Forecasting Outcomes Achieved in Cultural and Creative Projects: System Dynamics Approach

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Abstract: The article provides project managers with a new approach to project planning with regard to monitoring the actual progress of the project implementation. The method introduced in the article is based on system dynamics modelling and project management principles outlined in the internationally recognised PRINCE2 methodology. It also makes use of the principle set in the EVM method, which is a part of the standard of the PMI. The System dynamics model of a plan and of the real-life situation have the same structure but differ in the values of exogenous variables. The method enables better information for the project manager and their team on the expected project outcomes. The project model is divided into stages and the actual outcomes of the project are compared against the plan at the end of each stage, indicating the current trend for further development of the project. This approach provides the project manager with a strong argument for introducing timely managerial interventions in the project team. The method resembles checking the route by a traveller with the use of GPS navigation, which is why we named it GPS-PM. The method is used in real-life projects that are part of university courses in project management.

Keywords: forecasting, project management, team, manager, project assurance, Earned Value Management method, PRINCE2, model, cultural projects, team behaviour

Introduction

Cultural sphere and creative industries often generate projects that require creative atmosphere in the team rather than a qualified managerial approach. Managers of cultural projects find a creative project environment more important than detailed planning of project activities. They have little interest in consistent ongoing checking of the project outcomes, as production is quite on the edge of their interest. Project team members in the creative sphere are often volunteers, which partly determines the specific features of these type of projects. The work of volunteers is not free of charge, but it is not rewarded as is common in other industries. Nevertheless, not even in the cultural and creative environment can we resign on the efforts that should be invested into project planning and management, since uncontrolled projects do not pay off in any organization in the long-term. Yet, we cannot rely on traditional project management either. Managers' requirement for a detailed plan of a cultural event provided a couple of months ahead of time is feasible, but when the plan is implemented later on, new circumstances arise that were not included in the plan. In the cultural environment we have to rely on the project dynamics already in the course of planning by creative teams. A project manager in the cultural sphere needs to find ways of project management that support creativity, not supress it. Similar conflict within the need for project management methods in the environment characterized by constant changes is discussed by Manfred Saynisch (Saynisch, 2010) in his article Beyond Frontiers of Traditional Project Management. Saynisch came to the conclusion that in projects we inevitably face dynamic situations and states of instability, and we face the need for progress to a higher level by an evolutionary leap (evolution of the 2^{nd} degree; PM-2). Saynisch encourages further research into this new situation and calls on universities to participate in a research programme describing PM-2. This article deals with forecasting the outcomes of cultural and creative projects carried out with the use of system dynamics modelling within real-life projects implemented at universities, and as such is a specific, independent contribution to the research (Saynisch, 2010).

1. Theoretical background to the GPS-PM method

The name of the new method for monitoring the actual development of a project with emphasis on forecasting the outcomes achieved in the project was inspired by the principle of the Global Positioning System Navigation tool. This tool is better known under the acronym GPS navigation, which is why we shall use the abbreviation for the method's name, i.e. GPS-PM (GPS-Project Management). The method resembles the process of adjusting the route by a traveller with the use of GPS navigation: it puts emphasis on the managers' proactive approach in managing the project. The method is applicable in organizing cultural and other events where the team members' creativity needs to be supported (and not supressed). The new method is also suitable for planning and monitoring projects with scientific creative potential. The method meets the needs of a cultural manager, who is often under pressure to make additional adjustments to the plan. The plan is prepared for changes and continuous adjustment so that it better reflects the increasing level of the team's responses to the requirements submitted by the parties participating in the project.

The starting point for the development of the system dynamics tool for designing a plan and monitoring of the actual project development is the Earned Value Management method (hereinafter referred to as "EVM", A Guide, 2000). Another foundation for the GPS-PM method is the international process-oriented methodology PRINCE2 (Projects in Controlled Environments, PRINCE2, 2009), with a process approach to project management based on the principle of dividing a project into manageable, controllable and monitored stages. The internationally recognised PRINCE2 methodology gives the GPS-PM method certainty as to what variables to select for modelling, and provides guidelines for the preparation procedure and creation of project documentation for the subsequent simulation, including forecasting the future development of the project.

Furthermore, the GPS-PM method is based on system thinking and system dynamics modelling (Forrester, 2009, Sterman, 1992, De Marco, 2006). The project plan is converted into a computer model, which simulates first the planned, then the actual, and finally the predictable behaviour of a cultural project. The GPS-PM method is designed with the use of software for dynamic simulation Vensim. For graphic depiction of the simulation outcomes, the programme Sable was used. Thus, thanks to its specific software support, the method is designed rather for work with the person who is assigned to supervise the project (Project

Assurance). The GPS-PM method provides information on expected project development and on the outcomes to be achieved in the final stage of the project.

The purpose of project management is to ensure efficient and effective implementation of a process leading to the intended change, which shall bring the anticipated benefit. The basic objective of project management is the design and implementation of a successful project (Lacko, 2000), i.e. achieving the target in the planned period of time, with defined costs and available resources. A properly managed project always includes a model of itself (Weinberger, 2002). This model is determined by the project plan. Simply put, the model is determined in advance by various factors, such as, what outcomes, i.e. tangible or intangible specialist products, should be created by the project, who is responsible for their creation, when is their deadline for delivery, what quality they should be, what risks they contain and other parameters of the project plan.

The benefit of approaching the project planning as a model lies in the possibility to simulate the expected behaviour of the project in condensed time. Computer modelling which was employed to monitor and forecast the project development has also certain disadvantages that we had to cope with. The model is not supposed to be the goal in itself; the aim of designing the model is to solve the questions set in advance. However, each project is specific and it is impossible to determine in advance what problem will have to be solved in the course of the project. We can set the problem to be solved only in general terms; for example, it can be expected that each project has to tackle lack of time and limited resources, and that there can appear problems regarding the required quality of the outcome (Tripple Constraint, Ojha, 2011). The model certainly cannot pretend to be the real thing; it only reflects the reality with its many limitations. The actual project will probably behave in a different way than we expect. All the same, it holds true for system dynamics modelling that the model should be as simple as possible. That does not imply we can omit its important elements and their mutual relations, i.e. significant factors influencing the project development. However, the biggest problem of the scientific method of system dynamics modelling is obtaining relevant data that can be easily quantified. How can this limitation be overcome? What data can we insert into the model to make them verifiable and valid? Therefore, we focused our effort also in this direction and looked for possible solutions.

