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## PECULIARITIES OF INITIAL DATA FORMATION FOR DECISION MAKING AT EARLY STAGES OF LIFE CYCLE OF HIGH-TECHNOLOGY PROJECTS

*Analysis of modern approaches to the formation of initial data for management decision making on the basis of recommendations regarding usefulness of the project conceived is presented.*

*Possibility of making the erroneous management decisions, based on non-alternativity of initial data for usefulness project evaluation, is shown.*

*Necessity of alternative and competent formation of initial data for evaluation of the project usefulness is substantiated by the explanatory example. In case of the Project Idea Customer incompetency, it is recommended, during alternatives formation in RFI/RFP documents, to involve the external consultants which activity is not depends of work of the project usefulness evaluators. [dx.doi.org/10.29010/087.2]*

*Keywords:* project management; complex project; high technology engineering; life cycle of high technology project; RFI; RFP; initial data; usefulness evaluation.

### Introduction

Results of any process (action) are formed on initial data, laid into the base of sought result obtaining - it is well known not only as a methodology, but also from practice of activity of any material object. Importance of initial data for business-project success was determined by the classics of project management (see Fig. 1) [1]. It is noted, that the possibility of mistake (i.e. event connected with risk) "... is most considerable at stages of concept development, planning and beginning of work for the project ..." by which it is confirmed, that "... the

effect of risk event consequences on expenses will be the less, the earlier it will be revealed that such event may be happen. Namely at early stages of project realization the opportunity exist to minimize the risk effect or to avoid it at all ...". Correspondingly, the development of the project concept is based upon such initial data, which are selected before the work (processes, actions) beginning.

All the above-mentioned pertains equally to the complex projects which are typical for high technology machine-building enterprises, such as aircraft constructing works. However, quite often the aircraft con-

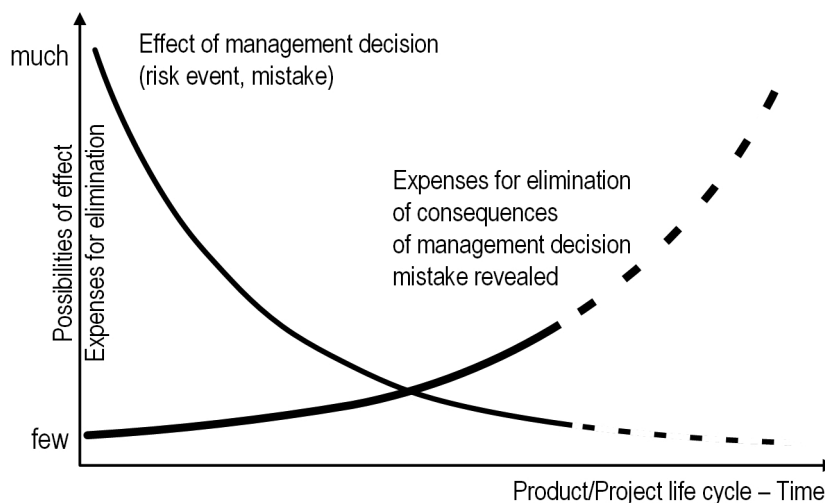


Fig. 1. Characteristic dependence of "price" of consequences elimination for erroneous management decision on time of such decision making in the Product (Project) life cycle [1]

