Journal of Multidisciplinary Engineering Science and Technology (JMEST)
ISSN: 3159-0040
Vol. 2 Issue 7, July - 2015

Method Of Choosing Web Project Management Strategy With Using Of Modified Analytic Hierarchy Process

Kateryna Alekseyeva
Dept. of Social Communications and Informational Activity
L'viv Polytechnic National University
L'viv, Ukraine
kateryna.alekseyeva@gmail.com

***Abstract* — The paper describes the method of choosing web project management strategy using Analytic Hierarchy Process and fuzzy logic.**

Keywords — web project; project management; fuzzy logic; analytic hierarchy process; project strategy

I. INTRODUCTION

Project management planning is one of the key tasks that appears during web project lifecycle. The process of managing web project assumes definition of some parameters that characterize such project peculiarities as scope, commercial characteristics, technologies that are used etc. One of the peculiarities of the parameters is some difficulty in determining their exact values. In such cases, it is reasonable to use methods and tools for project management, based on the principles of situational management [1] and fuzzy logic [2]. Today, systems and technologies of management, that operate using fuzzy values have become widely spread in various fields - from home appliances to the operation control of complex technological, industrial, biomedical, social and other processes [3]. Experience gained in the use of fuzzy logic in various fields allows applying its principles in the project management tasks.

Commercial web-project is creation by developer specific Internet resource for the sales order for further profits by using this resource in order to support the core business. One of the significant features of commercial web projects is their focus on using by the wide range of customers. Thus, the commercial component of project's success depends on many internal and external factors. Developer, project initiator and target audience of the product determine the value of indicators that characterize these factors of influence on project. These indicators cannot always be determined accurately and authentically enough. In such cases, there is a need in making design decisions, planning and tasks execution taking into account absence, incompleteness or inaccuracy of some data.

In the process of project management (in general case) management is carried out in the following areas [4]: time management, human resources management, project scope management, cost management, quality and communication in project procurement (purchasing finished products or third-party services that are necessary to project), project stakeholders management. For each of these areas there is a need to decide on how the particular resource is controlled.

The issue of the establishment, implementation and application of Internet technology for commercial use in various fields is now urgent. The issue of organization of commercial Internet resources discussed in [5], [1], [6]. [5] describes the general structure, key principles pf organization, designing and using of e-commerce content systems. In [1], [6] theoretical studies are made and the main principles of functioning of these systems are described.

II. DESCRIPTION OF KEY PROJECT CHARACTERISTICS

Projects is a product development stage and the project documentation containing final technical solution and provides a complete description of the structure of the software being developed. Project is an activity limited by timeframes that has the defined beginning and the end, usually limited by the date but can also be limited by the achievement of the results. This activity is made in order to achieve some goals and tasks that are unique to each project, having a goal to lead to beneficial change or added value [7].

Web project is a projects of informational resource with specific set of characteristics, that is limited in time, funding, customer's requirements and destination of the final informational product.

The basis of every project managing process (in particular, commercial web projects) are procedures of making project decisions. Basing on these decisions we define the very existence of the project, scope of the project, deadlines, budget, team of developers, resource allocation etc. The set of project decisions that define content, specification and order of execution of some project P will be called project profile S^P. In general case the project profile can be represented as a tuple $S^P = (s_1, s_2, \dots, s_n)$, where $s_i, i = 1,2, \dots, n$ – i-th project decision, n – number of project decision taken.

Every taken project decisions is based on the set of some parameters that characterizes the project and its environment. These parameters we will call the project characteristics. Every project characteristic h_j ($j = 1,2, \dots, m$; m – number of project characteristics for the project) in decision-making processes is specified by the pair

$$h_j =< N_j, d_j >$$

where N_j – the name of project characteristic,

d_j – the value of project characteristic, $d_j \in Dom(h_j)$

$Dom(h_j)$ – set of valid values (domain) of the j-th project characteristic.

So, the procedure of making some project decision $s_i(h_1, h_2, .., h_m)$, we can represent as some mapping

$$Q_i: Dom(h_1) \times Dom(h_2) \times \dots \times Dom(h_m) \rightarrow Dom(s_j)$$

where $Dom(h_1) \times Dom(h_2) \times \dots \times Dom(h_m)$ – generalized Cartesian product of domains of project characteristics (a set of tuples formed by their values),

$Dom(s_j)$ – a set of possible values of project decision s_j.

