The subject of tourism and the web ontology

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Abstract   Reviewed scope of contractual relations in tourism based on the theory of games with the aim of forming web ontologies for professional and educational activities.
Keywords   web ontologies, semantic web, a matrix of strategy, game, a payment matrix, partners with the nonzero sum, tour operator, hotelier

The background

A common problem in multi-agent intelligent systems is a significant dominance of the software implementation of the above subject area or subject formulation of the task. But it was subject knowledge are at the core of these systems. Many description languages, models, and approaches used in knowledge management systems, on the one hand, enhances the details of the subject description, on the other - complicates the perception of the surveyed links, requiring the researcher knowledge and skills to work with each tool.

The introduction of ontologies in the design of complex systems reduces the value of the specified problems. It was first used philosophical term in the field of information technologies, in particular on the semantic web, Thomas Graber, interpreting the ontology as a specification of conceptualization [1]. As a conceptual category ontology explains such constructs as a class hierarchy in object-oriented programming, concept maps, semantic networks and other.

The construction of the ontology includes (1) subject area analysis, (2) the assignment of basic elements (objects, their attributes, relations and processes) that are semantically relevant to a given domain, (3) operations on these ontological elements [8].

The thus created the exact specification of a certain subject areas and relevant it resources is based on a formal and declarative representation of pointers to special definition and logical relationships between them by dictionary type.

In other words, ontologies form vocabularies (taxonomies) for the objective of providing and exchange of knowledge, including interdisciplinary, as between the terms in these dictionaries have multiple links. The use of ontologies actively oc-

curs in the area of multi-agent intelligent systems and knowledge management systems.

Tourism is an information-sensitive industry [10]. The tourism in the preparation of ontologies for knowledge management portals as basic elements can be considered: tourist and travel; economic agents and objects of tourist demand; contractual relations and business entities, and other areas of multifunctional and cross-sectoral level. Structural-semantic analysis revealed 95 concepts [12], determining the content of the tourism and requiring the subject specification.

As properties characterizing the subject elements, can be considered respectively: the needs of tourists and climatic preferences; type of activity and the way to meet needs; contract types and varieties of agents of the tourist market. Operations on designated ontological elements will be included: moving tourists from normal habitat; air transportation; forming conditions and the contract.

Ontology tourist portals can be used in an organization intelligent search on travel web resources, the development of intelligent agent in the field of e-Commerce [9], the learning agent interacts with the environment, the ranking of the most likely user preferences from a list of trips, the analysis of opportunism and wins in a contractual relationship. The same ontology can be used to build educational conceptual model on the basis of which further creates learning games.

The theory of being moved into exact Sciences, where semi-formalized conceptual model accompanied by a rigorous mathematical definitions

The structure doesn't change, changes a condition. The system always assumes existence of the relations between elements, it making. Numerous elements of system have an interconnection. Plurality of actions is ordered by the relations. Relations: the unity, coordination, a set, a wholeness of everything around, equality, more, less, the identity, similarity, distinction, a contradiction, accessory, a causal interaction, target interaction, mutually advantageous interaction, opportunism, etc., except the subject - an objective component are allocated with an existence and change of events.

Temporary relations of real events: before, after, together (the coexistence, a simultaneity, a synchronism) are ideal moments of the realized idea of time [6]. Really, all called relations have no current on time axis, they aren't events, but they make a necessary condition (coordination) of approach (fulfillment) of an event and its fixing on time axis (N. O. Lossky's idea, 1870-1925). Besides, the heterogeneous relations in system submit to temporary hierarchy: (1) ecology-social level – the relations of the person with environment; (2) level of the relations of the individual and group; (3) event (situational) level not person, but individual (F.Brodel, I.Prigozhin's ideas. Similar stratification of life allows constructing a matrix of conditions on the basis of which there is a process organization

(consecutive following of set of events). The matrix allows splitting up "a movement" and at the same time to fix various dispositions, situations which took place during the various moments of time. The matrix structure allows predicting behavior of system (table 1).

Table 1. The matrix splits up movement and at the same time fixes situations during the different moments of time

Hierarchy by attribute "duration" Min ➤ Max	Axial time		
	last time	present time	future time
Events	a_{11}	a_{12}	a_{13}
Groups of people	a_{21}	a_{22}	a_{23}
Environment	a_{31}	a_{32}	a_{33}

Having added hypothesis of Aristotle's strategy by modern knowledge of a phenomenon of time it is possible to present construction, characterizing the relations function. Argument of this function is time. The in itself phenomenon of time is multipurpose. To functions of time refer movement, a condition, sequence, a mode, representation, for example, idea of a variety is no other than information.