structuring projects may be attributed reasonably to the unique "megaprojects", which are characterized, first of all, by large variety of internal interconnections, extra-high cost (tens and hundreds billions euro), colossal labor-intensiveness (taking into account even the modern computer technologies, etc.), large duration of their complex realization (years, and, frequently, ten years), specific mechanisms of capitalization (joint ventures, corporations, concerns, consortiums, etc.) and finance resources securing (mainly loan funds, state protectionism, preferences, etc.), as well as territory localization (locality, country, continent) and considerable social-economical effect (including both positive and negative electoral evaluation). At that, namely in the aircraft constructing projects, as a rule, two main parameters are combined, which result in great complexity of such projects (up to megaprojects) - there are high cost and large duration. Practice of modern aircraft constructing demonstrates, that the cost of only one project stage of modern aircraft development usually estimated in billions USA dollars (tens billions, for instance, for Boeing 787 Dreamliner) and duration of development stage only is not less than 5 years (for instance, the development stage for Airbus A380 was more than 11 years). Then it is obligatory follows the resource expenditures (financial, time, etc.) for creation (or modernization) of production facilities, at that, not only for direct manufacturers, responsible for aircraft final assembling, but also for numerous partners in production co-operation (for instance, manufacturers of engines, avionics, semi-finished constructional materials, etc.). Then the expenses are available for aircraft operating maintenance, including service, overhaul period extension, etc. According to the experts' forecasts, the life cycle of F-35 fighter project will be more 50 years and is evaluated summarily as 1 Tn. USA dollars. As a consequence, under such parameters of the project resource ensuring the "price" of management decision mistake, made during period of initial events before the project conception development, may be of inadmissible high values.

As is well known, the management decision always formed on the basis of initial data accepted. Correspondingly, selected and relatively accurate assigned initial data, considerably reducing the "inconvenient" primary total uncertainty for the conception development and oriented at most understandable and, seemingly, acceptable variant of the problem solution, nevertheless, may lead to unexpected negative result and ever to the rejection from further consideration of the project perspectives. And vice versa, "inconvenient" absence of concreteness in the initial data accepted and high uncertainty in the problem solution directions, as a rule, highly increases price of pre-project investigations, simultaneously not permitting to stop at acceptable variant of project conception – usu-

ally in such initial data the specific evaluation criteria are absent.

### **Problem Formulation**

It is obvious, that both variants of initial data selection (formulated specifically or formulated within wide limits) do not provide the acceptable solution of the problem. Nevertheless, the difference is in such matter that specifically preset data permits to evaluate the usefulness of further solving of the problem formulated, but expanded initial data ensures the possibility to re-evaluate the problem itself. Namely, if under some definite initial data the solution of initially formulated problem is evaluated as useless, than under consideration of another initial data the possibility to re-formulate this problem, if necessary, is appeared compulsorily. And so on - up to revealing of such formulation of the problem, which solution shall be evaluated as a useful. So, the "degree of risk" to refuse the useful project owing to initially incorrect formulation of the problem is considerably reduced [3]. Accordingly, the "error price" is highest during the initial data accept for management decision making for the project.

The necessity of initial data assigning for evaluation of project usefulness and decision making in connection with expediency of its initiation is an actual problem.

### **Known approaches to solving the problem**

Traditional base for solving the problem of initial data assigning for analysis and subsequent evaluation of usefulness of new complex high technology project is, first of all, practical scientific and technical experience relating to the similar projects which were realized formerly. According to such "traditional" methodology, the party interested in realization of the stated project (hereinafter referred to as the "Idea Customer", IC) usually applies to the well-known owners of proper practical experience with the proposals.

First of all, as a rule, the confirmation of competence in field of expected "evaluation" is requested, i.e. information request (RFI – Request for Information, see Fig. 2), as well as it is clarified the interest of the "competent" addressee to submit his proposal regarding the IC problem and to took part in competition of similar proposals. Then the request to submit the proposal (RFP – Request for Proposal, see Fig. 3) is sent to the competent (by the IC evaluation) potential participants of competition in which the main parameters of the IC problems are specified. At that, namely in the RFP there are assigned frequently in very accurate and specifically manner the initial data for acceptable variant of solution of problem prescribed, as well as its boundary parameters.

Undoubtedly, such accuracy is large "convenience" for any executor of works for fulfillment of evaluation requested by the IC, because in such case the work of the executor comes to obtaining the set of indices only which characterize the evidence of usefulness (or useless) of the conceived. Correspondingly, if the IC formulated the problem erroneously, for instance, narrowed the consideration areas of problem formulation variants, then the error value became the rejection of useful project in other, but more correct formulation only (as a sequence, with other initial data).