Project characteristics is key factors that influence on making project decisions. The main ones are listed below.

A. *Customer's Financial Data (H_1)*

The level of income of the customer (h_1) defines the budget of the project and characterizes client's solvency. We will estimate this characteristic on a scale from 0 to 1, where 0 means low client's income, 1 – high income.

Previous revenue from the customer (h_2) is a characteristic that describes existing relationships between executor of the project and the client. Previous revenue from the client we will estimate in percent from total executor's revenue and will convert in value from 0 to 1.

Potential revenue from the customer (h_3) we estimate in percent from total potential revenue of project's executor in some period and convert in values from 0 to 1.

B. *Data on Persons Who Represents Project Stakeholders (H_2)*

The character of the client's representative (h_4). Characters of the persons who communicate during project execution have a noticeable influence on quality of the communication and, so, on quality and speed of the execution of tasks set. In order to estimate the level of comfort of relationships we have to be informed about sociotypes of client and executor's representatives. Depending on relationship type between these sociotypes, they are assigned a rating, which indicates the level of comfort of the relations. [8].

Gender of client's representative (h_5) may affect the quality of communication between client's and executor's representatives, albeit lesser extent than character. Value 0 will means that gender has less priority, 0.5 – does not matter, value 1 – this is the gender with more priority.

Age of client's representative (h_6). In condition of great difference in age, (25 years or more that actually is one generation), communication between client and executor's representatives can be difficult because of different perceptions of tasks and different approaches to solve them. Assess the influence of age difference we can using the formula (1)

$$AgeInfluence = {}^{1}/_{AgeDiff} \quad (1)$$

where $AgeDiff$ is actual difference in age, in years.

Language of communication (h_7) is a level of knowledge of client's language by project executor. Value 0 – doesn't know at all, 0.5 – intermediate level, 1 – speaks fluently.

Professionalism of client's representatives (h_8) means how client's representative is aware of technologies used by project executor, so 0 – does not know, 0.5 – user's level, 1 – developer's level.

The number of people who make decision on the project (h_9). The simplicity of making decisions by the client's organization can be described by formula (2)

$$DecisionEfficiency = 1/n \quad (2)$$

where n is a number of people making final decisions on project.

C. *Project Budget Description (H_3)*

The scale of the project (h_{10}) is a percent of executor's resource that will be involved in developing the project in the scale from 0 to 1, where 1 means that all executor's resources will be involved.

The type of project funding (h_{11}) defines the flexibility of project's budget. Value 0 means the fixed budget where there no additional funding planned. Value of 0.5 means the possibility of additional funding if there is a critical need. Value 1 means that the client is ready to extend project's budget and provide additional funding in case of non-critical needs.

The ways of project funding (h_{12}) is a parameter that characterizes phasing of the work on project by funding the project partially. 1 means that work is paid all at once in the beginning or in the end of the work. $1/n$ – in case when project is divided in n stages.

D. *Characteristic of Developer and Customer Relationsips (H_4)*

Frequency of relationship with a customer (h_{13}): 0 – no periodical relationships, 0.5 – relationships are periodical but are limited in time, 1 – collaboration with client is periodical and not planned to be finalized.

Priority of the customer (h_{14}). Value 1 means that client has the highest priority, 0 that the priority is lowest.

Importance of the customer (h_{19}) is integral project characteristic that if defined by the actual and planned revenue from the client, loyalty of the client, with taking

into account strategic plans and business interests of project executor.

Comfort of work with the client (h_{20}) – is integral project characteristic that id defined by client's representative's character, client's loyalty, urgency of the project, client's form of ownership, level of client's representative's knowledge of technologies used, client's representative's age and gender.

E. The Specifics of Client's Organization (H_5)

Client's form of ownership (h_{15}). Value 1 means that the client's form of ownership is interested for project executor to work with. 0.5 – form of ownership does not matter, 0 - project executor is not interested to work with such client.