Time is a data carrier. Information is differently coded in a situation when reflects superficial signs, and when intrinsic, internal. The concept of information corresponds with ideas of its quantity and quality, reliability, adequate quality, and also value for the solution of specific objectives. Relevance (compliance) of information in the theory of systems correlates with paradoxes of a "strict" form of rationalism. For example, basis of concepts and categories of rationalism doesn't include such concepts as belief and hope (K.Jaspers) though theories use mathematical models of time. In forecasting or representation (modeling) of succession of events (future) always there is something from "desire" of the person, from his plans, his expectation. In this regard it should be noted that in the theory of games the concept "expectation", not equivalent to mathematical definition «average expectation», but quite similar to the concept "hope" is used. Possibly theory of games is that field of knowledge which plans ways of expansion of traditional rationalism.

Let's consider the solution of contract tasks in the sphere of tourist services from positions of the theory of games. The contract relations assume conditions of mutually advantageous action of several partners on business: (1) conditions of a sure gain - receiving profit at once; (2) conditions of the mediated benefit in the long-term period at the expense of coherence of business processes.

Contract terms in tourism from the standpoint of the theory of games

By participants of the contract relations we will appoint tour operator (the founder of a complex product – traveling) and an hotelier (service provider of hospitality). Strategy of tour operator and hotelier are reflected in tables 2 and 3 respectively. Relevant information on a condition of the environment of interaction is presented in tables 4-6. Event' level is considered in the game description.

The problem of game consists in search of optimum (mutually advantageous) strategy of business for both partners.

Table 2. Strategy of Tour operator

Tour operator A The Strategy	Scenario (version)	
	Benefits	Risks
A1 Rent of all hotel	The guaranteed number of rooms during a season High % (till 45-50) discounts from the price of direct sale of a number of rooms that increases price maneuverability of realization of tours (difficult products) Possibility of distributive sales and obtaining the commission income	Immobilization of the large sum of money in the period (no more than a quarter) The big amount of losses during a low season Probability of absence of sales during a season Delay of bank operations Change of an exchange rate
A2 Commitment	Full or partial advance payment of the declared quantity of numbers (block) directly ahead of a season Possibility of acquisition of blocks of places at the same time in several hotels - expansion of the range of rounds according to served segments of the market Situational regulation - possibility of a choice of the soft block (with penalties for failure of all block or from a part before arrival date, but with smaller %) or the rigid block (with a full liability for realization and higher %) – decrease in situational risk Possibility of distributive sales and obtaining the commission income	Responsibility for realization The big amount of losses during a low season Probability of absence of sales during a season Delay of bank operations Change of an exchange rate
A3 Allotment	The demand about the sizes and duration of the reserved block without an advance payment Doesn't demand big financial support and immobilization of assets Great opportunities in assortment policy There are no risks of loss of advance payment Allows to begin business without the considerable starting capital	Work with little-known or unpopular hotels Low interest of a discount from the price of direct sale (10 %) Price appeal of round is reduced The share of profit in a tourist's product is lowered
A4 Irrevocable booking	Defines quantity of numbers for the fixed or prolonged period with the instruction in the demand of date of fee	In case of violation of terms of payment there are penalties Delay of bank operations Change of an exchange rate

| A5 | The raised commission | Booking and payment of room numbers under the specific client concordant with conditions of tour, made an advance payment or paid completely a tourist's package that excludes risk of penalties which are transferred on the client in default from tour | Low % from direct sales (15%) Change of an exchange rate The share of profit in a tourist's product is lowered |
| A6 | Time share | Participation in exchanges of weeks and in registration of accompanying documents, tickets for vehicles, excursion and entertaining service, rent of cars Work with a consumer segment – small group | Change of an exchange rate |

Table 3. Hotelier's Strategy

Hotelier B The Strategy		Scenario (version)	
		Benefits	Risks
B1	To lease all hotel	Receiving advance payments for a quarter forward, appears possibility to invest money in development Decrease in expenses for marketing, flow of documents The guaranteed sale of room numbers There are no risks of seasonal dependence of sales The account part of the budget is covered by rent payments	At a great demand the probability of loss of the most part of the income is high Delay of bank operations Change of an exchange rate
B2	Commitment	Guarantee of obtaining the income irrespective of success of sales and demand size Extension of marketing programs without additional financing	Need the declared room numbers to provide in certain terms at determined price Acceptance of a part of responsibility in case of absence of sales or low sales Delay of bank operations Change of an exchange rate
B3	Allotment	Payment occurs at arrival of tourists Loading is guaranteed during a low season Decrease in a distributive discount provides profit growth A wide number of the partner relations provides more possibilities in promotion and realization	Absence of advance payments Idle time of room numbers is possible High risks of the missed benefit in the absence of sales, unreliability of partners Change of an exchange rate
B4	Irrevocable booking	There is an additional sales channel of a number of rooms is block The fixed dates of receipt of payments Penalties in case of non-compliance with terms of payment or other contract provisions	Fragmentary character of the business relations Decrease in profit on sales Change of an exchange rate
B5	The raised commission	Additional sales channel of individual room numbers Responsibility for timely payment lies on in full by the guest	Fragmentary character of the business relations Decrease in profit on sales Change of an exchange rate
B6	Time share	The guaranteed sale of an apartment's part of a number of rooms to the end user on time share system Obtaining the fixed income in the long-term period Participation in programs of an exchange for weeks Advertising in catalogs of tour operators and other hotels working in system of an exchange Service of small group	Non-payment of the week by the end user