Fuzzy logic is useful for quantifying variables. As Tsabadze (2013) points out, managers often think in terms of indefinite categories and not simply in terms of yes-no decision making. Fuzzy logic can thus be used in a model for instance to quantify the difficulty of the planned outcomes and to determine the behaviour of the project team members. With the use of a scale, the increasing and decreasing difficulty of work on the project can be expressed, as well as other conditions for further development of the project. Points on the scale are then the sought-after numerical expression of the entry variables in the model. In the GPS-PM method we focused on estimation of the difficulty of the project outputs. However, we did not do that within the context of difficulty adopted by traditional project management: simply as measuring the duration of activities leading to the creation of outcomes. The change of paradigm lies in the attempt to estimate and then quantify how difficult the creation of the output will be. In the GPS-PM method we do not estimate primarily how much time and resources we are going to need; we are not trying to enumerate the value of resources in man-days and consequently in money value. That is an approach typical for the EVM method. The basis for the entry data is drawing up the Product Breakdown Structure (hereinafter referred to as “PBS”, following the PRINCE2 methodology), determining the difficulty of individual outputs with the use of a common unit (points), arranging their production in a sequence, incorporating the completion of outputs into project stages, and setting the final deadline for completing all monitored outputs.

2. Procedure for implementing the GPS-PM method

In order to use the GPS-PM method in a project, we recommend adhering to the procedure whose initial steps are in agreement with the PRINCE2 methodology (PRINCE2, 2009), and at the same time respect the procedures setting the stages of dynamic model creation (Sterman, 1992). The GPS-PM method requires preparation of some fundamental project documentation in order to be used, and these have direct impact on the model design.

Primarily we use the following project documentation for setting the entry parameters for the cultural project model:

1. Product Breakdown Structure (PBS),
2. Project Product Descriptions, especially the data on purchases necessary for achieving the output, the deadline for completing the output, responsible person, budget.

After the project documentation is drawn up, a plan is designed as a project model with the use of the recommended procedures (Sterman 1992, Šviráková, 2011, p. 48):

3. Compiling a complex database for recording difficulties with outputs, deadlines and basic budget, measuring the team productivity,
4. System thinking, formulation of dynamic hypotheses, which map the feedback relations between the model elements, preparation of the mental model,
5. Establishing the simulation system dynamics model, incorporating the entry parameters into the model,
6. Simulation of the project progress, starting the plan operation and continuous assessment of the data on the actual progress of project works,
7. Proposal and evaluation of policies leading to the correction of the problem that arose in the project.

2.1 PBS and estimation of output difficulty (step 1, step 2)

The traditional project management (Saynisch, 2009) uses EVM method and other project management tools with the premise that we need to allow longer periods of time or allocate more workforce for more complicated activities. The EVM method uses man-days converted into money value as a measurable parameter. For our method, the measurable parameter will be the difficulty of the planned outputs of the project (not of its activities), which we also have to establish by guesswork. We looked for a suitable approach to estimating the difficulty which would be simple and understandable for the project team. The following table (Table 1) presents a 60-point scale and a selection of nine possible states, and combines the variability of the procedure for achieving a quality output and effort on the part of a team member.

Table 1. Proposal of criteria for allocating points to the key outputs – work packets

variability of procedure / team effort	low variability of procedure	medium variability of procedure	high variability of procedure
low effort	max. 10	20	30
medium effort	20	30	40
high effort	30	50	60

The Table shows the limit amount of points for evaluating the difficulty of outputs. Every output defined by the project team is evaluated (given points) in the same way, while each output can be divided into more parts for detailed planning of the next stage of the project. There follows the description of the stages of the scale, based on Ojha (2011).

1-10: Trivial. The outcome of work is trivial if the approach and proposal is easy to understand, and no further research or complicated process in needed for its completion. The team expects that no big effort will be needed for its achievement.

11-20: Very simple. In order to achieve a very simple outcome of work, maximum of two different approaches must be evaluated. Nevertheless, its achieving will not require big effort.

21-30: Complicated. This outcome might involve a sequence of certain research works related to the given outcome. It will require either evaluating several different approaches or a big effort by the team.

31-40: Very complicated. For this outcome, evaluation of several various approaches and a big effort on the part of the team will be necessary. In order to accomplish it, external resources will have to be used that are achievable only with big effort.

41-50: Difficult. This outcome will probably include hidden or unexpected difficulties. Its achievement is subject to extensive further work that is prerequisite.

51-60: Very difficult. A very difficult outcome is the most demanding result of work. It can be achieved efficiently only through the means of iteration. Experienced members of the team should work on it, or it can be outsourced to a specialized workplace.

Within the process of simulating the future development of the project, it is not necessary to spend several preceding months working on detailed and final assembly of all outcomes. We should rather focus on preparing such an outcome structure (PBS) that fulfils its purpose – the purpose which makes it the key technique for drawing up a project plan. PBS must capture the complexity of the project objective which will be achieved if we deliver all outputs at the end of the project. There might be as many key outputs as the project team needs in order to understand and grasp the project scope and to achieve its objective. The GPS-PM method in this aspect limits the team only to the planned setting of the final number of points that the project team needs to gain. The number of points that were set for the project plan (model) should not be increased by the team in the course of the project. However, it can be divided into multiple, more detailed outputs. This process of further explication helps the project team to better realize and prepare for the overall difficulty of achieving the project objective.

2.2 Compiling a database and measuring the team productivity (step 3)

When compiling the database for the GPS-PM method, we proceeded from EVM and used some parameters according to the Project Management Institute standard (A Guide, 2000). We adapted the method in order to use the elements that are well applicable on the projects in cultural sphere. For measuring the values in the model we used the following key parameters:

- Planned Value (PV – the value of points in the plan for output production), which we used to draw up the complete project model so as to know in advance in every stage how many points are planned for it and need to be achieved;
- Earned Value (EV), shows the number of completed outputs according to the project team members' reports, converted into points;
- Actual Costs (AC), are costs reimbursed for the project converted into points in agreement with the Planned Value concept and with the use of the BAC parameter;
- Budget at Completion (BAC – the total budget), a key parameter for determining the point values of separate budget costs;
- Estimate at Completion (EAC – estimation of costs at the moment when the project is completed), uses the simulation to predict the total amount of points to be achieved at the end of the project. Estimation of the expected points to be achieved at the end of the project refers to the budget, outputs (i.e. scope) and also time needed to complete all outputs.