Client's sphere of activity (h_{16}). Value 0 means that client's sphere of activity is at odds with project executor's interests, 1 – the sphere of client's activity is interesting and promising for project executor.

F. Project Requirements(H_6)

Urgency of the project (h_{17}) has an influence on planning work on the project and prioritization for project executor. 0 – project is not urgent, 0.5 – average urgency, 1 – project is highly urgent.

Technologies of the project (h_{18}) is a set of technologies that can be described as a tuple (3)

$$TP = (t_1, t_2, \dots, t_n) \quad (3)$$

where t_i is the i-th technology, $i = 1,2,\dots,n$, n – number of technologies to which the client has requirements.

III. Elimination of Uncertainities in Project Characteristics

The analysis of project characteristics listed below shows us that defining their precious values in practice is complicated and sometimes even impossible task. Whereas a commercial web project matches a model of situational management [1], we can organize the process of making decisions on the project basing on incomplete, inaccurate or fuzzy data without decreasing the quality of result. We can replace the values of the project characteristics by some generalized values, which allow choosing the strategy of project management with sufficient accuracy.

One more peculiarity of the web project characteristics is absence of formal methods and procedures for determining values for most of them. The approach creates a possibility of using the principles of fuzzy logic [2] according to which the results of the estimating are shown in verbal linguistic form and management is basing not on the concrete values but on their fuzzy analogues. We will use in the process of web project management fuzzy matches of h1… h20, named h1* … h20*.

The following steps make using of fuzzy logic in processes and management systems: precise value → defining function of belonging → fuzzification [10] (transition to fuzziness) → fuzzy calculations → defuzzification (transition to precise values). The peculiarities of commercial web projects and the usage of model of situational management requires using the other way of forming and using fuzzy values of project characteristics in management process.

The first step is forming a verbal expert assessment h_i^* of value of i-th parameter without defining its precious value and function of belonging. For using fuzzy assessment in processes and means of commercial web project management the second step is their normalizing, which means coordinating of fuzzy values of parameters $h_1 - h_{20}$ to a single syntax and interpretation by semantic differentiation [6] using a scale [0;1]. The result of such action is replacing verbal assessment h_i^* by the numeric value d_i^* with taking into account content and relationships of linguistic values.

A. Types of Uncertainties in Project Chatacteristics.

Achievement of qualitative results in commercial web project management with the availability of incomplete and inaccurate data is based on identifying their origin and possibilities of interpretation. As shown in [9], uncertainties may arise for various reasons. The most common types of data uncertainties, according to [9] are:

1) Unacceptable value. The value is unacceptable for certain object because of its certain features or other objective or subjective reasons.

2) Unknown value. This kind of uncertainty provides options: value exists, but is not specified, or the fact of existence of the value is unspecified.

3) Value does not exist. It means that it cannot be specifies because of objective reasons or is not specified for the current time.

4) Value cannot be specified. It means that the value exists but is not accessible for using.

5) Value is not significant. This kind of uncertainties arises because of unreliable sources, receiving different data from multiple sources, using of anonymous sources, and ambiguity of evaluation, measurement inaccuracy or errors.

6) Value is not received. The value exists and it is significant, but because of some reasons, it is not yet received to the means of its application.

7) Value is empty set. Uncertainties of this kind arise for aggregated values.

This list can be prolonged, because in some situations other reasons of absence of project data may arise.

B. Processing of Uncertainties in Project Characteristics.

The algorithm of processing of uncertainties and selecting project management strategy is shown in Fig.1. For decreasing the level of uncertainty of project characteristics in decision-making process, we have to follow the steps below.

1. Divide the set of values of project characteristics on following categories:

- available and accurate,

- available and inaccurate,
- missing.

2. For missing values make a qualification of the reasons of the lack of project characteristic using the list of types of uncertainties given above.

3. If it is set that the value is missing because of its unacceptability or lack of preconditions of its origin:

- decisions for which current project characteristic belongs to the fundamental factors cannot be made;
- decisions, for which current project characteristic is secondary factor, are made without taking it into account, assuming that there is no influence of this characteristic on the decision making process.