Explanatory example. Let us imagine that the IC is considering the project of any perspective aircraft production somewhere. By specific parameters of this aircraft the initial data are assigned in the RFP documents and problems are formulate, which the executor should evaluate as a result of his work for the IC recommendation issue: which decision should he make regarding usefulness of initiation of such business-project. For instance, marketing investigations present the results illustrating low payback of the IC project in the nearest years of production under condition of high level of modern automation of aggregate production and automated final assembling. At that, the IC is not includes into the RFP the alternative possibilities connected with simultaneously production of other perspective aircraft also. Moreover, the alternative of specified in the RFP ambitious high-level automation was not considered by no means. Although it is obvious, that under condition of absence of any essential basis of high technology machine-building (qualified personnel, developed normative-technical basis and corporative knowledge base/database, etc.) it is difficult to reach the effectiveness of automated production of complex high technology products, such as aircraft, without long-term experience of previous aircraft constructing production. At the same time, the reasonable alternative of such ungrounded production automation usually is gradual (step-by-step) development of technological aircraft constructing processes, beginning from mechanized assembling with "screwdriver" (complete knock down) technology, then passing gradually to more progressive and productive technological processes, including processes with elements of production automation. In other words, the problem formulation – "creation of co-operative automated production of perspective aircraft" may be changed by another formulation, for instance, "creation of aircraft industry" or others.

### Correction of conceptual approaches to the formation of initial data of complex projects

Classical sequence of management decision making process, based on multi-alternative selection, is known

[4]: at first, search of evident alternatives (variants) of problem solution, then, creation of new alternatives (variants), after that the selection of the best variant of management decision (by specified evaluation criteria) is carried out. The search and creation of alternatives is carried out according to initial data for decision making.

Formation of initial data for management decision making regarding usefulness of complex high technology project initiation is carried out by the IC, frequently with utilization of conceptual approaches based on RFI/RFP methodology. In general case, there are two alternatives regarding competence of the IC in field of the problem evaluated, for which the management decision must be made:

a) *competent*, because it is a participant of corporative surrounding, as well as a creator and producer of the Product<sup>1</sup>;

b) *non-competent*, because it has not enough practical experience (science, standards, guidelines, engineering, technology, management engineering, economics, marketing, operative maintenance, repair, upgrading, etc.).

The *competent* IC has possibilities to investigate in sufficient scope the presuppositions of realization of the project considered, to evaluate conditions and surrounding of this project, prepare necessary forecasts, as well as to propose the alternatives of the problem solutions with formulation of proper purposes and variants of its realization. First of all, this relates to evaluation of strategic and operational value of the project considered for achievement of the IC objectives, corresponding to its mission. Not less important mission of the competent IC is formation of initial data which permit to realize the project (science, engineering, resources, etc.) taking into account the obligatory of usefulness of results expected. Nevertheless, based on its own practical experience and corporative analogies, the competent IC may propose alternative resource (temporal, financial, price-based, etc.) and cost (productivity, labor intensity, production cooperation, etc.) aspects of variants of realization of the Customer's Idea. As a consequence, if the IC shall apply to the external executor for work fulfillment regarding the project usefulness evaluation, then such consultant usually confirms/refuse the management decision prepared by the IC itself. Then the possibility exists that the IC may make decision regarding closing or considerable revision of the project initial data.

Another situation is with the *non-competent* IC. Because in RFI/RFP methodology just the non-competent IC forms the initial data for subsequent evaluation of the project usefulness, the possibility is high that in such data the IC reflects its own non-alternative vision of the project results. In such case the IC

<sup>1</sup> Product – item or work.

