

Project Families and their Application for Project Evaluation¹

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Introduction

There may be several reasons for project grouping. The best-known of them are achievement of an organization's strategic goals (these project aggregates being called *portfolios*) or better management (for which we have *programs*). But sometimes it is natural to focus on another type of project sets. Consider a situation in which a project-oriented company invests in a new technology. The effects of such investments should be observable in projects applying this technology. So in order to fully analyze this project one should take into account the investment project and all commercial projects executed as an effect of the investment project. Or looking from another point of view: consider a commercial project that delivers its products to a customer. When analyzing such a project one should take into account not only the project under consideration, but also all of the investment projects which made the execution of this project possible. There may also be other, non-financial reasons for collectively analyzing more than one project – like tracing changes in processes of project execution or tracing innovations introduced and used by projects. So there may be another reason for project grouping: analyzing them. This analysis in turn is performed for the purpose of better management of projects performed in an organization.

This paper describes *project families*, a way of grouping projects for analytical purposes originally presented by the author at the 22nd IPMA World Congress (Gasik, 2008).

Project parenthood relationship

Let us consider the following sets of related projects.

Example 1

A project-oriented organization carries out a project for an external customer. There are two goals of this project: earning income and proving to the customer that the performing organization is capable of doing subsequent, probably bigger, projects.

Evaluating the first project must be related to effects of follow-up projects.

There is a relationship between the first project and later-performed projects for this customer:

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the former enables execution of the latter.

Example 2

A company carries out a project of developing and implementing a software system for a customer. But there is also another aim of this project: developing a software library to be used in other projects.

Again, evaluation of the first project must take into account effects of the subsequent projects; at least the parts of them which directly use this software library.

There is a relationship between the first project and those using the software library. The former project influences the latter ones.

Example 3

Consider a project of making a film. After production, this film is distributed in several countries. There are promotional campaign projects in these countries.

Evaluating the project of making the film must take into account effects of promotional campaign projects for the film.

There is a relationship between the project of making a film and projects of promoting the film. There would be no promotion without the film having been produced previously.

Example 4

A commercial project develops a totally new way of producing a deliverable. The projects that follow apply this new process for their commercial purposes.

Evaluating this first project should take into account the effects of applying the improved process of product development in subsequent projects.

There exists a relationship between the first project and those projects that use the new technology.

In all examples shown above, the former project influences execution of the latter ones. Such an influence will be called a **parenthood relationship** between projects.

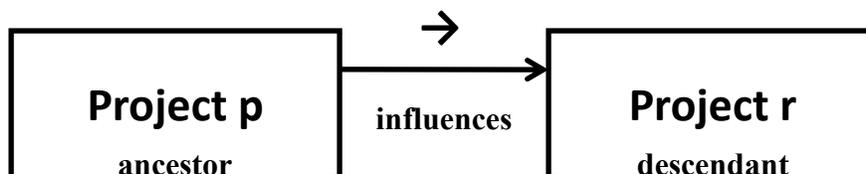


Figure 1. Parenthood relationship among projects

We will denote the relationship of parenthood between projects with the \rightarrow symbol. The text $p \rightarrow r$ means that the project p is an **ancestor (parent)** of project r and project r is a **descendant (child)** of project p .

There are three categories of influence on one project by another:

1. The ancestor enables execution of the descendant.

The first example cited above belongs to this category.

2. Products of ancestor are used by descendant.

The examples of developing a software library and producing a film belong to this category.

3. The ancestor influences the way the descendant is performed.

The last example belongs to this category of parenthood relationship.

There is a rough categorization of projects into investment and operational. Operational projects are those projects that are executed in order to directly meet an organization's business goals. The concept of operational project is a generalization of commercial project. An operational project is a commercial project if its products are sold to customers. The investment projects are parents of operational projects, as investment projects enable the execution of new types of operational projects, provide products for operational projects or improve the efficiency of operational projects.

Project Families

Every relationship defines its set of linked objects. The set of all projects linked by the parenthood relationship will be called a **project family**. The project families may be seen from two vantage points: that of investment and the operational one.

