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Similarity of Projects: Methodology and Analysis with
TRANSCALE Tool

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Abstract

Statistical methods in similarity analysis of projects and project management best practices methodology like other statistical methods of project management are far from meeting the requirements of the industry.

In addition, comparison of projects, and in general, project management best practices methodology without taking into account the goals and objectives of projects can lead to erroneous results and undesirable consequences.

Therefore, there is a need for a paradigm shift in this area, which will make it possible to use the new mathematical theory of projects for similarity analysis of projects and in the area of project management best practices.

This article discusses a new methodology of project comparison and project similarity analysis with the aid of project scaling and transformation TRANSCALE tool.

Key words: Similarity of projects, static similarity of projects, dynamic similarity of projects, comparison of projects, project goals and their similarity, project data mining, critique of project similarity statistical methods, generalized theory of projects, analytical relationships between project parameters, TRANSCALE tool for project grouping and similarity analysis.

Introduction

At all phases of project works including planning, execution and postmortem analysis, it is necessary to solve two basic problems. These are the comparison of projects and analysis of their similarity.

The need to compare projects arises in many practical situations related to quality assessments of projects during their planning and execution.

In turn, assessment of the quality of projects implies that in this process the goals and objectives of projects should play a central role.

Depending on what the project goals and their priorities are the very meaning of the concepts of "good project" and "bad project" can be changed.

In particular widely spread project management best practices methodology uses comparison of projects in order to determine what project or group of projects in a given situation is more advantageous to use as a good example to follow.

At the present time the whole area of project management best practices, including comparison of projects and analysis of their similarity is mainly governed by statistical methods.

It is also known that the results of such statistical methodology for project estimation and prediction of their parameters do not satisfy the requirements of the industry. Moreover, the absence of rigorous scientific study of statistical methods for project estimations, such a methodology can cause considerable damage to the industry in the form of a huge number of failed projects.

In general, as a quantitative methodology the existing statistical approach to the problems of project estimation and planning, as well as project data mining is in between of two extremes. In the best case it is a self-deception, at the worst case it is a deception of others.

In this situation, improvement in the quantitative project management is associated with the development of new scientific approaches to the problems of project data mining including comparison and similarity analysis of projects.

Comparison of projects

If there are projects and there is a need to find out which ones among them are the best examples to follow, we first need to understand the meaning of the notions “good project” or “bad project”. The matter here is that any project may have multiple objectives, which in different environments may have different priorities. This means that each specific project represents some combination of the priorities of their goals and objectives.

In turn, this means that if the database has a certain number of projects and there is a need to choose the best one among them, it must be understood that for the different combinations of the priorities of project goals as a result we can have completely different projects.

This in turn means that when it comes to planning a new project and we want to find in the database project that is close to the projected one, then first it is necessary to know the priorities of the goals and objectives of the new project.

For example, suppose a new project has two objective functions, which are the development cost and quality of the project. In this situation the additional testing increases the cost of the project, as an additional test means an additional time and effort. But on the other hand the same test improves the quality of the project.

This means that depending on the priorities of these two objective functions we can have as “similar” completely different projects from the database.

Ideal similarity of projects

Ideally, for a full description of the projects there is a need for a large number of parameters. These might be system-level parameters such as complexity, effort and duration of the project, productivity and the average number of people in the team, as well as many other parameters related to the dynamics of the project execution.

The number of these additional parameters can be very large, and their measurement may be associated with enormous financial and organizational difficulties. Thus, having available the full information about the numerous parameters of projects, their similarity can be seen as their distance in the multidimensional project space. Clearly, this idealized approach to the problem of similarity of projects is not real and is only of theoretical interest.

When solving practical problems of planning and execution of projects we need to simplify the formulation of the problem of their similarity. For that purpose we need to find out approximate solutions of the problem by seeking for “similar” projects by several practically important features only.

Real similarity of projects

In real life, proceeding from practical considerations, it is often sufficient to deal with one or more parameters of project similarity. In this problem we should clearly distinguish between two basic approaches to the current practical problems of decision-making.

The first one is the business approach, which requires finding acceptable solutions of tasks under severe time constraints. The second is the scientific approach, which requires a comprehensive and detailed analysis of problems.

Analysis of practical problems associated with the real similarity of projects, rather belong to the business approach to the problems of decision making.

In this sense, it is also very important to know the objectives of the specific project and, proceeding from that, to develop local criteria of project similarity.

Such a formulation of the problem makes it necessary to analyze the project database using local criteria of project similarity in order to build project libraries in the form of the groups of "similar" projects [1].

In practical project data mining the simplest case is the similarity analysis of projects by one parameter. That might be the similarity by project complexity, by total project effort, by team productivity and team size and by the duration of projects.

Similarity of projects by complexity

For example, if the complexity of the new project subject to planning is known, it is always possible to select from the database a group of similar by complexity projects. In Fig.1 as a screenshot of TRANSCALE tool are represented five similar by complexity projects.

The similarity of these projects is expressed by the fact that all projects in the field $[E, P]$ are located approximately along the same hyperbola. But, as seen from the figure, the similarity of projects by complexity does not mean their overall similarity.