4. If the cause of lack of the project characteristic is its inaccessibility, failure to obtaining it or unreliability that the value is replaced by the surrogate equivalent by the following options:

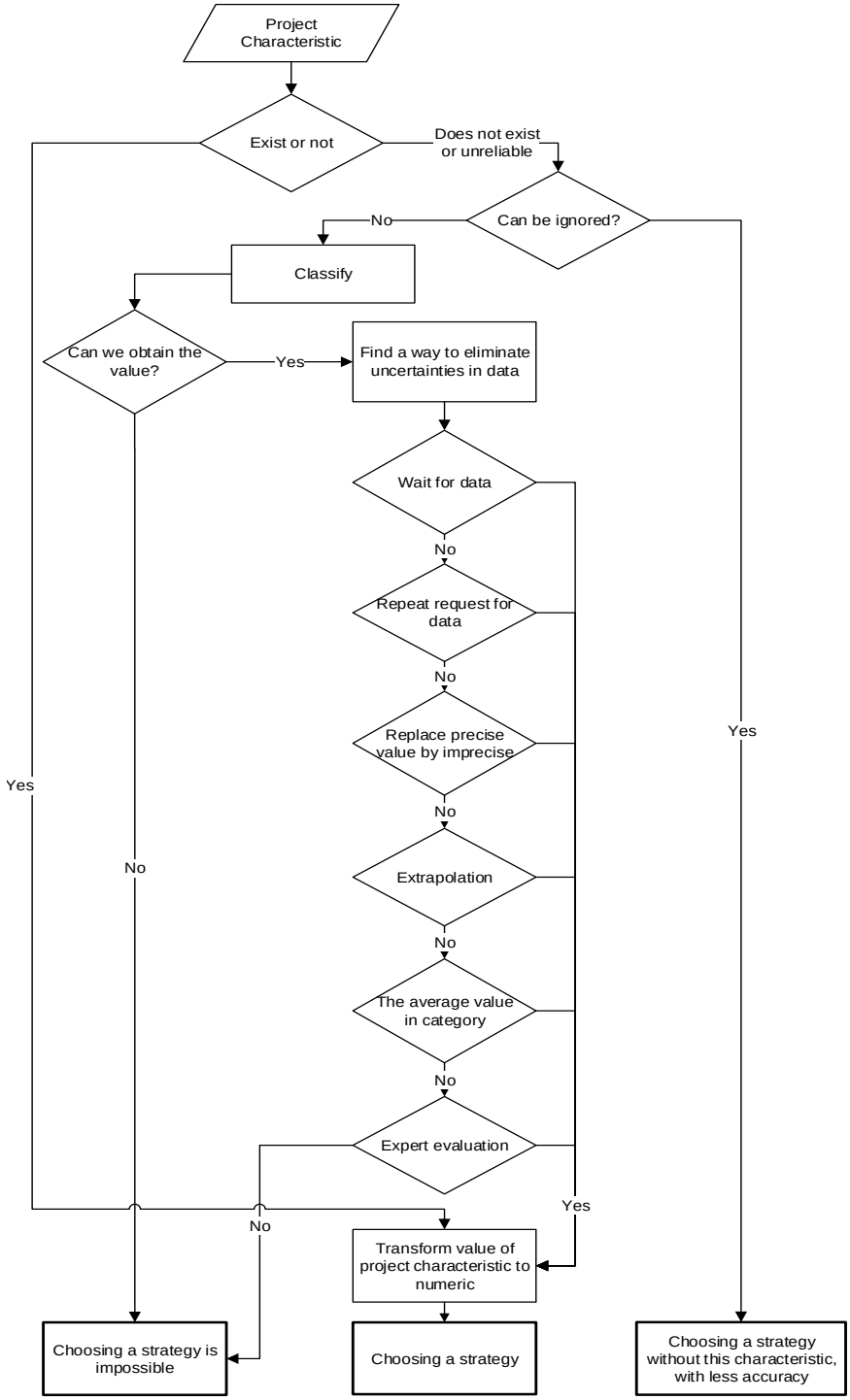

Fig. 1. *Example of a figure caption. (figure caption)*

- using predictive (evaluative) values;
- using of the average value of the characteristic;
- using the most probable assumption.