The project family defined from the operational side consists of one or more operational projects and all their ancestors – this will be called an **operational family**. Consider a project **k** intended to integrate and implement a set of internally produced applications at a particular customer organization. This project and all other projects which developed the applications that are being integrated and implemented, constitute an example of an operational family.

Projects may be seen from the investment perspective, too. An investment project that introduces a new technology and all the projects that apply this technology constitute a well-defined project family. This type of project family will be called an **investment family**.

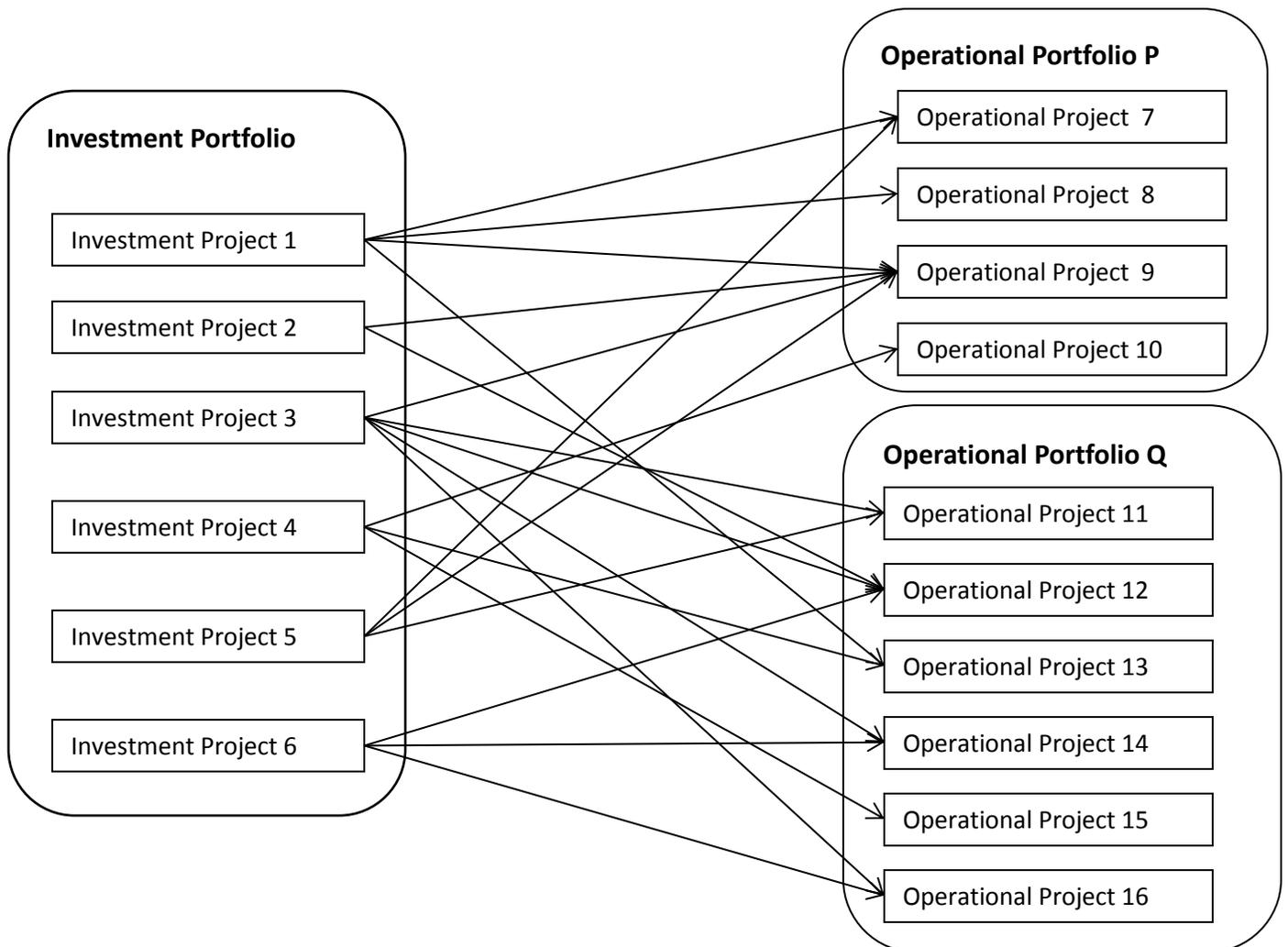


Figure 2. Examples of parenthood relationships

Figure 2 shows examples of project relationships that define simple, two-generational project families. There are investment projects numbered from 1 to 6 and operational projects numbered 7 to 16.

Figure 3 shows the investment family of project 3. The set of descendants of project **p** will be denoted by **D (p)**.

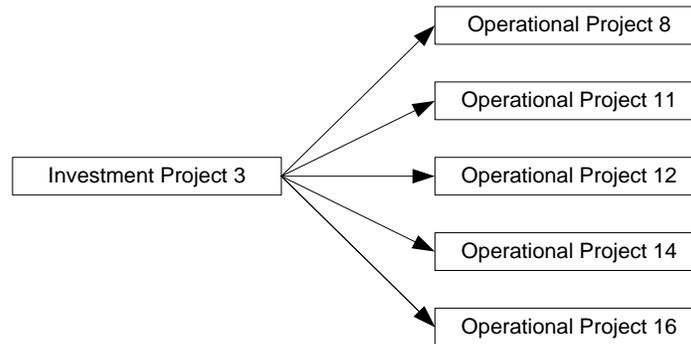


Figure 3. Project investment family

The investment family of project **p** will be denoted by **IF (p)**.

$$D(3) = \{8, 11, 12, 14, 16\}$$

$$IF(3) = \{3, 8, 11, 12, 14, 16\}$$

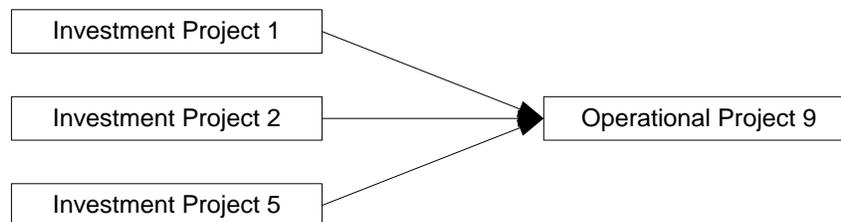


Figure 4. Project operational family

Figure 4 shows an example of an operational project family. Ancestors of project **p** will be denoted with **A (p)** and its operational family with **OF (p)**.

$$A(9) = \{1, 2, 5\}$$

$$OF(9) = \{9, 1, 2, 5\}$$

Note that the concept of project family is substantially different from those of program or portfolio. An investment family may contain projects belonging to more than one portfolio – the results of a project implementing software development technology may be used by projects from several business sectors associated with different operational portfolios. Different operational portfolios may have intersecting sets of ancestors – their investment families intersect.

The Unified Project Evaluation Model

The concept of project family may have numerous applications in the domain of project management, but one of the most evident is its application for evaluating project financial effects. When assessing the financial effect of an investment project, one must analyze the

effects of all projects from its investment family. From the other vantage point, when one analyzes the financial effect of an operational project, one must take into account its costs and income as well as an appropriate portion of the costs of all its ancestors. Projects not only use “direct” resources such as labor or materials, but profit from using output developed by other projects. Such output may be used by many projects that are executed later. All such components of a project’s environment may be systematically included into the project evaluation model using the concept of project family.

As was mentioned above, organizations carry out **operational** and **investment** projects. Operational projects are those projects that are executed in order to directly meet an organization’s business goals. But when we focus on the domain of finance (or on commercial projects), the business goal is just the financial **income**. The two other financial categories are **costs** and **savings**.