Significantly, as seen from the figure, the scatters of all other parameters are large and are random in nature. This means that only the similarity of projects by complexity cannot serve as a basis for assessing and predicting their parameters.

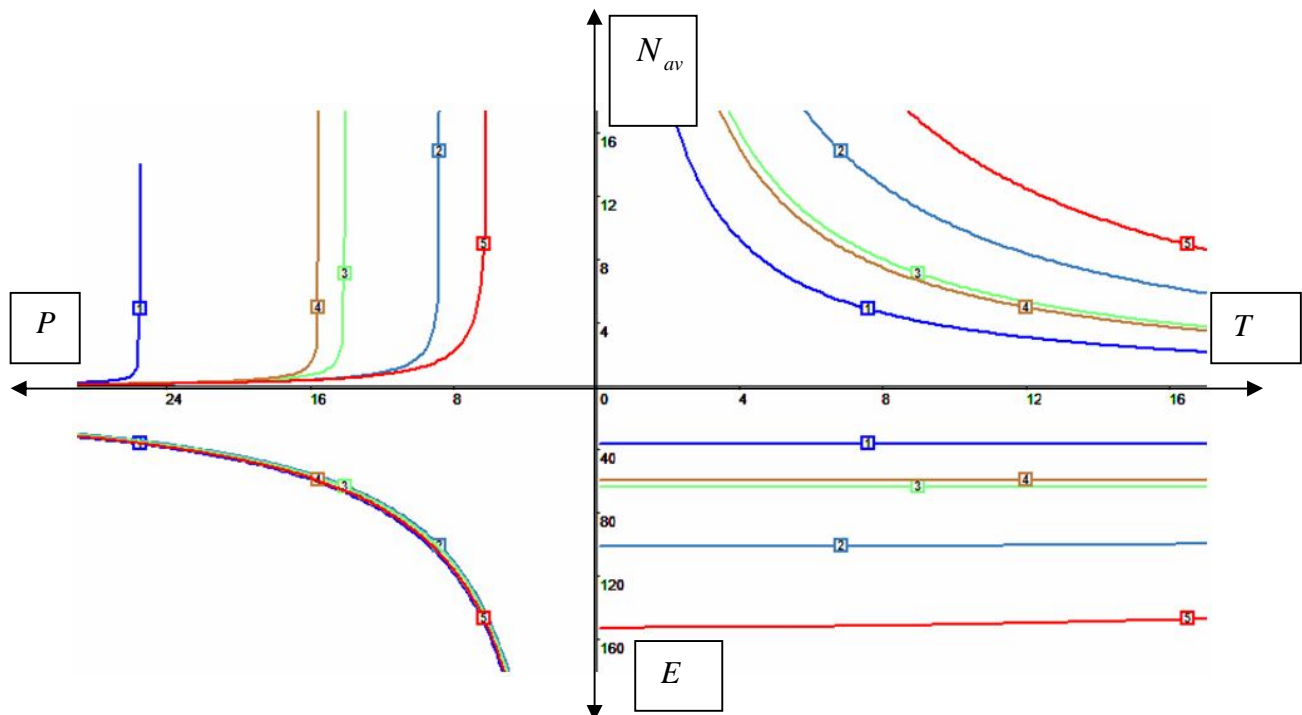


Fig.1 Projects with the same complexity in the multi-parametric flat project space

Similarity of projects by team productivity

Consider the similarity of projects by team productivity in the multidimensional flat project space. Fig.2 presents four projects with approximately the same team productivity P . The constancy of team productivity is expressed by the fact that all projects in the field $[P, N_{av}]$ are located on the same $P = Const$ line parallel to the axis N_{av} . In this figure, as in the case of the

complexity of projects, all parameters except the team productivity P have a large and uncontrolled spread.

This means that based solely on information about the productivity of the team it is impossible to make accurate estimates of project parameters.