5. For every kind of project characteristics, we form the set of fuzzy linguistic values in order to replace real precise, undefined or missing values and the set of functions of membership [10].

6. The fuzzification of every of the project characteristics by replacing its value by the fuzzy linguistic value.

7. Normalization of the scale of values of project characteristics by defining numeric equivalents of the fuzzy linguistic values.

8. As a result, we obtain a complete set of precise values of the project characteristics that is needed to make project decisions that are consolidated to a single scale of such kind:

$H^* = \{ H_1^*, H_2^*, \dots, H_p^* \}$,

where $H_j^* = < N_j, f_j >,\ j = 1,2, \dots, p$;

p – number of project characteristics that are involved in decision making processes after using the procedure of reducing uncertainties,

N_j – name of characteristic,

f_j – numerical relative value of characteristic, $f_j \in Sc(H_j^*)$,

$Sc(H_j^*)$ – numerical scale of fuzzy linguistic values of j-th project characteristic.

So the procedure of making project decision $s_i(h_1, h_2, .., h_m)$ can be modified to the mapping

$$Q_i^*: Sc*(H_1^*) \times Sc(H_2^*) \times \dots \times Sc(H_m^*) \to Dom(s_j)$$

where $Sc*(H_1^*) \times Sc(H_2^*) \times \dots \times Sc(H_m^*)$ – a generalized Cartesian product of numeric scales of fuzzy linguistic values of project characteristics, $Dom(s_j)$ – a set of possible values of project decision s_j.

IV. Using Modified Analytic Hierarchy Process for Choosing Project Management Strategy

A. The Basic Set of Strategies of Web Project Management

The template of web project managing strategy is a set of strategies, each of which relates to one aspect of managing the project.

$$ProjectStrategy = (TimeStrategy, ScopeStrategy, BudgetStrategy) \quad (3)$$

$TimeStrategy$ – strategy of distribution of the time for the project (either project can be done in one step, or work on it should be divided into several stages, this strategy also depends on project urgency).

$ScopeStrategy$ – strategy of distribution of resources of project executor and planning the volume of work on project. This strategy depends on client's importance for project executor, on project urgency, on how promising is the project for executor.

$BudgetStrategy$ – strategy of managing project budget. It is a planning of project functionality that is implemented on each stage, because this depends on how the project is financed.

These strategies are associated to each other, and their relations is described by the project triangle (Fig.2), which describes the balance between project development time, project scope and budget [11]. The change of one aspects affects the other ones.

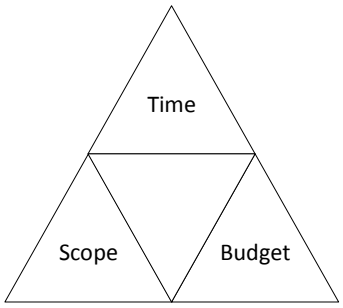

Fig. 2. *The project triangle*

Basing on these three components, we can form the basic set of strategies, as shown in Table I.

TABLE I. Basic Set of Web Project Managing Strategies

	Time	Budget	Scope	Project characteristics
S1	→ max	→ max	→ max	Long time, big budget, large amount of work
S2	→ min	→ max	→ max	Short time, big budget, large amount of work
S3	→ max	→ min	→ max	Long time, small budget, large amount of work
S4	→ min	→ min	→ max	Short time, small budget, large amount of work
S5	→ max	→ max	→ min	Long time, big budget, small amount of work
S6	→ min	→ max	→ min	Short time, big budget, small amount of work
S7	→ max	→ min	→ min	Long time, small budget, small amount of work
S8	→ min	→ min	→ min	Short time, small budget, small amount of work
S9	→ 0	→ 0	→ 0	Rejection of project

In order to form a basic set of strategies, we took the extreme values for each of three spheres – time, budget and scope. This set is extendable and refined by adding intermediate target values for each of these sub-strategies.