As mentioned above, the EVM method is in the PMI standard (A Guide, 2000) used to evaluate activities within the time schedule of the project. The modification of this EVM method used in the GPS-PM method lies in assessing the achieved value of the project outputs (not activities), while the outputs of the project represent completed, submitted, and high-quality work as a partial outcome of the project efforts. According to PRINCE2 there are six aspects of project implementation that have to be always controlled (Pic 1). With the use of the GPS-PM method in this article we control three of these aspects: Time, Scope, and Cost. The remaining three aspects can be controlled in a similar way and forecasted through simulation. Issues concerning incorporating these aspects (Benefits, Risk, and Quality) into the model will be subject to further research, which should lead to intended improvement of the GPS-PM method.

Pic 1. Project Performance Aspects according to PRINCE2

The Manage by Stages Principle included in the PRINCE2 methodology suggests that only a rough project plan should be prepared in advance. This draft should be particularised at the end of each stage and the further stage of the plan will be prepared. This approach ensures that we will concentrate on those outputs that must be achieved earliest and will not lose sight of the total scope of the project.

For the purpose of designing the project model, we created a document that is to a certain extent an integration element for the previous key project documentation (PBS, Product Descriptions, Budget). We named the document "Database" and a sample is shown in Table 2. It must be noted that the table is not complete; for the purposes of creating a model of a real project and monitoring its development, a complete database is compiled, which contains 83 working packets, BAC parameter value is 2130 points and the entry budget was converted to the same value. The table below (Table 2) shows a part of this database; the complete database, which served as the entry for the model, is an MS Excel appendix to the article.

Table 2. Sample of the database for creating the entry parameters for the model

Team	Stage	Product No.	Total PV-points-1	Total EV-points	Total AC-€-plan	Total AC-points-plan	Total AC-€-reality	Total AC-points-reality
1-production	1	1.1.1	20	20		0		0
		1.1.2	20	20		0		0
		1.1.3	25	25		0		0
	2	1.2.1.2	20	20		0		0
		1.2.2.1	15	15	12000	56.73274		0
		1.3.1.1	20	6		0		0
		1.3.1.2	10	10		0		0
		1.3.2.1	20	20		0		0
		1.3.2.4	5	5	5000	23.63864		0
		1.3.3.1	10	10		0		0
		1.3.3.2	10	10		0		0
		1.4.1.2	20	20		0		0
		1.4.2.1	25	25	11000	52.00501		0
		1.4.2.4	5	5		0		0
		1.5	10	10		0		0
	3	1.2.1.2	10	10		0		0
		1.2.2.3	25	5		0		0
		1.2.3.1	10	8		0		0
		1.2.3.3	15	10		0		0
		1.2.3.4	25	15		0		0
		1.3.1.1	20	10		0		0
		1.3.1.2	5			0		0
		1.3.3.1	30	16		0		0

The success of project management depends mainly on the quality of the project team management. A project team with a better management will achieve better performance. However, people are not all the same in any field, especially not in cultural and creative spheres. Every team member has different talents, personality, knowledge and skills. Productivity of the team members' work can differ, yet it is always subject to other influences of the project environment. We must not ignore the fact that the team work productivity fluctuates also during the project implementation and depends on the quality of team management. A model that only works with an average productivity and does not include soft factors that influence productivity, will be easy to understand but only at the expense of significant factors that must not be missing in the model. While in case of numeric expression of the output difficulty we expect that we have selected the best possible solution, we are aware of the fact that there are more possibilities when quantifying the influence of the team members' behaviour on the speed and quality of the delivered outputs. We realize that there are many further research questions to be answered that will help to choose the best procedure and to make the process of modelling more accurate.

The process of establishing the further procedure for achieving entry data on soft variables (team behaviour) for the model is based on the experience from the recent three-year work with projects included in the project portfolio of the Communication Agency[1]. In the years 2011-2013 we had a chance to follow the development of 27 projects, various management styles, different production procedures and recurrent mistakes. How can we incorporate our findings into a model? We decided to create a simplified set of variables based on the observed behaviour patterns[2] within the Communication Agency, which appear in cultural projects, add these elements into a model, assign points to their actually achieved quality and evaluate their impact on achieving outputs.

In order to test the abilities of team members, we chose ten characteristics of project managers' and teams' behaviour that regularly recur in projects. The table below (Table 3) shows a list of these qualities alongside the proposed evaluation scale. After the project plan is drawn up and the actual results are evaluated and compared against the project plan for the first time, answers to selected questions are assessed. If the actual course of the project is in agreement with its planned progress, then the impact of these factors is low and does not cause changes in productivity. In case the actual development of the project (measured by the number of points achieved at the end of a stage) falls behind the plan, the project manager has to solve a problem with a delay in the project.

[1] The Communication Agency is a portfolio of projects carried out at the Faculty of Multimedia Communications of Tomas Bata University in Zlín, Czech Republic. These are real-life projects that have been implemented and comply with project characteristics.

[2] Description of behavioural patterns are adapted according to the findings of the research worker, the director of the Communication Agency, who had the possibility to manage and supervise students in roles of project managers in nine projects per year for the period of three years.

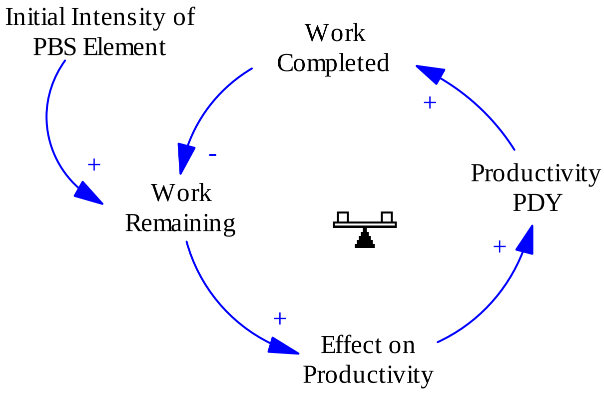
Table 3. Scale for project team assessment[3]

