoxon–Mann–Whitney criterion. Since this criterion is rank-based, any monotonic modifications of measurement scales have no effect on it. In accordance with alternative hypotheses, the difference between PP projects, which were submitted under small and large project categories as subportfolios, regarding the request for funding volume is insignificant. After carrying out the calculation by applying the program product IBM SPSS Statistics 22, we rejected each of the alternative hypothesis with a level of significance of 0.05. It means that the difference between PP projects, which were submitted under small and large project categories as subportfolios in the relevant thematic areas, regarding the request for funding volume is significant.

Therefore, it is fair to rank the projects within their thematic areas with budgeting of these areas as singled out categories or to evaluate projects based on the number of votes, where the request for funding volume has no bearing on how they are rated. I.e., in the first case, we deal with a portfolio (subportfolio).

It is obvious that if we introduce ranking by another for a certain thematic area criterion within one common budget, it must be applicable for all units of the single portfolio. As a result, it may have a negative impact on rating results for projects of other portfolio segments, which are singled out in accordance with their spheres (thematic areas).

Our considerations bring us to a logical assumption of the necessity to single out within the public budget portfolio of Kyiv inside of with the existing categories (subportfolios) – small and large – categories (subportfolios) of thematic areas. The latter, as we mentioned beforehand, now may only be considered as subdivisions created for the ease of management.

Model for optimization of the PP projects portfolio

The issue of optimization of a portfolio or subportfolio which corresponds to the existing singled out categories of projects as portfolios (subportfolio) is of special interest during portfolio aligning of PP projects. This issue could be considered through a few aspects. Firstly, it is a possibility to consider the conditions of dependence between separate projects. Within the singled out categories as portfolios (subportfolio), as well as within the subdivisions of these categories, PP projects may be presented as independent or dependent. On the basis of addition or replacement, the latter can therefore be depicted as dependent. In the meantime, by creating new, integrated, components that comprise dependent projects, the conditions of the components' reliance in accordance with these principles can be taken into consideration. When we examine, for instance, the PP projects that were completed in Kyiv in 2019 (planning) and 2020 (implementation) under the category of small projects in the «Education» thematic area, we can see that there were numerous requests for funding in the same amount for projects that were similar but for different schools, and that were intended to install audio and multimedia equipment. These projects can be considered together, for instance, as a program, which are addition in cost. We can expect a positive synergy effect due to the possibility of centralized procurement, with subsequent installation and maintenance appropriate to these equipment projects [10]. The same considerations can be applied when we observe projects for kindergartens «Music and Dances», which were completed in the category of small projects in the thematic area «Culture» in 2019 (planning) and 2020 (implementation) [10].

We could also provide some examples of mutually exclusive projects. For instance, in the thematic area «Education» or «Sport». Some requests for funding equipment for playgrounds and sports grounds, which are located so close to each

other, based on «target audience» as a number of residents who will potentially use these sites, can be considered mutually exclusive. The provided conditions of dependence can be partially taken into account during the preliminary examination and, finally, taken into consideration after the rating vote and the optimization process. It is also appropriate to consider the conditions of dependence in the optimization process, based on the definition on the optimization process [3–6], according to the selected categories as portfolios or subportfolios.

The second sensible aspect to consider when dealing with the optimization of the PP portfolio (subportfolio), in our opinion, is the selection of the formulation of tasks for the optimization. First of all, we are to decide whether the optimization will be applied exclusively based on individual ranking, gained by projects according to chosen criteria as a result of voting, or whether the optimization will concern a portfolio (subportfolio) as a whole.

We constantly face an obvious dilemma while forming a list of PP projects for implementation. On the one hand, it is an individual ranking that a project gets based on set criteria, and on the other hand, we deal with the conditions for efficience use of taxpayers' money within allocated budgets. And as we noticed earlier, there might be certain contradictions. By the way, it is worth noticing that the practice of using individual rankings in many cases, including those in accordance with normative acts regulating the public budget in Kyiv, indicates that these ratings are of a pure recommendation nature.

If we deal with the formulation of task for the PP projects portfolio optimization in a category as a portfolio (subportfolio) as a whole, we can apply an integer linear programming method to solve the problem of the portfolio content optimization. The objective function is built on the number of votes given to support separate projects, and it requires maximization. The budget allocated for a certain project category, which under these conditions is considered as a portfolio (subportfolio), serves as a constraint.