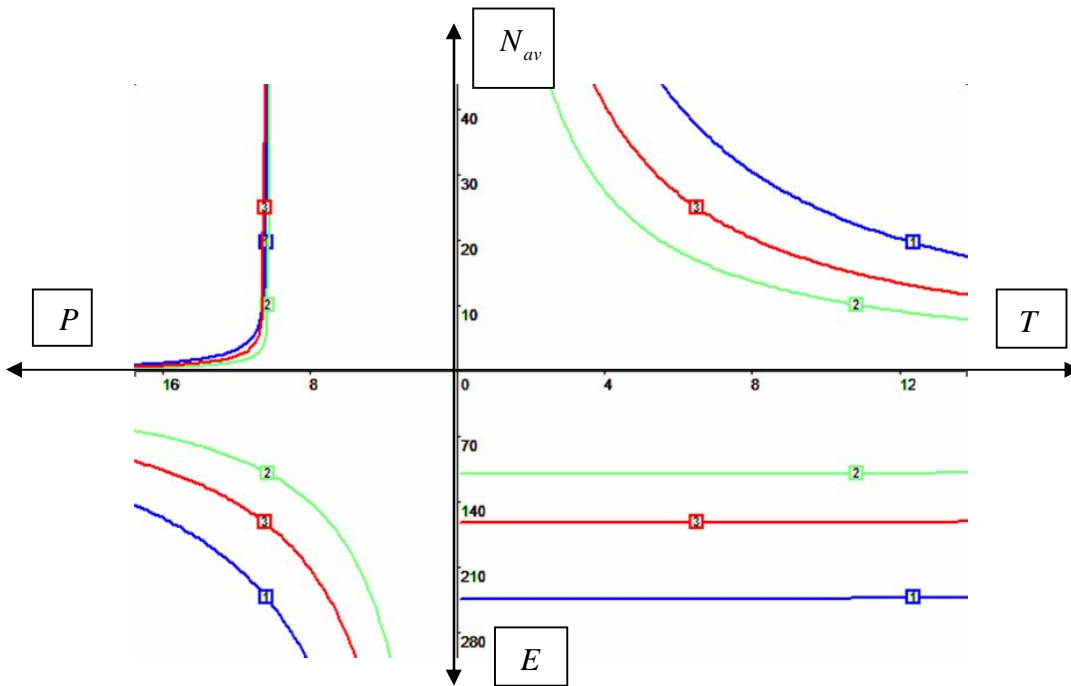


Fig.2 Projects with the same team productivity in the multi-parametric flat project space

Similarity of projects by effort

Consider the similarity of projects by efforts on the example presented in Fig.3. This figure presents three projects with approximately the same effort in the multi-dimensional flat project space. As can be seen from the figure, the efforts – duration relationship for all three projects is a line parallel to the axis of project duration, so-as the relationship productivity – team size is also almost constant.

In this case, too, except for the efforts, all the other parameters of projects have a large and random variation. This is again a sign that the availability of project effort is not enough for the assessment of its other parameters.

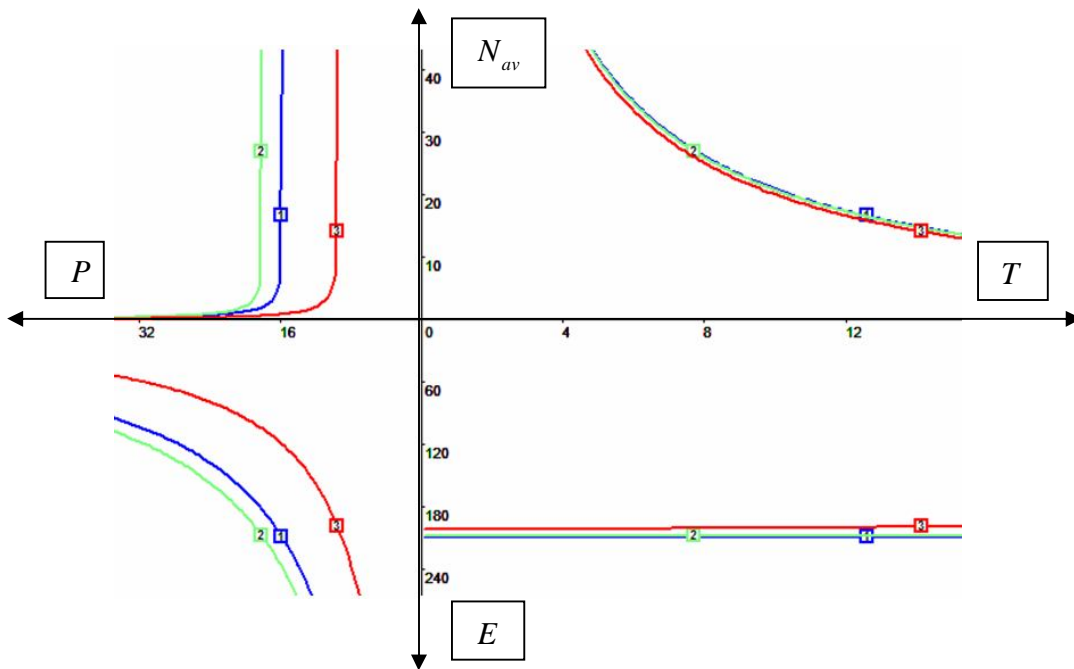


Fig.3 Projects with the same total effort in the multi-parametric flat project space