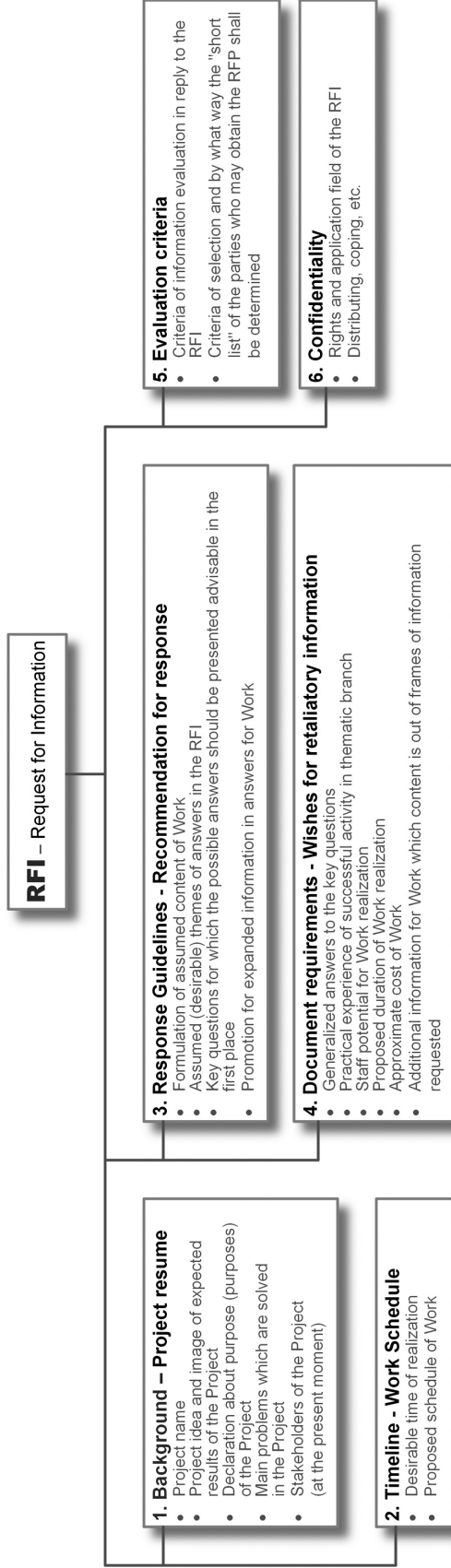


Fig. 2. Approximate block diagram of RFI for aircraft constructing project (by experience of the UkrRIAT, JSC)