Bonham (2005) describes two groups of projects directly influencing other projects:

- Projects changing business directions – they extend the range of products or services provided by an organization to its clients (**scope-extending** projects, or even more simply, **extension** projects).
- Projects improving the efficiency of an organization’s business (**efficiency improvement** projects, or more simply: **improvement** projects).

Following this categorization, costs may be further divided into three categories:

- **Scope extension cost**
Cost incurred with the aim of developing a new product or service by the performing organization.
- **Efficiency improvement cost**
Cost incurred with the aim of improving the way earlier developed products or services are delivered.
- **Operational costs**
Costs for effects that will be used only in the operational project in which they were incurred.

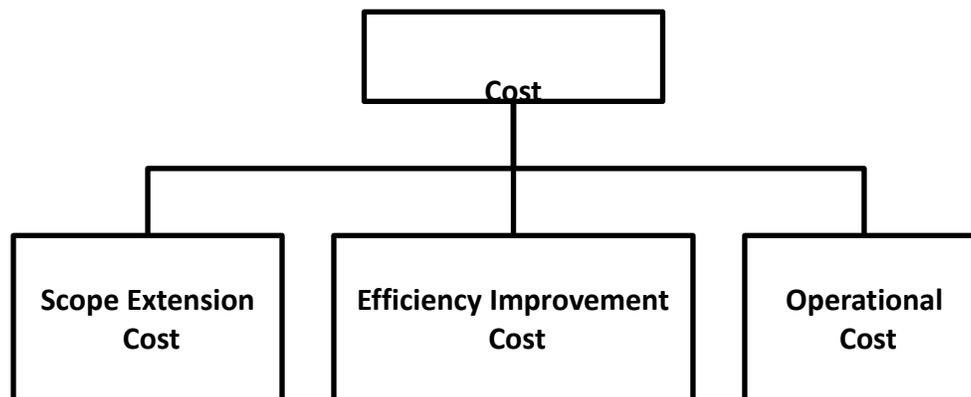


Figure 5. Types of project costs

But any project may have each of these types of costs. Especially when a project is basically of an operational nature, it may develop some products that will be further utilized by its descendant projects. An operational project may also prepare some improvements for other projects. Moreover, it sometimes happens that investment projects are executed just after finding the first client for their products, so that an investment project also has characteristics of an operational (commercial) project. Thus, the classification presented in Figure 4 does not consist of mutually exclusive categories. It is better to speak of operational (commercial), scope-extending and efficiency-improvement components of projects, instead of classifying them into one of the classes referred to above.

The full model of financial project evaluation should cover all types of financial project components. Moreover, it should take into account an appropriate share of financial components from evaluated project families – investment as well as operational.

In order to properly evaluate a project’s business effect, the scope extension cost and the efficiency improvement cost should be divided into two categories:

- Direct cost
 Costs incurred in a particular project.
- Inherited costs
 A share of ancestors' costs. If a project uses output from its ancestors, it must be charged with the appropriate portion of the costs of developing this output.

The operational costs, because of their very nature, are never transferred to other projects, so they invariably belong to the category of direct costs. The sum of all direct and inherited costs constitutes the full project cost.

Table 1 presents all components of financial project evaluation.

Table 1. Components of financial project evaluation

Evaluation Element	Symbol	Method of Calculation
Income and Savings		
Direct Income	DI (p)	The value received from selling the product of an evaluated project.
Expected Income	EI (p)	Income of evaluated project descendants received from selling products developed in an evaluated project.
Direct Savings	DS (p)	The measure of project processes performance improvement in an evaluated project in comparison to previous performances of the same processes.