Similarity of projects by their duration

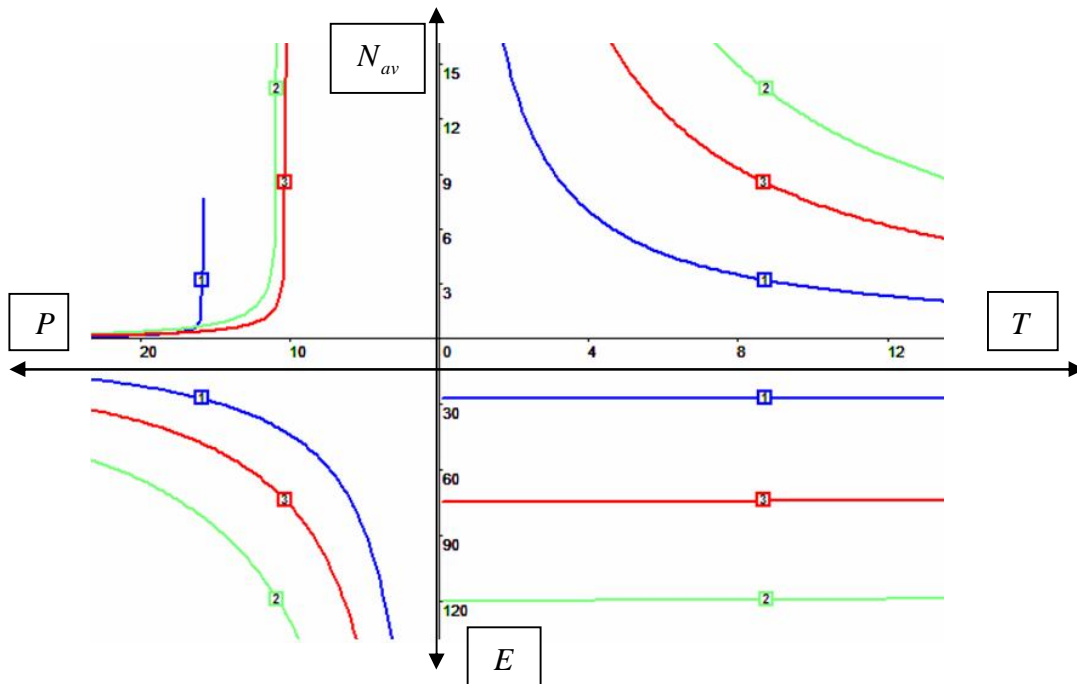


Fig.4 Projects with the same duration in the multi-parametric flat project space

Naturally, the projects with the same duration may have little in common with each other. Fig.4 presents three project with almost the same duration. As we can see from the figure, again all other parameters of projects have large and random variations.

Again, this indicates that the project duration alone cannot be a guide in assessing of other project parameters.

Similarity of projects by their average staffing level

One can come to a similar conclusion for projects with almost the same average number of people who work on projects. Fig.5 presents four projects with almost the same team size. Here we must take into account the fact that the projects with the same number of N_{av} may have a variety of scatter around the mean value.

This problem is presented in [2], where is discussed the relationship between project staffing profile and their scheduling risks.

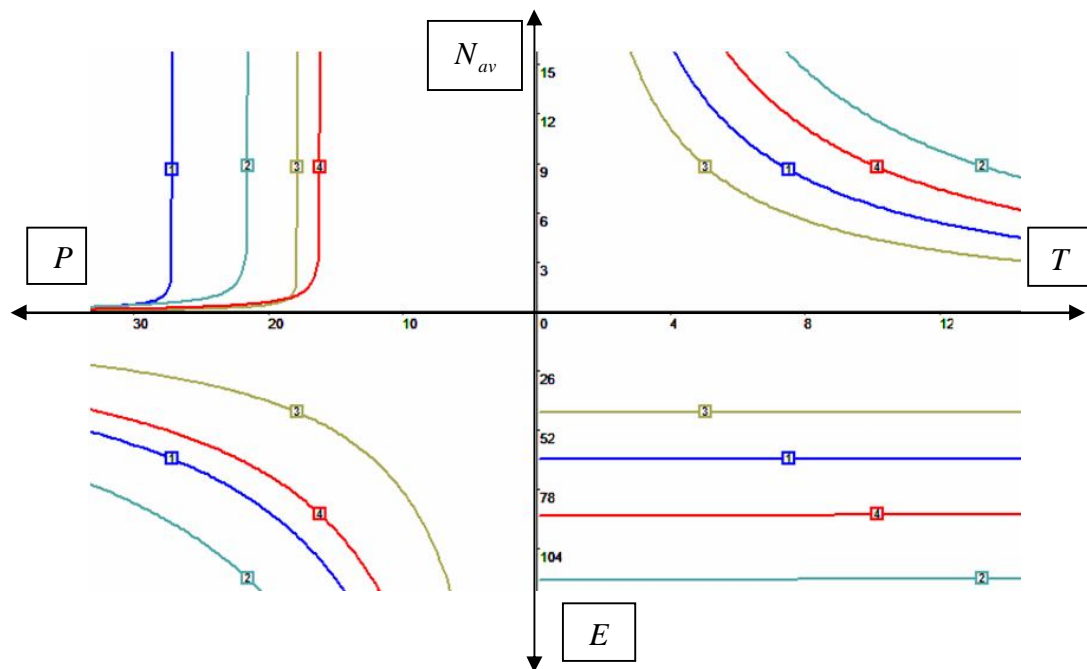


Fig.5 Projects with the same average staffing level in the multi-parametric flat project space

Similarity of projects by their goals and objectives

Studies show that the project goals and objectives are important indicators of their similarity. In [3, 4] is shown that project objectives and their priorities can be quantitatively represented in the form of time/people ratio. This allows establishing a functional relationship between objectives

of the project and its basic parameters such as total effort, project duration or the average size of the team.

Accounting for these factors and functional relationships between them serves as a mean of finding the distribution of project effort over time.