No.	the worst feature	points					the best feature
1	team manager’s authority: imposed / formal / none	1	2	3	4	5	team manager’s authority: natural
2	relations between the project manager and the team manager: close and friendly	1	2	3	4	5	relations between the project manager and the team manager: formal
3	personal involvement of the team manager in the project: the manager was left with the project	1	2	3	4	5	personal involvement of the team manager in the project: pilot project / the manager got it through into the portfolio
4	managerial style: directive / formal	1	2	3	4	5	managerial style: delegates – checks – evaluates fairly
5	communication within the team: mostly electronic communication – emails, Facebook, other form	1	2	3	4	5	communication within the team: mainly personal meetings of teams and pairs
6	length of communication response: often without response	1	2	3	4	5	length of communication response: within two hours
7	project documentation quality: documentation supplied late or orally	1	2	3	4	5	project documentation quality: documentation is prepared in time and is actively used
8	adhering to the time schedule: mostly does not respect deadlines	1	2	3	4	5	adhering to the time schedule: always meets deadlines
9	sponsoring management: what is written down (i.e. contract or order from the partner) that is only a technicality, does not have to be followed	1	2	3	4	5	sponsoring management: communicates constantly, keeps to all agreements
10	team members’ responsibilities: nobody knows what they are responsible for	1	2	3	4	5	team members’ responsibilities: responsibilities are delegated and observed

2.3 System thinking (step 4)

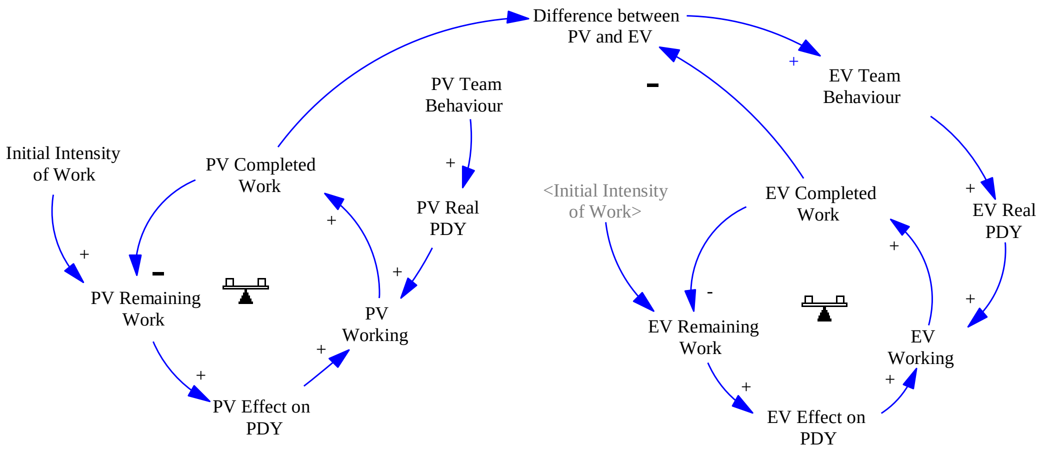
System thinking is the basic premise for creating a system dynamics model. The creation of the model is preceded by compiling feedback loop diagram for the project for organizing a cultural event, which can serve as a general basis for project modelling. The key feedback loop in the following picture (Pic 2) explains the core of the mental model with the use of the system thinking tools.

[3] *Project team according to the PRINCE2 methodology: Project Manager, Team Managers, Team Members. Various communication relations emerge within the team and these are assessed in the research with the view to their mutual links. The project manager evaluates team managers; team managers evaluate the project manager and their team members. Team members evaluate only their team manager.*



Pic 2. Basic feedback loop as the core of the complex loop diagram

First of all, the entry difficulty of the PBS element enters our train of thought. It influences the amount of the remaining work, i.e. the work stock, which has not been carried out yet. The amount of work remaining influences the work productivity (bigger amount of remaining work, higher productivity) and higher productivity leads to a bigger amount of work completed. A bigger amount of completed work causes lower stock of work not yet completed, which leads to a lower work productivity (PDY) and lower created value. The feedback loop is thus negative, self-adjusting, which is emphasised by the symbol of the balance state inside the loop. The plus and minus symbols next to the arrows show the tendency for growth or decrease for the following element in the model in comparison with the previous element. The following picture (Pic 3) shows a simplified feedback loop diagram for a project. Another variable enters the loop diagram, which was tested through research into qualitative parameters in project teams. Low values of the variable "team behaviour" will result in lower work productivity, or more precisely a lower amount of completed work. The difference between work planned as completed and work actually completed will influence the element "team behaviour". As a consequence of lower amount of points on entry for expressing behaviour and decision making in a team, there is for example, a requirement for higher work productivity in the team.

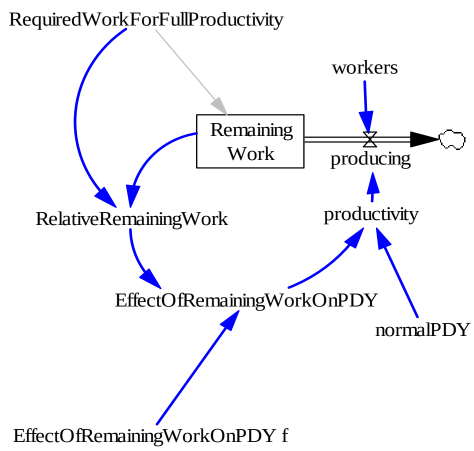


Pic 3. Proposal of a simplified causal loop diagram for the GPS-PM method

The causal loop diagrams are a significant communication tool, as they can convey the dynamics of the system and at the same time show causal relations as well as feedback loops including their polarity, which is important for the interpretation of the model. Therefore they are suitable for expressing mental models. Nevertheless, causal loop diagram alone is not an exact tool that would show us the current state of the project and forecast its development.