According to the above-mentioned statement, we can write:

$$\sum_{i=1}^{I} V_i x_i \to \max, \tag{1}$$

with the constraints:

$$\sum_{i=1}^{I} C_{c_i} x_i \le C_{c_p}, \tag{2}$$

$$x_i = 0,1 \quad i = \overline{1,I}, \tag{3}$$

where V_i – number of votes, given to support the i-th PP project, $i = \overline{1,I}$;

C_{c_i} – capital expenses for the i-th PP project, $i = \overline{1,I}$;

C_{c_p} – maximum value of the capital expenses that can be allocated for the financing of PP projects within the given category as a portfolio (subportfolio);

I – total number of PP projects in the given category as a portfolio (subportfolio).

The constraints mentioned by this model for a PP projects portfolio optimization, expressions (1)–(3), in accordance with accepted practice, do not always take into account the operating expenses, which are linked with operation of PP projects in future. These expenses can be accounted for in different ways. In particular, these expenses may be defined as a total sum for a certain period of project operation, for example, 5 years, and can be taken for as a constraint at the preliminary selection stage. It is also possible to include these expenses – as discounted operating expenses – as a constraint for objective function (1) in the following form:

$$\sum_{i=1}^{I}\sum_{t_e=1}^{T_e}\frac{C_{o_i t_e}}{\prod_{j=1}^{t_e}\left(1+k_{ij}\right)}x_i \le c_{o_p}, \tag{4}$$

where $C_{o_i t_e}$ – the operating expenses for the i-th PP project in the time period t_e, $t_e = \overline{1,T_e}$, $i = \overline{1,I}$;

k_{ij} – cost of capital for the i-th PP project in the time period j, $j = \overline{1,t_e}$, $t_e = \overline{1,T_e}$, $i = \overline{1,I}$;

c_{o_p} – maximum value of the operating expenses that can occur within the given category as a portfolio (subportfolio);

T_e – economic life cycle, that is accepted by PP projects.

The objective function can be supplemented with a constraint on the operating expenses in the form of:

$$\sum_{i=1}^{I} C_{o_i t_e} x_i \le C_{o_{t_e} p},\ t_e = \overline{1,T_e}, \tag{5}$$

where $C_{o_{t_e} p}$ – maximum value of the operating expenses that can be allocated for the given as a category portfolio (subportfolio) in the time period t_e, $t_e = \overline{1,T_e}$.

When, developing the PP projects portfolio optimization model, taking into account the concept of the time value of money by using discount procedure, poses the question of the degree of risk. Project risk refer to risks relating to particular

projects included in the portfolio. Structural risk refers to risks relating to the processes used to construct the portfolio and potential conflicts between its components. Global risks refer to risks that are bigger than the sum of risks for individual components [3–6]. As a rule, we take into account the risks of separate projects in their budgets by possibility of increasing the latter by up to 20%. Meanwhile, considering the existence of structural risks and partially global risks in the totality of projects in a certain thematic area will be allowed us, if we shell present components of a certain thematic area as a portfolio (subportfolio).

In this research, we examine, as an example, the requests for funding, which were submitted in the small project category as a portfolio (subportfolio) within the thematic area «Culture» in 2019 [10]. The projects were implemented in 2020. To define the optimal content of the project set of this thematic area as a portfolio (subportfolio), we applied the integer linear programming method, using the add-in program Solver in Microsoft Office Excel 2010. We took into consideration the following indicators for each project: the number of received votes in favour, the request for funding volume, criterion value for evaluation, and ranking. 50 requests in total were selected for competitive selection. 28 projects received the status «implemented» under the conditions of applying the current, based on individual ranking of projects, approach to selecting projects for implementation, the total number of votes in support of these projects amounted to 10 659 votes. The total budget was 3 985 659 hryvnias. In accordance with the proposed, based on portfolio (subportfolio) optimization as on whole, approach to optimization, 27 projects received the status «implemented» (26 of which had this status before). We recommended changing the status of 2 projects to «participated» and, vice versa, we recommended adding one project to the list of projects that could be implemented. The total number of votes in support of these projects amounted to 10 713 votes. The total budget was 3 985 959 hryvnias. Under the condition of using the current approach to the optimization, the number of votes assigned to 1 000 hryvnias of funding for this project set was 2,67, and in accordance to the offered one, 2,69. At the same time, we considered the restriction for funding the projects in this area as a budget, based on the funding volume allocated for implementation of accepted projects, which amounted to 4 000 000 hryvnias.

We need to set a separate budget for the category in order to single out the PP project category and refer to it as a portfolio in the future. For instance, in accordance with the parameters of the public budget of Kyiv for 2022, it is foreseen that 40% of it will be used to implement small projects and 60% to implement large projects. If we introduce separate budgets for thematic areas, we can hypothetically

use different variants to allocate budgets for small and large projects for this area. For example, this distribution can be used in proportion to the number of submitted requests or to the number of votes already received based on the results of voting by thematic areas. Other variants are also possible.