Expected Savings	ES (p)	The measure of project processes performance improvement in descendant projects developed by a project under evaluation.
Cost Elements		
Direct Extension Cost	DEC (p)	The cost incurred for developing new products and services in an evaluated project.
Inherited Extension Cost	IEC (p)	A part of cost incurred by ancestor projects to extend a company's scope of products and services. Proportional to the share of income resulting from extending the scope of products or services.
Direct Savings Cost	DSC (p)	The cost incurred to improve effectiveness in an evaluated project.
Inherited Savings Cost	ISC (p)	A part of cost incurred by ancestor projects to improve project processes performance, which is ascribed for analytical purposes to the evaluated project. Also proportional to the share of income resulting from extending the scope of products or services.
Direct Operational Cost	DOC (p)	Incurred costs with results only in the evaluated project.
Auxiliary Elements		
VIN (p, r)	The value expected to be received in project r as the effect of scope extension by project p .	
CIN (p, r)	The coefficient of the share of the value expected to be received in project r as an effect of scope extension in project p divided into the total sum of all incomes in all p descendants attributable to scope extension by project p .	
VES (p, r)	The portion of project p scope extension cost ascribed to project r due to use by project r of products developed by project p .	
VSI (p, r), CSI (p, r)	Analogous to VIN and CIN, but related to savings developed by ancestors and effecting on descendants.	
VIC (p, r)	The portion of project p effectiveness improvement cost ascribed to project r due to use by project r of effects of efficiency improvement work performed in project p .	

Full evaluation	
E (p)	The sum of all income, savings and cost elements.

These components should be aggregated in the following way:

$$\text{Direct Cost DC (p)} = \text{DEC (p)} + \text{DIC (p)} + \text{DOC (p)}$$

$$\text{Inherited Cost IC (p)} = \text{IEC (p)} + \text{IIC (p)}$$

$$\begin{aligned} \text{Full Cost C(p)} &= \text{DC (p)} + \text{IC (p)} \\ &= \text{DEC (p)} + \text{DIC (p)} + \text{DOC (p)} + \text{IEC (p)} + \text{IIC (p)} \end{aligned}$$

The full project income is the income from all of its investment family – the evaluated project and all of its descendants. The same principle is valid for project savings.

$$\text{Full Income I (p)} = \text{DI (p)} + \text{EI (p)}$$

$$\text{Full Savings S (p)} = \text{DS (p)} + \text{ES (p)}$$

In order to fully evaluate a project's financial effect, one must take into account all of its income, savings and costs, direct, inherited and expected. Generally, the financial effect of project p is equal to:

$$\begin{aligned} E (p) &= I (p) + S (p) - C (p) \\ &= \text{DI (p)} + \text{EI (p)} \\ &\quad + \text{DS (p)} + \text{ES (p)} \\ &\quad - \text{DEC (p)} - \text{DIC (p)} - \text{DOC (p)} - \text{IEC (p)} - \text{IIC (p)} \end{aligned}$$

Figure 6 schematically presents components and structure of the Unified Project Evaluation Model.