Each strategy of the basic set and their derivatives have such characteristic as priority. The priority of

strategy can be one of the following three (according to the project triangle, Fig.2):

- Strategies with time and scope priority
- Strategies with time and budget priority
- Strategies with scope and budget priority

The essence of this priority is the manifestation of triple limitations in the project, and predetermines the necessity of choosing two of the three areas possible. Take for example one of the strategies from the basic set S_4 $(Time \rightarrow min, Budget \rightarrow min, Scope \rightarrow max)$. If you apply this strategy priority time and budget, it will affect the amount of work and the amount will be planned as large as possible for a fixed time and budget. If you shift the priority to time and scope, i.e. to put a task to make the maximum for the short period of time, then the budget cannot be minimized lower than in case of the before-mentioned priority.

The priority defined the weight coefficients for the project characteristic for some category of strategies [12]. For each of them the project characteristics have different priorities, for example such project characteristic as the client's importance is important for the strategy S_8 $(Time \rightarrow min, Budget \rightarrow min, Scope \rightarrow min)$.

The strategy is a combination of possible values of project characteristics $H = \{H_1, H_2, \dots, H_n\}$. $H_1, \dots, H_n$ are values of the above-mentioned categories of project characteristics.

B. *Using the Analytic Hierarchy Process for Choosing the Strategy of Web Project Management*

Analytic Hierarchy Method is optimal for decision making in such conditions, because it is adapted for decision making in case of many factors [13][14]. It is often used it make decisions with a large number of factors and alternatives. It has wide application in various fields. For example, in [15] it is used for determine the competitiveness of firms.

For each strategy, we define the weight of each project characteristic. According to these weight coefficients, we make the analysis of priority of the groups $H_1, \dots, H_6$ for each strategy. At last, when we defined all priorities, we can put the normalized values of the project characteristics of the concrete project to this hierarchy and get numeric values.

The values of the project characteristics we get from the user of the method.

The process of defining the priorities consists in pairwise assessment of the project characteristics. Each category of project characteristics ($H_1, \dots, H_6$) we present in separate table for more convenience, and thus we obtain weight coefficients for the characteristics of certain category.

For the pairwise assessment of project characteristics, we will use the scale of pairwise comparison, proposed by Saaty [14].

TABLE II. THE SCALE OF RELATIVE IMPORTANCE ACCORDING TO SAATY

Intensity of relative importance	Definition	Explanation
1	Equal importance	Two items contribute equally to the objective(s)
3	Moderate importance	Experience and judgement slightly favor one item over another
5	Strong importance	Experience and judgement strongly favor one item over another
7	Very strong importance	An activity is strongly favors and its dominance demonstrated in practice
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
2, 4, 6, 8	Intermediate values	When compromise is needed
Reciprocal of the nonzero	If the activity i has one of the above nonzero numbers assigned to it when comparing with activity j, then j has the reciprocal values when compared with i	

1) Pairwise assessment of project characteristics for defining their weght coefficients in their parent categories.

In our situation, when the objective is to choose a strategy of managing web project, the process of setting the priorities will be modified. As was mentioned below, each strategy has such characteristics as priority.

The result of the pairwise assessment of the project characteristics, and, as a result, their weight coefficients, depends on choose of priority of the strategy.

a) Pairwise assessment of the basic project characteristics for calculating the integral ones.

Besides the basic set of project characteristics, the integral project characteristics also belong to the factors that have an influence on making project decisions. The value of the integral project characteristics are derived from the value of certain set of basic project characteristics and their weights. As

for different projects the priorities for calculating the integral characteristics may differ, we decided to use for their determining the pairwise assessment that is user in Saaty's analytic hierarchy method.

Therefore, we will calculate the value of integral project characteristic H_{Int_i} according the following scheme. $h_k, \dots, h_p$ is a set of basic project characteristics, that is included into integral characteristic H_{Int_j}, and $w_k, \dots, w_p$ are weights of corresponding project characteristics, or the intensity of their impact on integral characteristic. In our case the intensity of impact in an unknown value, thus the intensity of the impact assessment is arranged by pairwise comparisons, measured on a scale shown in Table II.