Table 4. Situational expenses of Tour operator, relevant to the scenario [3]

Index Situation	Specific costs for succession of events for the scenario (on unit of a number of rooms)						Cumulative value
	Costs for an advance payment (% of discounting of money for acquisition of an insurance stock – a share from the price of a unit of a number of rooms) **S1**	The expenses connected with placement of the order at service provider **S2**	Losses during a low season (costs for channel reservation) **S3**	The missed benefit at a great demand and limited possibilities of service **S4**	The missed benefit because of a delay of payments, changes of an exchange rate of currencies **S5**	Costs of acquisition of unit of the services, considering wholesale discounts for order volume **S6**	$\sum_{i=1}^{5} S_i$
A1:K1	20	20	0	15	15	40	110
A2:K1	20	20	30	15	10	25	120
A3:K1	20	20	45	10	10	15	120
A4:K1	20	20	45	5	10	10	110
A5:K1	20	20	50	5	5	20	120
A6:K1	20	20	5	0	15	30	90
A1:K2	20	20	0	0	15	40	95
A2:K2	20	20	30	0	10	25	105
A3:K2	20	20	40	5	10	25	120
A4:K2	20	20	30	5	10	10	95
A5:K2	20	20	40	0	5	20	105
A6:K2	20	20	5	0	15	30	90
A1:K3	20	20	0	0	25	40	105
A2:K3	20	20	0	0	25	25	90
A3:K3	20	20	50	0	25	20	135
A4:K3	20	20	45	0	10	20	115
A5:K3	20	20	40	0	5	25	110
A6:K2	20	20	0	0	25	30	95

Table 5. Options of succession of events

Option index	Character of option
K1	The current demand corresponds to the planned offer
K2	The current demand is higher than the planned offer (the missed benefit)
K3	The current demand is lower planned (straight losses)

Table 6. Assumptions of a market condition: the conditions influencing efficiency of contracts of Tour operator and Hotelier

Season	Price high		Price low	
	Popularity high	Popularity low	Popularity high	Popularity low
The high	C1	C4	C7	C10
Inter-season period	C2	C5	C8	C11
The low	C3	C6	C9	C12

Game. The tour operator signs the contract with the old partner Hotelier for a complete set of tours in a segment «the sun, the sea, the sand».

Within the contractual relations the following options successions of events (table 6) are possible:

1. The current demand corresponds to the planned offer (К1).
2. The current demand is higher than the planned offer (the missed benefit, К2).
3. The current demand is lower planned (straight losses, К3).

Strategy of Tour operator (A1, A2, … A6) are presented in table 2. Possible scenarios of succession of events will be 18. For the chosen scenarios the matrix of prizes on the basis of data from table 4 where expenses of Tour operator, relevant are presented to the scenario is defined. The economic sense of a prize of a matrix that a certain strategy will show the maximum volume of expenses of the participant of game, thus, declares strategy the least favorable at this conjuncture.

$$A_{ij} = \begin{Bmatrix} 110 & 140 & 130 & 120 & 105 & 10 \\ 105 & 135 & 140 & 130 & 110 & 15 \\ 120 & 135 & 95 & 100 & 100 & 15 \end{Bmatrix}$$

If elements of a matrix of prizes have negative values, it means losses at implementation of these scenarios.

The matrix of probabilities of emergence of this or that situation in the course of realization of strategy of Tour operator has the following appearance.

$$P_{ij} = \begin{Bmatrix} 0,5 & 0,7 & 0,4 & 0,6 & 0,6 & 0,7 \\ 0,3 & 0,2 & 0,4 & 0,3 & 0,2 & 0,1 \\ 0,2 & 0,1 & 0,2 & 0,1 & 0,2 & 0,2 \end{Bmatrix}$$

P_{ij} - a matrix of probabilities of implementation of possible scenarios in game, are thus satisfied the following conditions:

$\sum_i^3 P_{ij} = 1, \ j = \overline{1,m}, \ m = 6$

It is possible to find a mathematical expectation of a prize for each strategy of Tour operator of Aj

$$M_j = \sum_{i=1}^{3} A_{ij} \times P_i$$

The maximum average prize (in an example the maximum average value of expenses) will provide optimization of strategy of the player.