In this sense, the condition of constancy of time/people ratio enables an adequate selection from the database projects with the same priorities of their goals.

Fig.6 presents five projects with approximately the same time/people ratio. This constancy of the time/people ratio is expressed by the fact that all projects in the field $[N_{av}, T]$ are located along a line passing through point $[0, 0]$.

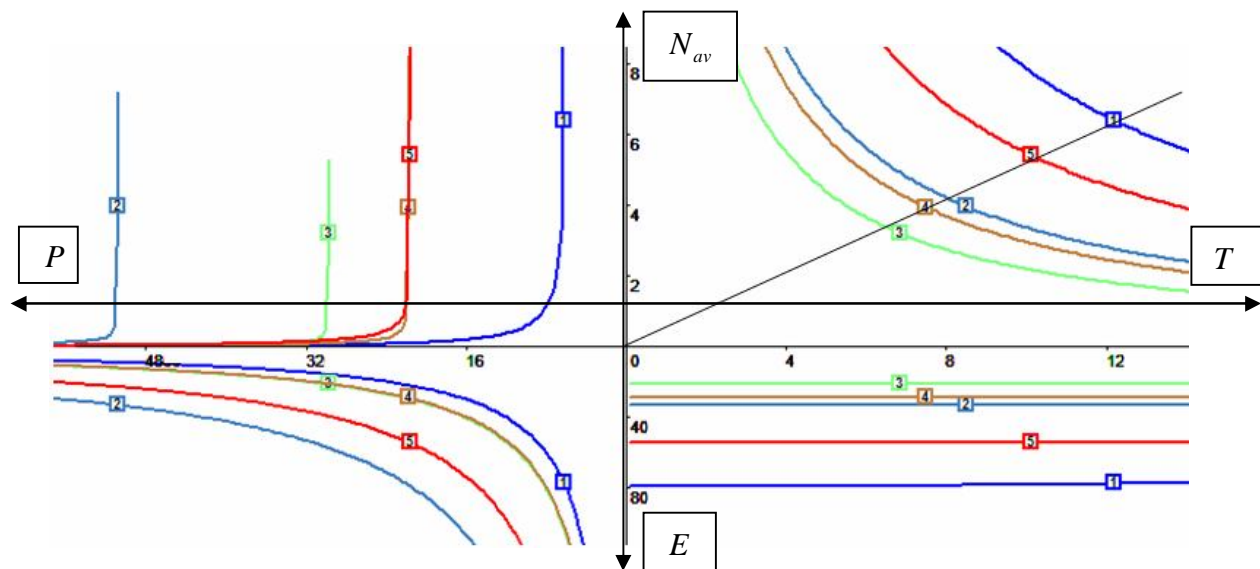


Fig.6 Projects with the same time/people ratio in the multi-parametric flat project space

From the figure is also clear that the similarity of projects by time/people ratio alone is not enough for the purposes of assessing and predicting the remaining parameters of the project, so, as they have large and uncontrolled spread.

Multi-parametric similarity of projects

One-parameter similarity analysis of projects carried out above shows that this methodology may not be reliable for the purposes of planning and execution of projects. From this point of view more convenient is the development and use of methods of multi-parametric similarity of projects. In this direction, the simplest case is the development of methods for two-parameter comparison and analysis of project similarity.

Similarity by project complexity and team productivity

For this particular case in Fig.7 is shown an example, which presents two projects that have the same complexities and the same productivities. Since these projects have the same complexities and productivities, then consequently they have the same effort, too.

But the equality of the three parameters of these two projects does not mean the equality of their other parameters too. This is clear from the figure, where projects have different durations and different team sizes. This also means that projects have a different time/people ratios.

This example clearly shows that knowing the values of project complexity and team productivity it is fundamentally impossible to determine project duration and team size unambiguously.