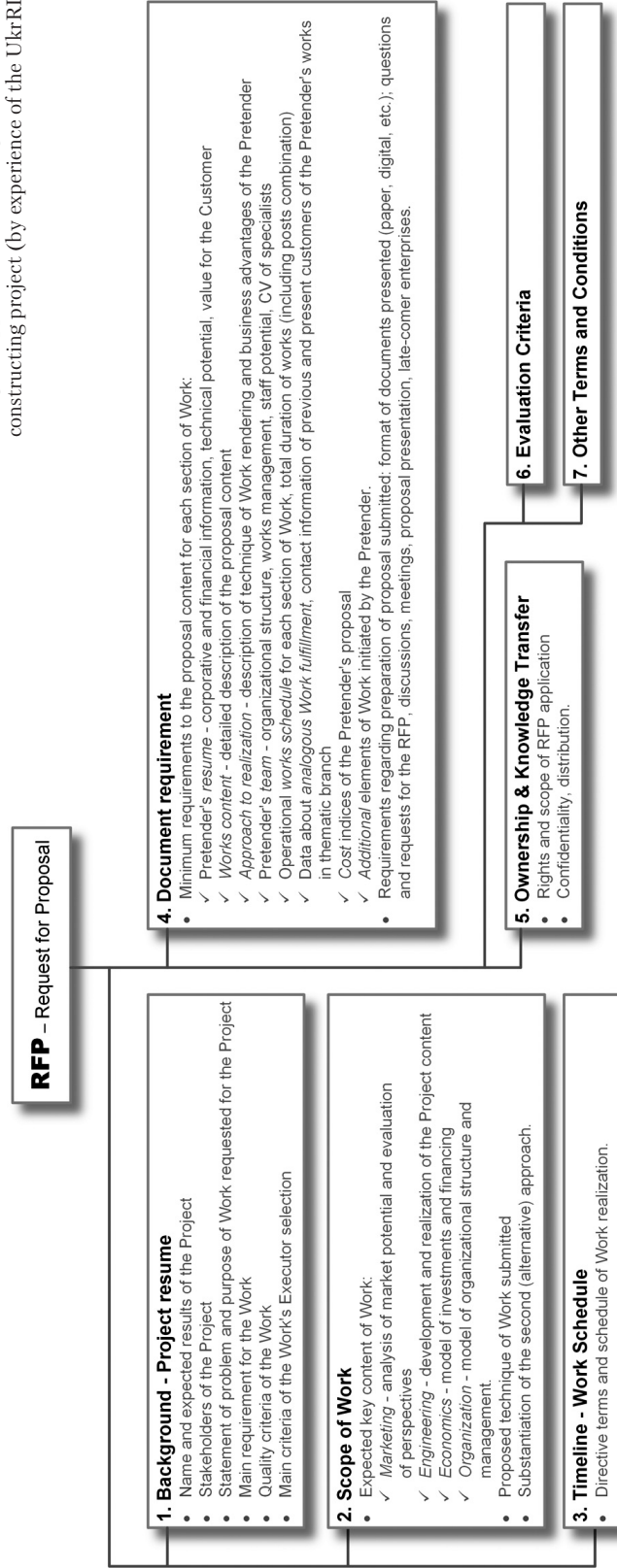


Fig. 3. Approximate block diagram of RFP for aircraft constructing project (by experience of the UkrRIAT, JSC)