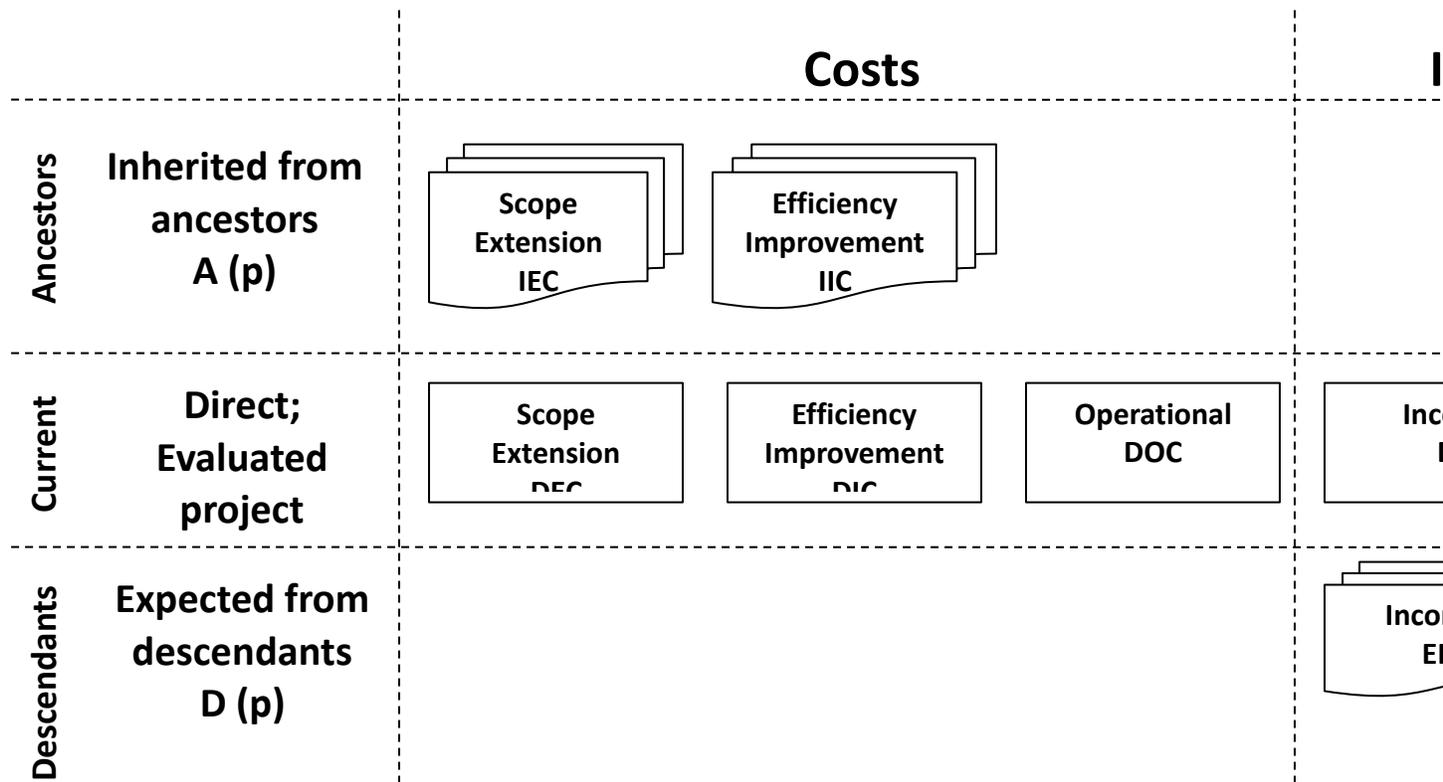


Figure 6. Unified Project Evaluation Model

Example 5

In order to demonstrate the use of the project family concept for evaluation of project financial effect, we will use the structure of projects shown in Figure 7.