2.4 System dynamics project model (step 5)

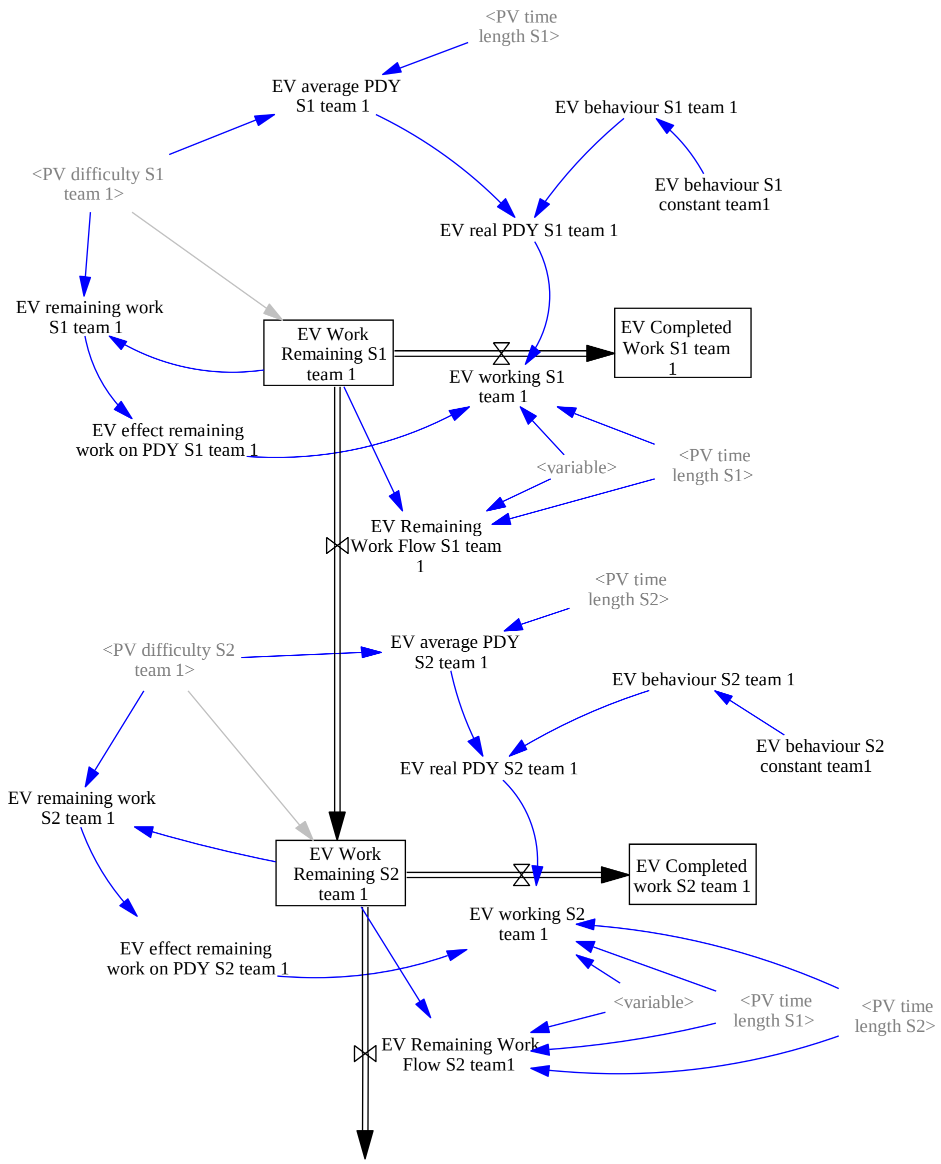
The software used for modelling was the Vensim programme by Ventana Systems, Inc. (Vensim, 2005). In order to make use of the GPS-PM method we used the tools according to Hinese – Structure molecules (Hines 2005). Our requirements for compiling a project model were met by a structure molecule: level of completed work protected by productivity. This structure molecule is designed to solve the problem of the level of remaining work which must not have negative value[4]. The basic scheme (Pic 4), which is based on the loop diagram (Pic 2) shows – with the use of levels and flows – how project team members gradually reduce the level of remaining planned work by working on the project. This task is solved by getting to understand the change in value of the variable "productivity" (PDY) which must reach the value zero when no tasks remain in the level. The level of tasks decreases through the influence of the production flow, while the production flow is influenced by productivity which also decreases at the same time as the stock of work remaining. In order to maintain high productivity of the team's work, we would have to simultaneously with the decreasing productivity create further supply of work that the team could work on, so that its productivity remains high. Searching for policies that result in high work productivity is, however, not the objective of our project model. The aim is to create such a model that enables comparing the plan against the actual situation, and provides a possibility to forecast to what extent the plan will be fulfilled at the end of the time period determined for the project. We used the structure molecule because of the setting of the level of work remaining.



Pic 4. Level protected by productivity – structure molecule (Hines)

[4] If the level of work remaining reaches negative values, the work flow, which is supposed to decrease its level, would, in contrast, increase it.

The following picture (Pic 5) shows a part of the final model. The complete model is large and its full version is not published in the article; it is an appendix to the article in the format of Vensim programme. Nevertheless, the picture adequately shows the recurring basic sequence of the model elements and their mutual relations. The picture (Pic 5) shows the three key elements characteristic for the whole model: the level of work that has to be completed (Work Remaining), the level of work that has been done (Completed Work) and the work flow (Working), which connects both levels.



Pic 5. Key part of the model: levels and flows within the project

The variable "Average PDY" is calculated on the basis of knowledge of two exogenous variables, namely duration of a stage and number of points that represent the planned project inputs. The complete system dynamics project model includes another key exogenous variable, "Team Behaviour" ("PV Behaviour" – Pic 5).

The calculated value of answers according to the set scale (Table 3) for specific elements is the input (external variable) into the project model and influences the speed of work, i.e. flow of “Working” between the levels of work remaining and completed.)

The value of “Team Behaviour” is in the plan model always set to the value of 5, which is the maximum. Each variable “Team Behaviour” is incorporated into the model of the actual development of the plan with such sensitivity so that the resulting behaviour of the model corresponds with the actually achieved points, which reflect the submitted outputs in the given stage of the project. That means that the questionnaire values are used in the model between the first and second stage, and possibly also between the second and third stage. The parameter “Team Behaviour” is thus the parameter showing the changes in team behaviour and in the team work intensity.

When drawing up the model of the plan we divide the whole project into stages. During each stage a certain number of planned outputs must be created or these outputs must be elaborated in more detail according to the activity schedule, which is prepared progressively by the project manager and team manager. This procedure is in agreement with the principles for managing projects in monitored environment according to the PRINCE2 methodology (“Manage by Stages” and “Focus on Product”). Each project output is placed in time so that the project team can clearly see at which stage the given output should be processed and when it should be completed (Table 3). If it is processed in more than one stage, then at the end of each stages we assess the progress in processing, which influences the forecast of the tendencies in project development. For the purposes of project development modelling we divide the work in the project according to teams that are responsible for delivering particular outputs. It is not an exceptional situation to have up to 60 students volunteering in one project. Therefore, project managers always have to react by disintegration of the organizational structure within the project into teams, as per the prevailing nature of work within the team (production, PR, promotion, sponsoring). The internal organizational structure of a project team within the model corresponds with the theme “Organization” according to the PRINCE2 methodology.