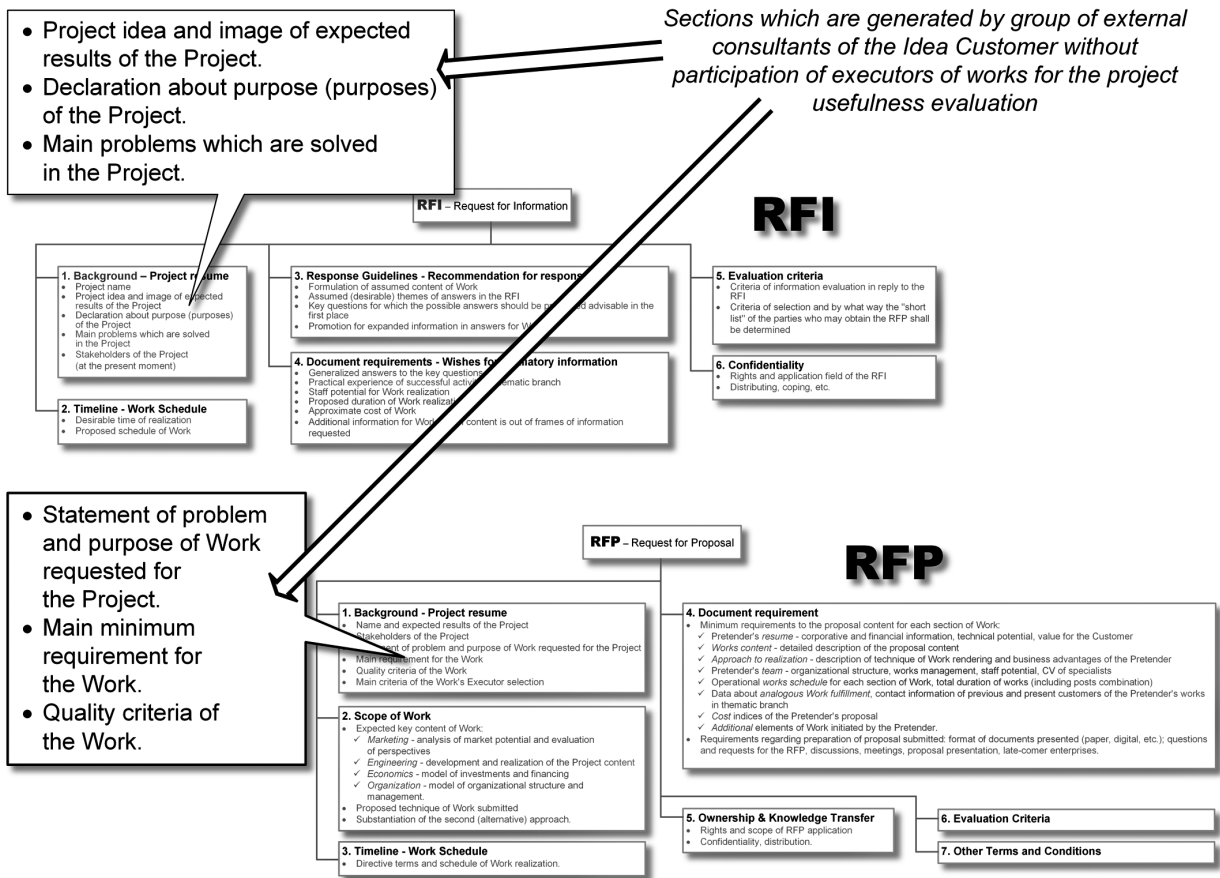


Fig. 4. Main scope of activity of the project's Idea Customer consultants (RFI/RFP methodology)

itself is waiting from the competent executor the work for evaluation of alternativeness of recommendations in order to make the management decision. Frequently such expectations are not substantiated because the executor is interested in good fulfillment of work, it handing-over to the IC and do not want to have any responsibility for subsequent development of events in connection with already evaluated project. However, such situation is not profitable for the IC.

Correction of conceptual approaches to the formation of initial data for complex projects, conceived by the non-competent IC, consists in consultants engagement for formation of initial data on alternative basis. Above-mentioned external consultants should be not less competent than the executors of work for evaluation of the project usefulness. Results of work of such external consultants must be proper corrections in the RFI and RFP (see. Fig. 4).

The IC must understand, accept and agree that the work of external consultants for formation of initial data for the project evaluation usually is not at all or weekly formalized, nevertheless it requires constant interaction both with the IC and with other potentially interested parties of the project. At the same time, the Idea Customer is interested objectively in providing of information-analytical and organizational-

bureaucratic support and protection for all main functions of external consultants in order to guarantee the correct account of all peculiarities of the project localization (legislative, lawful, public, resourced, etc.)

The important consequence of the external consultants participation shall be necessity of expenses for their work and proper rise of price of before-investment phase of the project. Thus, for simple projects the proposed correction of conceptual approaches to the formation of the project initial data may be considered as excessive, i.e. for such projects the additional justifications are necessary.

### Conclusions

1. The main reason for correction of conceptual approaches to the formation of initial data of complex projects is high possibility of non-alternative evaluation of usefulness of such projects owing to insufficient competence of the Idea Customer.

2. The work for more accurate definition of techniques recommended for the management decision making by the Idea Customer for the earliest events of the complex scientific-intensive machine-building project evaluated is continued by the authors.

3. For the project Idea Customers, which are not enough competent (without practical experience,

etc.), it is recommended to involve the external consultants for formation of competent alternative initial data by which the works for evaluation of usefulness of the project considered should be carried out.

#### Abbreviations

RFI – Request for Information  
RFP – Request for Proposal  
CI – Idea Customer

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### ОСОБЕННОСТИ ФОРМИРОВАНИЯ ИСХОДНЫХ ДАННЫХ ДЛЯ ПРИНЯТИЯ РЕШЕНИЙ НА РАННИХ СТАДИЯХ ЖИЗНЕННОГО ЦИКЛА НАУКОЕМКИХ ПРОЕКТОВ

*Представлен анализ современных подходов к формированию исходных данных для принятия управленческих решений на основе рекомендаций в отношении полезности задуманного проекта.*

*Показана возможность принятия ошибочных управленческих решений, основанных на безальтернативности исходных данных для оценивания полезности проекта.*

*На поясняющем примере обоснована необходимость альтернативного и компетентного формирования исходных данных для оценивания полезности проекта. Рекомендовано в случае некомпетентности Заказчика Идеи проекта привлекать к формированию альтернатив в документах RFI/RFP внешних консультантов, не зависящих от работы оценщиков полезности проекта. [dx.doi.org/10.29010/087.2]*

*Ключевые слова:* проектный менеджмент; сложный проект; наукоемкое машиностроение; RFI; RFP; исходные данные; оценивание полезности.

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