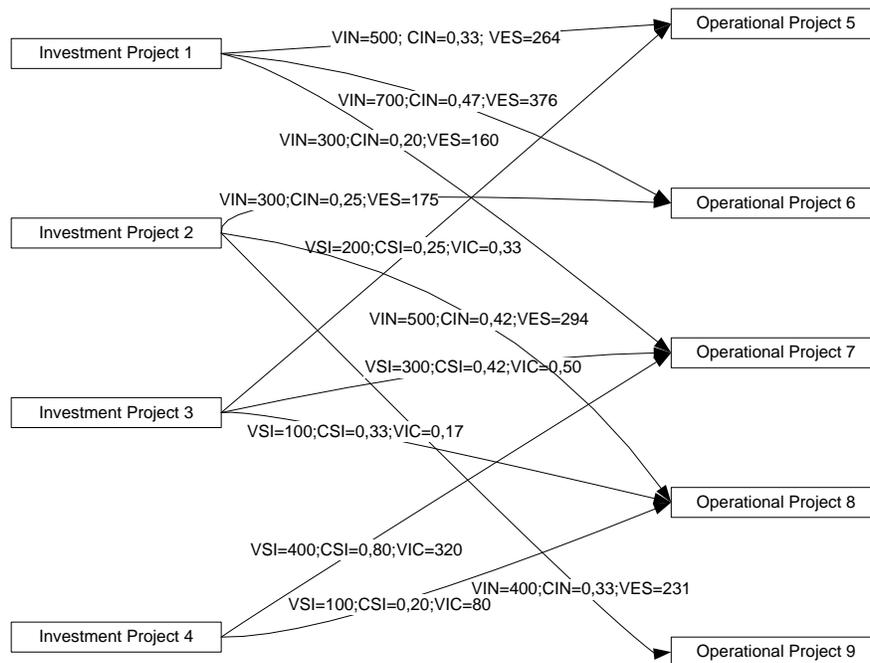


Figure 7. Exemplary project relationships

The final, full project evaluation is shown in Table 2 presented below. This example of analyzing the financial effect of projects illustrates the use of concepts related to the ancestor/descendant characteristic and the concept of project families established through direct application of this relationship.

Table 2. Example of full project evaluation

	EI	ES	DEC	DIC	DOC	DI	DS	DC	IEC	IIC	IC	C	I	S	E
p1	1500		800					800				800	1500		700
p2	1200		700					700				700	1200		500
p3		600		300				300				300		600	300
p4		500		400				400				400		500	100
p5					200	500	200	200	264	100	364	564	500	200	136
p6					300	1000		300	551		551	851	1000		149
p7					400	300	700	400	160	470	630	1030	300	700	-30
p8					200	500	100	200	194	130	324	524	500	100	76
p9					100	400	100	100	231		231	331	400	100	169

Extensions of the project family and UPEM concepts

Many organizations achieve their business goals by performing continuous processes. Health service units or post offices are good examples of such organizations. Some organizations more and more often achieve business effect by performing projects as well as by performing continuous processes. Where operational business processes instead of operational projects are conducted, the effect of investment projects may be observed in processes as well as in projects. The term “business managed object” denotes a business process or an operational project – entities of both types earn income or, more generally, constitute an organization’s business. So for purposes of extending the Unified Project Evaluation Model, the parenthood relationship as well as the investment family concept should be extended to include all business managed objects influenced by the investment projects.

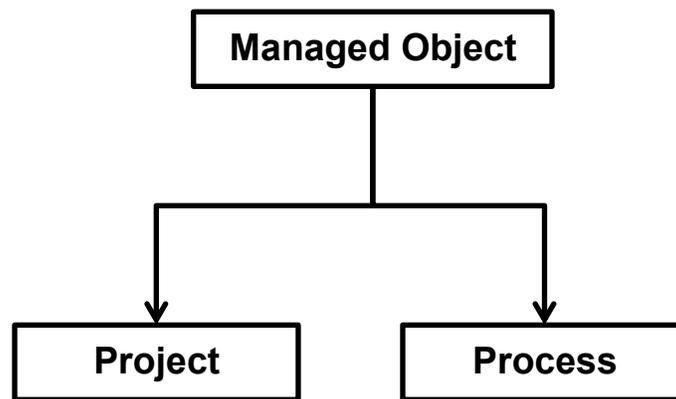


Figure 9. Managed Object as a generalization of project and process

If the main goal of project **u** is to improve client servicing process **k**, e.g. by implementing information system **S**, then the relationship $u \rightarrow k$ holds. The next, further extension of UPEM will generalize the concept of investment project to the concept of “organizational managed object”. An organizational managed object is a process or project, the output of which is used to achieve the organization’s internal goals; it does not generate any deliverables for the organization’s customers. There are two types of organizational managed objects: investment projects and supporting processes (e.g. training or accounting). Supporting processes must be components of the final evaluation model for several reasons – one of them is that they are implemented by investment projects, so a full model of project evaluation would be incomplete without them. The most general model of an organization’s performance is shown in Figure 8. The final extension of the UPEM will cover all of the organizational and business entities presented below and all of their interrelationships.