If we consider a project as a mean of realization and, under certain conditions, a way to form a strategy for a territorial community, we can apply the level of a weighting coefficient as one which stimulates the development of certain thematic areas. At the same time, it can be either «strengthening» the recognition of strategic areas of development that are important for the territorial community, or strengthening strategic areas that «don't get» funds due to the deficit in the «normal» budget, or searching for new promising areas of strategic development. The latter scenario gives PP projects an experimental feel. We need to deal separately with the issue of the hierarchical structure of PP projects portfolio: categories of small and large projects must be divided into thematic areas, or vice versa, thematic areas must be divided into small and large categories. However, this issue is beyond the scope of this research.

Hypothetically, there may be complaints about the «non-transparency» of PP project selection if we use the portfolio optimization approach. First of all, due to the fact that the portfolio optimization process is not as clear as the rating. Although we would like to note that the rating as it is mentioned in various normative rulings of territorial communities has the character of a recommendation rather than a final decision. At the same time, the correspondent program software used in the proposed approach is an open-source product, which is adopted for maximum ease of use for anyone who is eager to check whether this optimization is carried out properly. Such services are offered worldwide, and in particular in Ukraine for various areas of social life and in the context of solving a wide range of issues.

Conclusion

We have elaborated the concept for aligning of the PP projects portfolio, which is based on research of methodological approaches considered in the relationship to: structuring of categories; definition of criteria for evaluation, selection, and prioritization; and optimization of the PP projects sets as portfolios (subportfolios). We have formulated and verified, using the database for the public projects in Kyiv, hypotheses regarding the significance of differences in the requests for funding volume in the sets of the PP projects singled out by thematic areas in the small and large categories. It has been determined, using the Kruskal–Wallis significance test, that these differences are significant. So, we can see the necessity to present projects

of thematic areas as part of the corresponding the subportfolios (subportfolio of large projects or subportfolio of small projects) of the general portfolio of PP projects. The model, based on integer linear programming method, for the aligning of the optimal composition of the PP projects portfolio, which is recommended for implementation, is suggested. Under the present circumstances individual territorial communities of Ukraine could introduce in their thematic areas for public projects such area as protection civilians from affecting of the fighting.

The results can be used for improvement and further development of the methodological support for the aligning processes of the portfolios under the circumstances of the execution of the PP projects, which are regarded as components of the respective portfolios.

References

1. Vorkut T. A., Halak I. I., Petunin A. V., Kharuta V. S. (2020), Management of portfolios of implementation of logistics strategies in networks of supply chain organizations [«Upravlinnia portfeliamy realizatsii lohistychnykh stratehii v merezhakh orhanizatsii lantsiuhiv postachan»]. Monohrafiia. Kyiv: Milenium, 195 p.
2. Vorkut T. A., Bilonoh O. Y., Dmytrychenko A. M., Petunin A. V., Sribna N. V., Tretynychenko Yu. O. (2021), «*Portfolio-oriented management in organizational networks»* [«Portfelno-oriientovane upravlinnia v orhanizatsiinykh merezhakh»]. Monohrafiia. Milenium. Kyiv. 226 p.
3. Project Management Institute. Standard for Portfolio Management (2006), First Edition, Project Management Institute Inc. 79 p.
4. Project Management Institute. Standard for Portfolio Management (2008), Second Edition, Project Management Institute Inc. 146 p.
5. Project Management Institute. Standard for Portfolio Management (2013), Third Edition, Project Management Institute Inc. 121 p.
6. Project Management Institute. Standard for Portfolio Management (2017), Fourth Edition, Project Management Institute Inc. 140 p.
7. Yllaryonov A. V., Klymenko E. Yu. (2013), «*Project portfolio: an instrument of strategic enterprise management*» [«Portfel proektov: ynstrument stratehycheskoho upravlenyia predpryiatyem»]. Alpyna Pablysher. Moscow. 312 p.
8. Voropaev V. Y., Sekletova H. Y. (1999), «System representation of project management» [«Systemnoe predstavlenye upravlenyia proektamy»]. *«Project Management: East-West – Millennium Edge»: Proceedings of the International Symposium.* 1–4 December. SOVNET. T. 1. Moscow. P. 71–77.
9. The Kyiv City Council Decision On Approval of the Regulations on the Public Budget of the City of Kyiv. December 22, 2016. with changes and amendments. available at: https://kmr.gov.ua/uk/provisions-public-budget
10. Kyiv's Public Budget. Data on projects within the year 2020. available at: https://wiki-projects.kyivcity.gov.ua/pages/viewpage.action?pageId=28180652#tab-2020