TABLE III. PAIRWISE ASSESSMENT OF THE BASIC PROJECT CHARACTERISTICS THAT ARE INCLUDED INTO INTERGAL PROJECT CHARACTERISTICS

H_{Int_i}	h_j h_k ... h_m	Vector of priorities
h_j	w_j/w_j w_j/w_k ... w_j/w_m	$v(h_j)$
h_k	w_k/w_j w_k/w_k ... w_k/w_m	$v(h_k)$
...	....	…
h_m	w_m/w_j w_m/w_k ... w_m/w_m	$v(h_m)$

b) Pairwise assessment of the project characteristics in categories

Priority (weight) of the project characteristic for the category, to which it belongs, is variable and depends on priority of strategy, defined by user. The priority of strategy is a subjective need of the project customer and defined the key priorities. Namely, $w_i = w(h_i) = W_i(PrS)$ where PrS is the priority of the strategy and w_i is weight of the characteristic h_i.

Definition of priorities in general case is shown in the Table IV.

TABLE IV. PAIRWISE ASSESSMENT AND DEFINITION OF PRIORITIES FOR PROJECT CHARACTERISTICS INSIDE THE GROUP

H_j	h_{j_1} h_{j_2} ... h_{j_p}	Vector of priorities
h_{j_1}	$\frac{W_{hj1}(PrS)}{W_{hj1}(PrS)}$ $\frac{W_{hj1}(PrS)}{W_{hj2}(PrS)}$ ... $\frac{W_{hj1}(PrS)}{W_{hjp}(PrS)}$	$v(h_{j_1})$
h_{j_2}	$\frac{W_{hj2}(PrS)}{W_{hj1}(PrS)}$ $\frac{W_{hj2}(PrS)}{W_{hj2}(PrS)}$ ... $\frac{W_{hj2}(PrS)}{W_{hjp}(PrS)}$	$v(h_{j_2})$
...	…	...
h_{j_p}	$\frac{W_{hjp}(PrS)}{W_{hj1}(PrS)}$ $\frac{W_{hjp}(PrS)}{W_{hj2}(PrS)}$ ... $\frac{W_{hjp}(PrS)}{W_{hjp}(PrS)}$	$v(h_{j_p})$

$v(h_{j_1}), \dots, v(h_{j_p})$ – components of the vector of priorities. The most precise results we obtain when calculating $v(h_{j_1}), \dots, v(h_{jp})$ as eigenvectors of the matrix. To obtain vector of priorities we need to normalize results of the calculation.

After calculating all the components of the vector for each of n rows, these components can be used for further calculations.

Calculating values of the groups of the project characteristics $H_1, \dots, H_6$ will be look like:

$$H_j = h_{j_1} v(h_{j_1}) + \dots + h_{j_p} v(h_{j_p})$$

$i = 1, \dots, m$, p – number of basic project characteristics in j-th group, h_{jk} – value of the jk-th project characteristic set by user, $v(h_{jk})$ – weight coefficients for jk-th project charaterictic.

After calculating values for groups of project characteristics $H_1, \dots, H_m$, we can calculate values of each strategy aspects (time, scope, budget) by the same way.

2) Pairwise Assessment of the Categories of Project Characteristics

After doing pairwise assessment of the project characteristics in groups, it is needed to define the priorities of the groups for each of strategy aspects – time, scope and budget.

TABLE V. PAIRWISE ASSESSMENT OF THE GROUP OF PROJECT CHARACTERISTICS

Strategy component (Time, Scope or Budget)	H_1 H_2 ... H_n	Vector of priorities
H_1	$\frac{W_{H_1}(PrS)}{W_{H_1}(PrS)}$ $\frac{W_{H_1}(PrS)}{W_{H_2}(PrS)}$ … $\frac{W_{H_1}(PrS)}{W_{H_n}(PrS)}$	$v(H_1)$
H_2	$\frac{W_{H_2}(PrS)}{W_{H_1}(PrS)}$ $\frac{W_{H_2}(PrS)}{W_{H_2}(PrS)}$ … $\frac{W_{H_2}(PrS)}{W_{H_n}(PrS)}$	$v(H_2)$
...	…	...
H_n	$\frac{W_{H_n}(PrS)}{W_{H_1}(PrS)}$ $\frac{W_{H_n}(PrS)}{W_{H_2}(PrS)}$ … $\frac{W_{H_n}(PrS)}{W_{H_n}(PrS)}$	$v(H_n)$

For further work, we need to make calculations for each group of project characteristics, because the comparison of possible strategies will be made basing on these values.