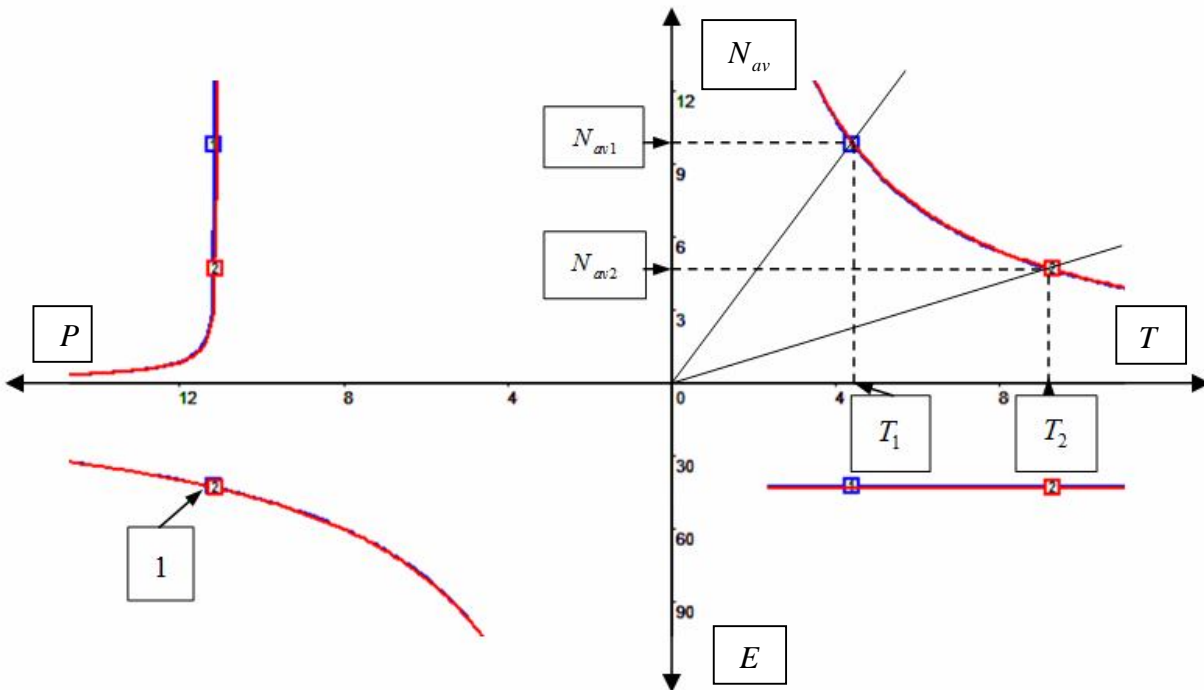


Fig.7 Projects with the same complexity, team productivity and effort in the multi-parametric flat project space

For that it is necessary to have at least one additional condition. It can be the similarity of projects by the priorities of their goals and objectives.

Similarity by project complexity, team productivity and project goals

Ensuring complete similarity of projects at the system level is possible if the projects have the exact same complexity and team productivity, as well as the same priorities for the project goals and objectives.

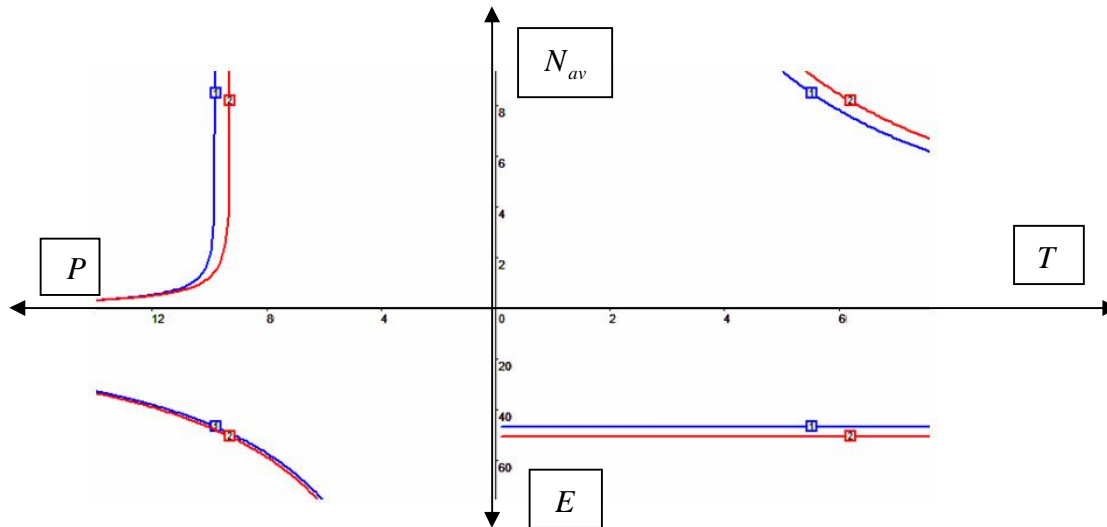


Fig.8 Projects with almost the same complexity, team productivity and time/people ratio in the multi-parametric flat project space

Fig.8 presents two projects, the system characteristics of which are almost identical. This example shows that at the system level representation project can actually be fully described by its three parameters (W , P and $R = \frac{T}{N_{av}}$).

Static and dynamic similarity of projects

So far, all discussions were conducted for the case when the basic parameters of the projects in the process of data mining remained unchanged. This kind of data mining methodology could be called "static analysis of project similarity".

Unlike static analysis of project similarity, the dynamic analysis of project similarity implies that during the process of the comparison and grouping of projects the values of their basic parameters can be changed. The purpose of such changes of the values of project parameters is the use of the great potential of "what - if" analysis in project data mining.

The additional need for such an approach to project data analysis is conditioned by the fact that usually, even in very large databases the number of similar projects is really low, which significantly limits the possibilities of analysis.