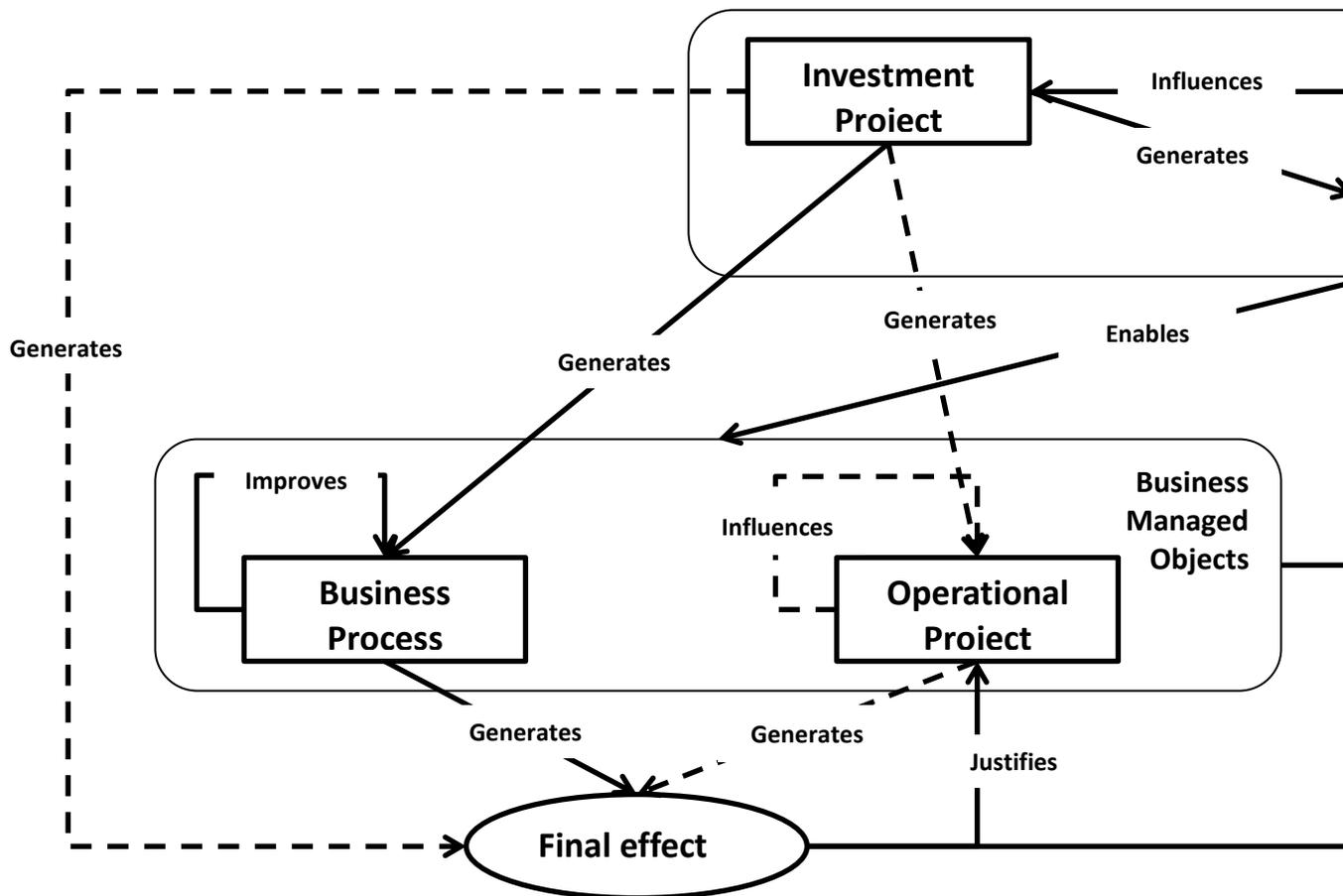


Figure 9. The full model of interrelationships between projects & processes in an organization

Systematic application of the extended Unified Project Evaluation Model will fully describe the flow of financial assets within any organization – project-oriented, operational (commercial) or of mixed type.

References

- Bonham, S. B. (2005), *IT Project Portfolio Management*, Boston, Artech House
- Gasik, S. (2008), Project Families and the Unified Project Evaluation Model, Proc. Of 22nd IPMA World Congress, IPMA, Rome 2008

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