The values of project characteristics we obtain as a data from the user, its further processing and eliminating uncertainties in it.

3) Pairwise Comparison of Strategies of Web Project Management

After doing all calculations, we obtained values of strategy aspects – Time, Scope, Budget. Then we will estimate the priority of strategies for different values of these aspects by using pairwise assessment.

To simplify calculations and facilitate the process of setting priorities in general case, we consider two possible cases for prioritization strategies by using

extreme values of aspects in two ranges: values for from minimum to medium and from medium to maximum. Dividing a scale of aspect's values by more ranges will make the process more complicated for expert who will make assessment.

For example, in the table is shown strategy prioritization process for Time aspect.

$WS_i(PrS,T)$ – weight of i-th strategy, that depends on strategy priority and value of aspect (in this case, Time).

TABLE VI. PAIRWISE ASSESSMENT OF THE PROJECT MANAGEMENT STRATEGIES FOR TIME ASPECT

T (Time)	S_1 … S_m	Vector of priorities
S_1	$\frac{WS_1(PrS,T)}{WS_1(PrS,T)}$ … $\frac{WS_1(PrS,T)}{WS_m(PrS,T)}$	$v(S_1)$
…	…	…
S_m	$\frac{WS_m(PrS,T)}{WS_1(PrS,T)}$ … $\frac{WS_m(PrS,T)}{WS_m(PrS,T)}$	$v(S_m)$

V. CONCLUSIONS

The paper provides the method for choosing web project management strategy basing on the set of project characteristics. The method uses fuzzy logic for eliminating uncertainties in project characteristics and modified Analytic Hierarchy Process for choosing strategy.

REFERENCES

[1] D. Lande, V. Furashev, S. Braytchevskiy, O. Grigoriev "Fundamentals of modeling and evaluation of electronic information flows" Kyiv, 2006.

[2] Ya. Golota "Logics of anthonyms and fuzzy logic: siilarities and differences", International Conference on Soft Computing and Measurement (SCM'98). St. Petersburg, 1998, pp. 208-210

[3] A. Berko, V. Vysotska "Semantic integration of incomplete and inaccurate data" Systems of processing information. Collected Works of HUPV I. Kozhedub, Edition 7(79), 2009.

[4] Project Management Body Of Knowledge (PMBOK®) Guide –5th Edition, Project Management Institute Inc., 2013.

[5] A. Berko, V. Vysotska, L.Chyrun "Strycture of means of processing of informational resources in e-commerce content systems", Informational systems and networks: Collected works, Lviv, 2014

[6] D. Lande "Fundamentals of integration of informational flows", Kyiv, 2006.

[7] PMI "What is Project Management?", Project Management Institute, URL: http://www.pmi.org/About-Us/About-Us-What-is-Project-Management.aspx

[8] I. Podmarkova "Method of defining the index of comfort of relationships in group", Socionics and other Typologies, 2010: http://www.socionic.ru/index.php/2010-10-02-22-36-21/847-podmarkovaipmetodikaopredeleniyaindeksakomfortnostiintertipnyhotnosheniivgruppe.

[9] C. Date "Not is not 'not'! (notes on three-valued logic and related matters)", Relational Database Writings, 1994–1997, Addison Wesley Longman, 1998.

[10] L. Zade "The concept of linguistic variable and its application to decision making ", Moscow, 1976.

[11] D. Haughey "Introduction to Project Management", Project Smart, 2014. http://www.projectsmart.co.uk/introduction-to-project-management.php.

[12] K. Alekseyeva, A. Peleschyshyn "Using incomplete and inaccurate data in commercial web project management", Informational systems and networks: Collected works, No.805, Lviv, 2014, pp.345-354.

[13] T. Saaty, K. Kern "Analytic planning. Systems organization", Moscow, 1991.

[14] T. Saaty "Decision making. Analytic Hierarchy Process", Moscow, 1993.

[15] P. Terelianskiy, S. Kremenov "The implementation of the analytic hierarchy process to evaluate the competitiveness of computer firms", Vestnik VolGU. S.3: Economics, Ecology, No.2, 2008. pp.35-43.