What-if analysis and dynamic similarity of projects

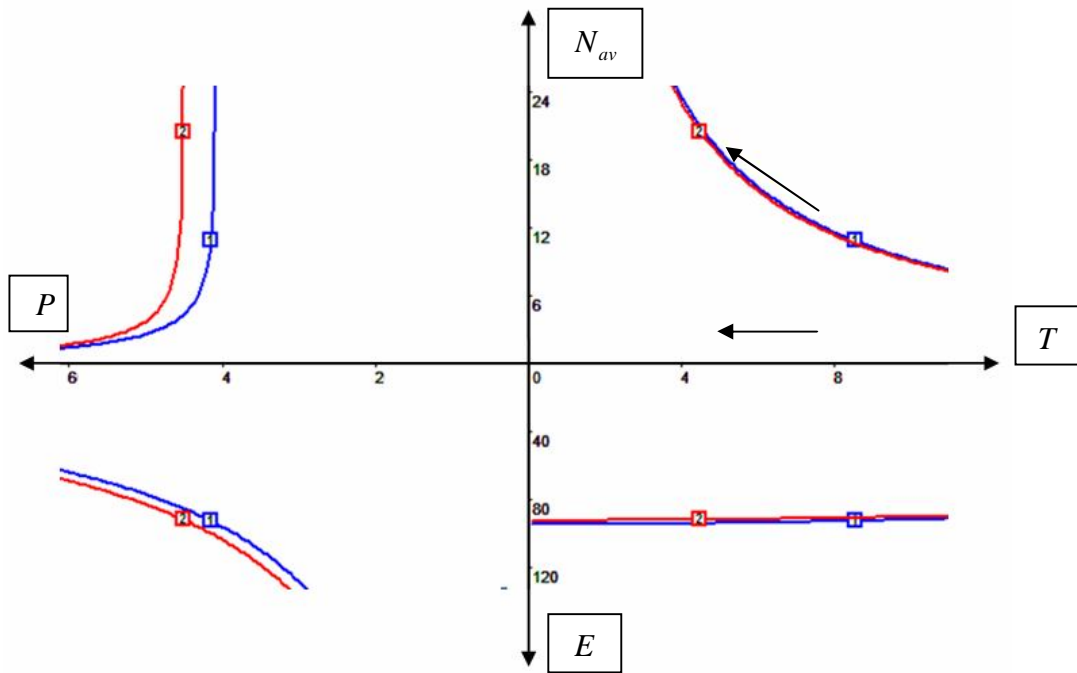


Fig.9 Dynamically similar two projects before transformation

Consider two projects for "what-if" analysis presented in Fig.9. These projects differ from each other only by the values of time/people ratios.

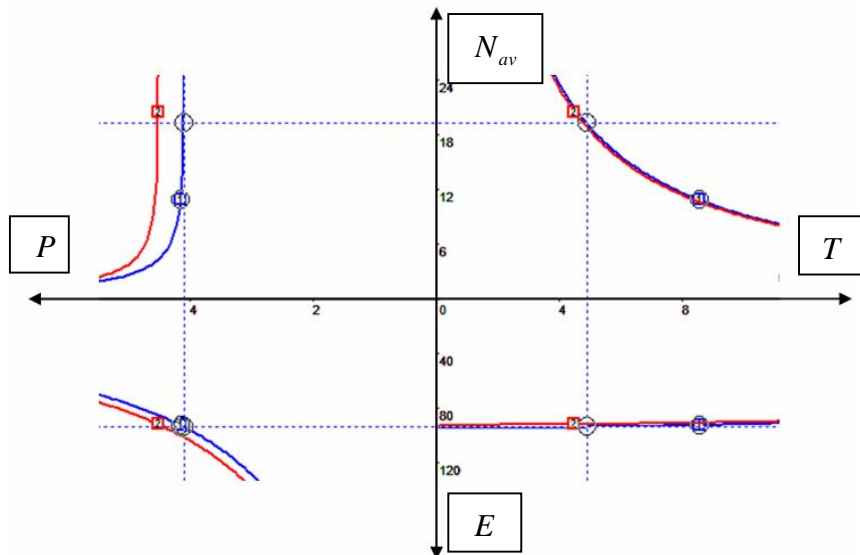


Fig.10 Dynamically similar two projects after transformation

Using the possibilities of TRANSCALE tool, one can reduce the duration of the project "1" in the direction of the arrow (Fig.9). As a result, the point "1" gradually will become closer to the point "2", since in the project space, their trajectories coincide.

The result of this kind of transformation is shown in Fig.10, where the final position of the point "1" denotes a circle.

By this transformation we respond to the question what would happen if the value of the time/people ratio for the project "1" would be closer to the same ratio for the project "2". As a result, it appears that using such an artificial way, one can create groups of similar projects for the purposes of project planning and execution.

Similar changes can be made for the group of projects with arbitrary parameters. As an example, consider a group of projects that have approximately the same complexity, presented on Fig.11. The purpose of this analysis is to determine what would happen to the projects of this group, if we artificially force them to have the same priorities of goals and objectives (or to have the same time/people ratio).