Modelling is primarily meant to serve as a proactive tool for a manager’s interventions within a project. Input data are entered into the model on the basis of an adequate information flow between the project manager, team managers and the person who ensures the project supervision. The person(s) responsible for supervising over the project, the Project Assurance (PA) member(s), are not entitled to make decisions, but provide methodical and process support for the team. Their work pervades all processes, and they monitor all events and give advice to the project board (PRINCE2, 2009). The PA team regularly communicates with the project manager, and discusses with them the amount and quality of the achieved outputs and also reasons why the work falls behind the plan, should that be the case. The information regarding the expected further development of the plan is an important element in the communication between the project manager and the coach. For the purposes of our model we set one step of simulation, i.e. the basic time period, as one week. The total duration of the project within which the objective must be achieved is 20-22 weeks. This period is the average length of time needed for planning and implementation of cultural projects in our university’s portfolio. The graphic representation of the plan and current state of the project implementation enables a quick and – in the given conditions – also exact assessment, which is based on comparing the planned points according to the project stages against their value actually obtained in the same amount of time. The key variable for the manager's interventions is "Working", i.e. the flow between two levels, which is a quantity measurable by the number of points for project outputs that the team members are supposed to complete (PV) or have already completed (EV) within one week. The average planned productivity of the team measured in points per week is set on the basis of the input conditions (number of points / number of weeks per stage). The actual work productivity differs from the entry (planned) productivity, because it is influenced by the behaviour of the manager and the project team ("Behaviour"). In the plan, the variable Behaviour is assigned with 5 points. The actual current state is monitored in regular intervals[5] at meetings between the Project Assurance team, the team manager and the team managers, and the future values of the actual progress of the project model are forecasted. In case the project falls behind the schedule, the project manager has to take corrective measures. They can deal with team managers and delegate tasks so as to increase the total team productivity in more completed or processed outputs (points) per week. At the end of a stage the person(s) serving as Project Assurance can recommend moving the responsibility for creating some of the planned outcomes to a different team, change of managers (of the project or teams) or even premature termination of the project in case the project manager does not achieve required outcomes.

3. Practical outcomes of modelling (step 6, step 7)

In order to verify the GPS-PM method we used the plan and development of the project Conference. The project is managed by a student team and we have monitored its modelling since the end of November 2013 when the 1st stage started. At the time when the modelling outcomes were prepared for this article, we assessed stage 3. During the planning process before starting stage 1, a plan was creating for submitting 83 outputs, distributed to teams as shown below (Table 4).

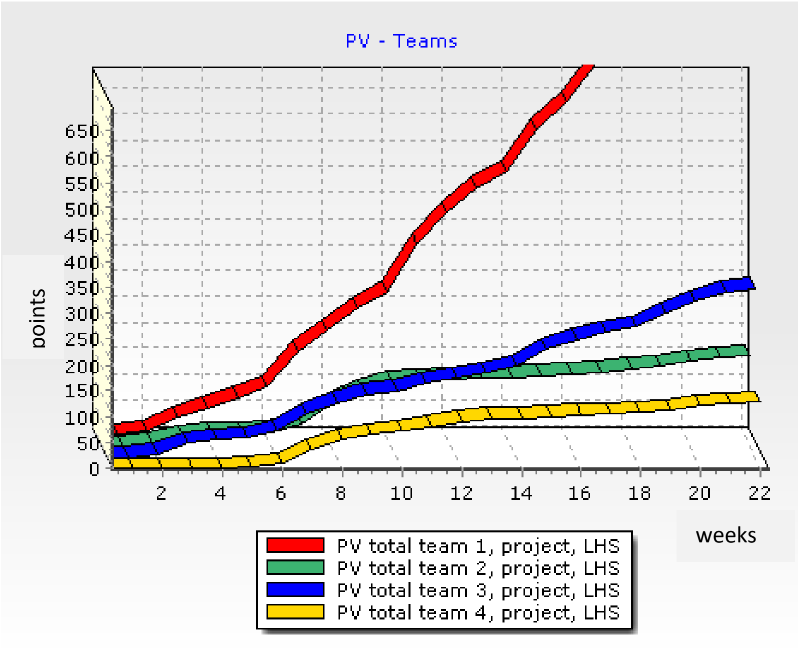
Table 4 Statistics: numbers of outputs, relevant activities and difficulty in points

Project Team	Number of Outputs - PV	Activities	Output Difficulty in Points	Team Behaviour-Test Results
1-Production Team	38	334	1501	4.17
2-Sponsorship Team	7	7	175	3.78
3-PR Team	20	65	325	3.85
4-Promotion Team	18	26	129	2.99
Total	83	432	2130	

The results of modelling according to the GPS-PM method are best understood with the use of graphic representation. The graphs are results of modelling in programme Vensim and are

[5] In our case one week was selected as a suitable time period – that is the standard time between two project meetings.

generated in the Sable programme. The total number of points according to the output difficulty as planned by the project team is 2130, and they should be achieved within 20 weeks. Four specialised teams are working on the project. The graph in Picture 7 shows the planned value during the project (PV) as per team, where the total expected value of project difficulty is 2130 points (EAC = 2130 points). This is a cumulative graph so it works with the level of "Completed Work". In Table 4 it is obvious that the cumulated planned value of difficulty for Team 1 – "Production Team" is up to 11 times higher than the planned output difficulty for other teams participating in the same project (Table 4, Pictures 7 and 9a). With regard to the fact that the personnel in Team 1 – Production Team is not bigger than the personnel in other teams, there arises a question as to how Team 1 – Production Team[6] is going to achieve the planned outputs. Such an uneven distribution of difficulty amongst teams does not, however, mean that we will be unable to forecast achievement of the project results.



Pic 7. Cumulated planned value of the project in total and divided for the four teams

Graph 8 below shows the actually achieved value (EV = 1095 in the 20th week) in the project after completing stage 3 of the project, i.e. at the beginning of week 13. The graph shows the total planned difficulty of the project and total actually achieved value of the project at the beginning of week 13, while between weeks 13 and 22 it indicates forecast which is in agreement with the up-to-date behaviour of the project team members. Each stage lasts 4 weeks. The two final weeks (21st and 22nd week) are reserved for project assessment.