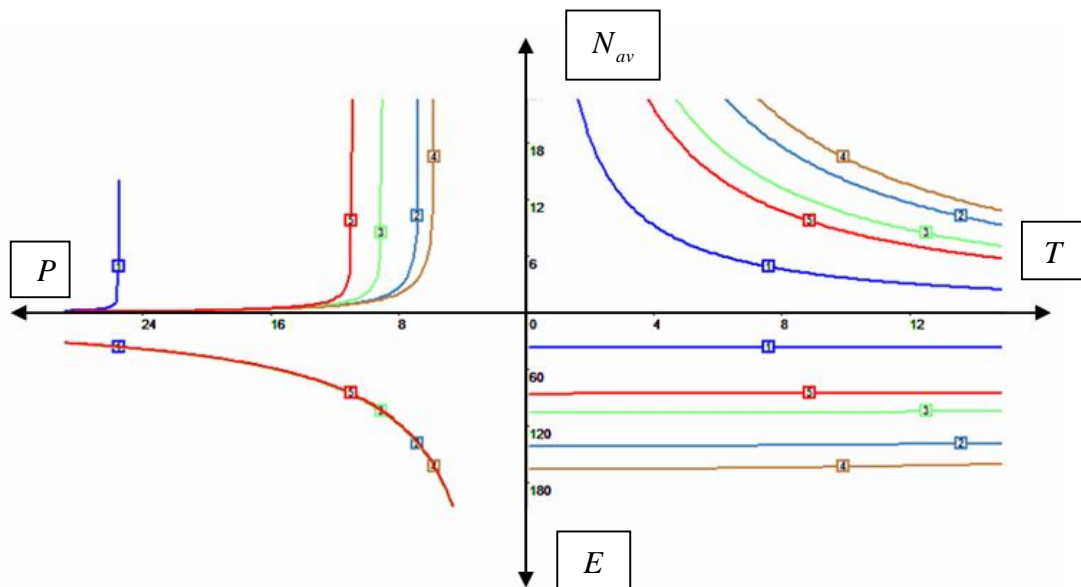


Fig.11 Group of projects with constant complexity before transformation

To achieve this goal, one can use the TRANSCALE tool to move all the points in the directions indicated on Fig.12 (by their sliding). The purpose of this sliding is to place all the circles on the final red line, which is the locus of a constant time/people ratio.

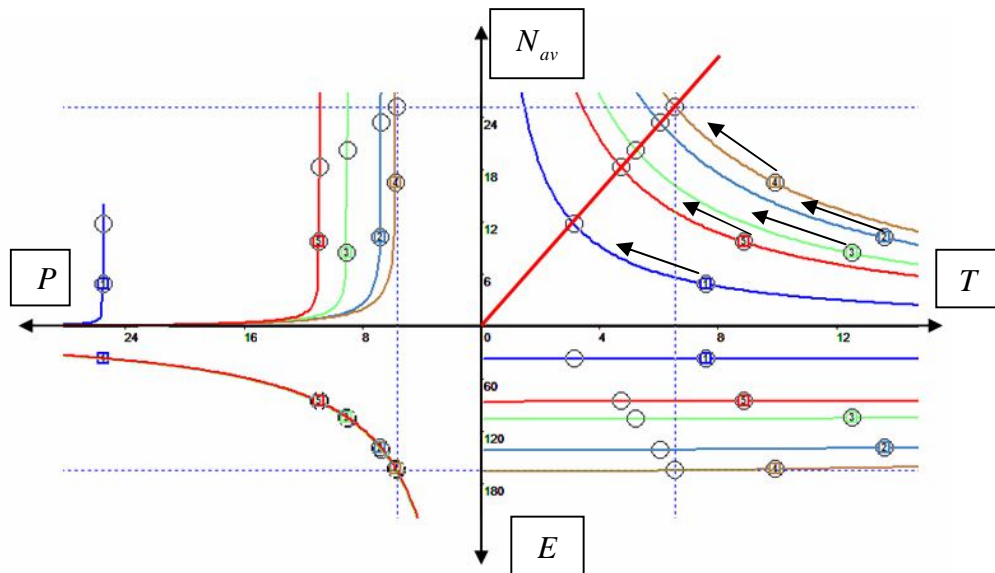


Fig.12 Group of projects with constant complexity after transformation

As a result of this conversion locations of the projects in the field $[E, P]$ remain almost the same, but in the fields $[P, N_{av}]$ and $[E, T]$ the new locations of projects comply with special laws, the analysis of which can be done with the aid of the state equation of projects.

Conclusions

1. Statistical methods in similarity analysis of projects and project management best practices methodology, like other statistical methods of project management, are far from meeting the requirements of the industry.
2. In addition, comparison of projects, and in general, project management best practices methodology, without taking into account the goals and objectives of projects can lead to erroneous results and undesirable consequences.
3. In general as a quantitative methodology, the existing statistical approach to the problems of project estimation and planning is in between two extremes. In the best case it is a self-deception, at the worst case it is a deception of others.
4. Project management requires a new methodology for comparing projects and analysis of their similarity, based on fundamental relations between the parameters of the projects.
5. The TRANSCALE tool enables both one-parameter and multi-parameter analysis of similarity and comparison of projects.
6. For a more complete and effective use of project databases it is necessary to introduce a new concept of dynamic similarity of projects.

7. Introduction of the concept of dynamic similarity of projects allows using the rich possibilities of “what-if ”analysis for project data mining.
8. The TRANSCALE tool can be used for both static and dynamic comparison and analysis of project similarity.

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About the Author



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