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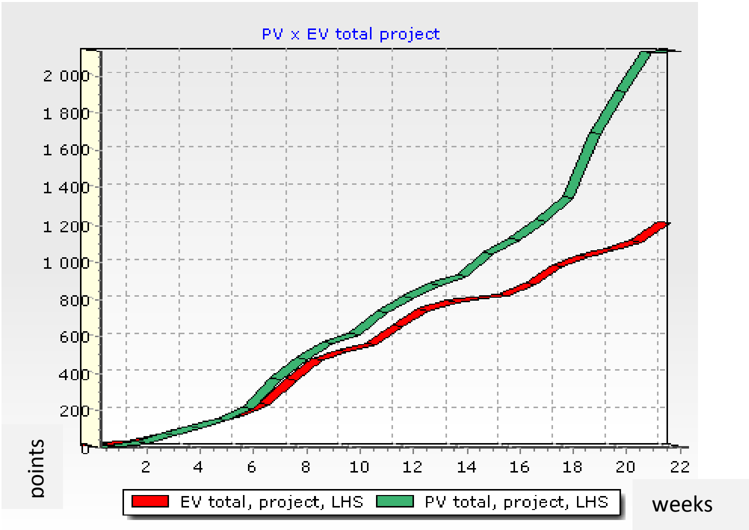
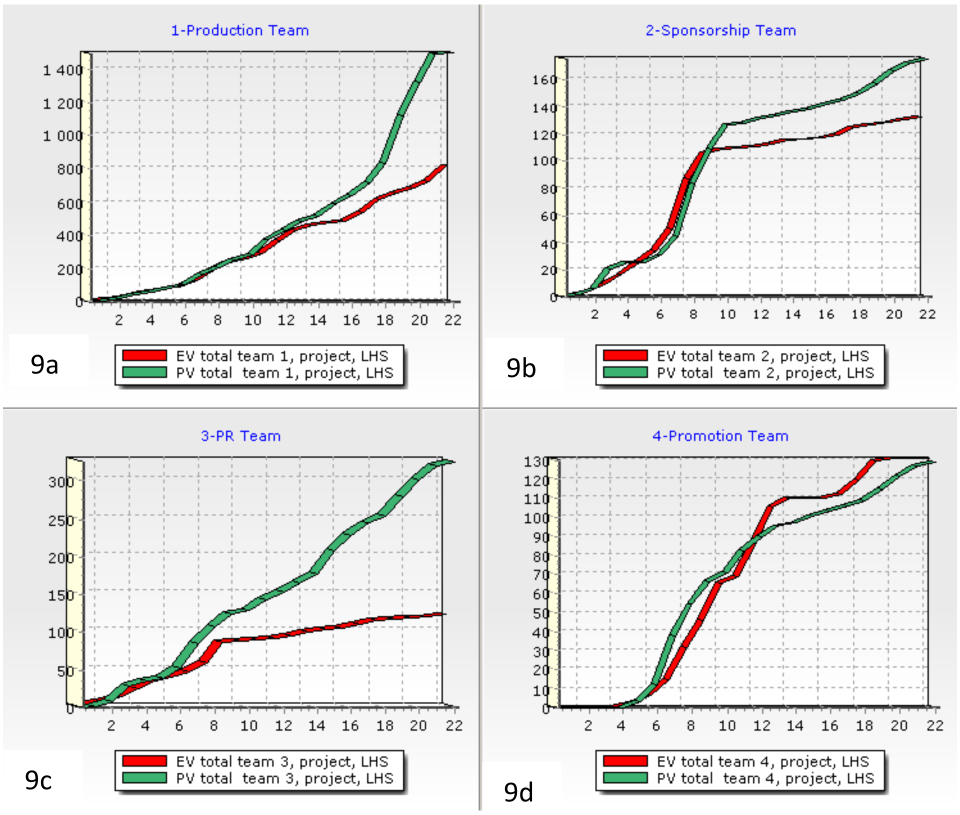
[6] In fact, the higher difficulty for Team 1-Production Team is caused by the exact work of the team manager, who planned systematically and carefully all necessary outputs and activities leading to these outputs. In her approach to planning she was in fact up to 10 times more productive than for example the manager of the team 2-Sponsorship Team.



Pic 8. Comparison of the planned and actual value of the work achieved within the project

The graphs (Pic 8, 9, and 10) clearly show that until week 5 the project team followed the plan. In the following period of time, especially at the end of stage 2 and 3 (beginning of weeks 9 and 13) a difference between the planned value and actually achieved value is beginning to show.

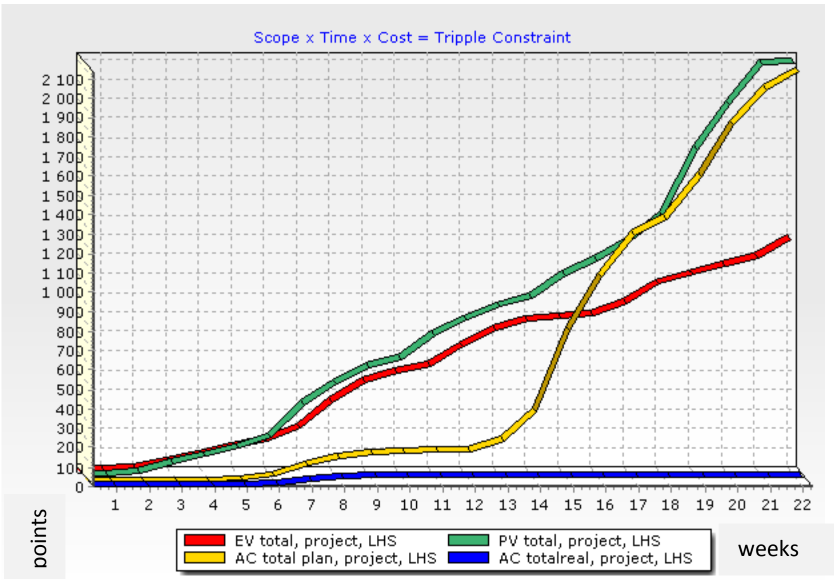
Graph in Pic 8, however, does not show in this total representation which team causes the delay. For this analysis, it is necessary to look at the value of the plan and actual situation in each specialized team. The Project Assurance team receives this kind of information from another graphic representation, a group of four graphs with one graph per each team (Pic 9 a, b, c, d).



Pic 9. Comparison of the planned and actual value of completed work in project teams

By dividing the plan development and the actual situation by teams we can specify where the problem is that the manager probably has to solve. The main risk is a higher difficulty of all outputs in Team 1-Production (Pic 9a). If we expect all teams to adopt the same approach (Variable "Team Behaviour") up to this moment, we can forecast how may outputs they should be able to complete by the end of the last stage. The four graphs (Pic 9) suggest that the largest unwanted expected difference between the plan and reality will be achieved by Team 1-Production (approximately 780 points) (Pic 9a). Even that, however, means that the team works with the highest intensity, because it can be estimated that it will achieve a total value of 720 points of difficulty. Team 2-Sponsorship (Pic 9b) is more successful than that of Team 1-Production in terms of the forecast of the difference between the total amount of points of difficulty planned and actually achieved. Yet, its total score of planned points is at the end of the project only 175 points. Team 3-PR (Pic 9c) is relatively the weakest in regards to its productivity, and Team 4-Promotion is successful because in the model we forecast that in week 20 it will complete all outputs planned for it. The project manager knows that in order for the whole project to be successful, all team managers and their teams have to achieve good-quality outcomes. When we assess all four teams together, then our forecast is that the project will fail to obtain the expected result by 1035 points. (1-Production = 781 points, 2-Sponsorship = 46 points, 3-PR = 208 points, 4-Promotion = 0 points).

Another representation of the actual development and forecast of further development of the project that is available at the end of stage 3 is the comparison of the cumulated values of all parameters. It is a comparison of the development of three monitored parameters for which diversion tolerance is set by the PRINCE2 methodology: scope, time and costs. Therefore, another parameter is added to the previously monitored and graphically assessed values (Pic 8 and 9), i.e. costs, in both the planned value and actual value at the given moment. The parameter of costs is made understandable by converting financial resources planned and really consumed into points, so that the total number of planned points for costs equals the total number of points used in terms of money (The foundation for this process is the database – Table 2).



Pic 10. Cumulated values of parameters PV, EV and AC throughout the project implementation

It is obvious from the graph that the planned development of costs has a different course than the planned development of work on delivering project outputs. The costs begin to be consumed in higher amounts from stage 4 of the project. If we compare the created value and the planned value and we are concerned with the actually achieved outputs, then the higher value created than planned is welcome. It means we did more work that was planned. When comparing the curve of the planned and real costs, the overlap of the reality over the plan is perceived negatively and it means that the project manager will need to save money in the following stages of the project. A significant failure to adhere to the planned costs is also a warning which means that the purchasing or supplies department are behind the time line and that this might cause problems with the project later on. That is why we need to monitor the AC parameter closely, especially in relation to the EV and possibly PV parameters.

All three limitations of the project can be conveniently shown in one graph thanks to the usage of the GPS-PM method. We processed the plan into an independent system dynamics model, which contains the same variables as the model for project implementation. The plan is a comparative platform for monitoring the progress of project implementation. The plan is a model of a project and it can be said it is as good as it gets. Project implementation is a model which has the same basic structure as the project plan. We can add variables that slow down or speed up the work on the work outputs into the model which simulates the real implementation of the project. The project manager in cooperation with the Project Assurance team can analyse the reasons that lead to the delay in the reality against the plan, while assessing the actual progress of the project, and corrective measures to remedy this situation can be prepared.

4. Use of the GPS-PM method – Summary

Cultural events are specific projects whose organization involves challenges that are hard to predict and not always possible to solve satisfactorily. A project manager is in most cases unable to foresee fully the impact of the current delay in project implementation against the plan within the context of the whole project before the project is completed. The traditional approach to project management is based on detailed planning of all activities from the beginning to the end of the project. The presented approach, which serves as the basis for modelling of the project progress, is based on project planning for shorter periods of time, or stages. At the end of each stage the progress of work assigned for the particular stage is assessed by the management; the value of the actually achieved outputs is measured and compared against the plan. Detailed outputs for the following stage are planned only after the previous stage has been completed and assessed. Project management for cultural managers is based on the ability to measure the achieved project quality and to forecast its future development. A tool for dynamic planning and monitoring the project development including the forecast is the simulation of project development and system dynamics modelling. The GPS-PM method complies with the new requirements that project management has to handle: to get past the limitations of technical and engineering disciplines and to create a procedure which will correspond with the trans-disciplinary and integration approach (Saynisch, 2010). As Soukalová (2011) states, the essence of management can be simplified as information-communication interaction, whose aim it is to transfer information quickly, effectively, truly and reliably. In the 21st century, cultural and any other creative and scientific projects cannot be based on bureaucratic and rigid procedures that do not allow changes to plans readily.

Creative environment must remain dynamic and must always offer new challenges, including the inherent possibility of changes to the planned processes. Yet, we shall not consent to purely intuitive management of projects in culture and creative industries. We need a plan that will be adapted if needed, but that will still provide comparison against the results actually achieved. Moreover, in creative industry, we need to predict further development, terminate projects that make loss or do not bring real benefits for stakeholders. The GPS-PM method is based on system dynamics, project management is product-oriented and ruled by stages (PRINCE2), and uses the tools of PMI standard (A Guide, 2000). We have proved in a real-life project for a cultural and social event, that this method can be successfully used not only to draw up a project plan, but also in the course of the project itself. We are able to prepare the project plan in such a way so as to establish the project parameters in its three limitations: costs, scope, and time schedule. In order to quantify exogenous variables that we need to obtain for the model, we compiled a set of research questions, mainly regarding the behaviour of project team members. For the purposes of simulation we defined the project objective with the use of the Project Breakdown Structure (PBS) tool and we quantified the objective into the model by setting the level of difficulty of project outputs. We divided the outputs into stages according to their planned and actual date of completion. The stages allow us to make the plan more accurate in the course of project implementation, which can be done through a detailed break-up of rough entry data from PBS into more detailed inputs, which means that we are still able to, with the use of points, determine the plan and reality and to predict further development of the project. System dynamics modelling of a GPS-PM project is a method which can be creatively extended and further modified in cooperation between the Project Assurance member(s) and the Project Manager.

The advantage of the GPS-PM method lies in the possibility to incorporate exogenous variables, which can measure all outputs – planned, achieved, and predictable – as well as the financial resources invested into the project. Furthermore, we are able to model even parameters that are harder to quantify, those that represent the behavioural competences of the team members. As we have proven, these competences can be measured with the use of a questionnaire, using scaling methods. However, we believe that the competences can be measured alternatively with the use of other creative methods. Their setup shall be subject to further research. System dynamics modelling is useful for a team which carries out cultural events and other projects that are based on human creativity and invention, and whose outputs cannot be effectively specified in detail at the beginning of the project. The GPS-PM method contributes to the range of project management tools for monitoring project development. In further research, we would like to examine how to simulate not only scope, time and costs of cultural projects, but also other aspects of project implementation: benefits, quality and project risks.

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