$$M^* = \max M_j$$

Such decision is called as optimization "on the average". The prize of the player "on the average" will make $\alpha = max \sum_{i=1}^{m} A_{ij} P_{ij}$

Matrix game on optimization of a prize will show us that strategy A2 will be the least effective as provides the maximum average prize 138,5. The tour operator can concentrate efforts to realization of strategy A1 and A5, guaranteeing the minimum expenses at a considerable turn. Strategy A6 is good addition to business as doesn't assume acquisition of a number of rooms. Strategy should be considered «Allotment» and «Irrevocable booking» as the most expensive.

Hotelier's strategy (B1, B2, … B6) are presented in table 3. Possible scenarios of succession of events will be 18. The matrix of prizes for these scenarios is defined: $A_{ij} = \begin{Bmatrix} 110 & 120 & 120 & 110 & 120 & 90 \\ 95 & 105 & 120 & 95 & 105 & 90 \\ 105 & 90 & 135 & 115 & 110 & 95 \end{Bmatrix}$

If elements of a matrix of prizes have negative values, it means losses at implementation of these scenarios.

The matrix of probabilities of emergence of this or that situation in the course of realization of strategy of Hotelier has the following appearance.

$$P_{ij} = \begin{pmatrix} 0,7 & 0,4 & 0,5 & 0,6 & 0,8 & 0,7 \\ 0,2 & 0,2 & 0,3 & 0,2 & 0,1 & 0,1 \\ 0,1 & 0,4 & 0,2 & 0,2 & 0,1 & 0,2 \end{pmatrix}$$

Matrix game will show that in considered situations of succession of events strategy B2 for Hotelier is the least favorable on joint costs. However, it is necessary to pay special attention to development of strategy B3 and B4 as expenses at their realization slightly differ from the maximum average value of strategy B2. Work on conditions «Time Share» (strategy B6) is favorable to Hotelier, but considering specifics of the Russian tourist market it can't be recommended as priority. Hotelier bears the minimum expenses and risks at realization of strategy B1 (To lease whole Hotel), however this strategy minimizes also profit.

The analysis of the relations of Tour operator and Hotelier can be concentrated to the solution of problems of formation of long-term profit. The partner relations in the long period allow concentrating efforts of each participant of the agreement on specialized tasks. Specialization strengthens competences and competitive advantage in the market both at the price and on quality.

Conclusion Cooperation of Tour operator and Hotelier can be realized according to the strategy considered earlier (A1, A2, A3, … A_n, where n = 6; B1, B2, B3, … B_m, where m = 6). The assessment of each option of interaction assumes a compromise reached by obtaining of advantage of one player at the expense of another. For example, the price of unit of services provided by Hotelier (Rack Rate) enters into prime cost of unit of services of Tour operator (Tour or a Route). Respectively Hotelier is interested in maximizing this price, and Tour operator - in minimization. The compromise can be reached at the optimum price allowing Hotelier to count on minimum price with the maximum profit, and to Tour operator to receive a ceiling price with the minimum expenses. Formalization of the accepted condition will allow making game [4].

Let the Tour operator chooses *i* course. In the worst situation for it he will win $min\ A_{ij}$. Aspiring to make the minimum prize maximum, he chooses the course from $maxmin\ A_{ij}$ condition. Such strategy is called as max-min. Similarly, Hotelier, choosing *j* course, in the worst situation for itself loses $max\ A_{ij}$. Aspiring to make the maximum loss minimum, he should choose the course from $minmax\ A_{ij}$ condition. Such strategy is called as mini-max. The ratio between max-min and mini-max strategy submits to inequality: $maxmin\ A_{ij} \leq minmax\ A_{ij}$.

Game is represented in the form of a payment matrix of *aij* which elements correspond to strategy of players of Tour operator *A* (*i*) and Hotelier *B (j)*. In this game strategy (6) isn't considered, as it doesn't assume acquisition of a number of rooms, so and the price for room in a payment matrix won't be. The prize subject for participants took the optimum price for the Hotel's room (Rack Rate). Expedi-

ently in matrix game to divide situations on signs the "high" and "low" price to avoid mistakes by optimization of the contract price depending as well on elasticity of demand. Players adhere to "careful" strategy at deduction of the optimum price both in high-price strategy, and in low-price: (1) the player A aspires to the guaranteed prize not less α; (2) the player B aspires to lose no more β.

Value of the price for unit of the services ($\alpha = \beta$) is a saddle value. The economic sense of a saddle value consists available balance of the price relations between Tour operator and Hotelier who defines the solution of game. At this price Tour operator and Hotelier become «the counterbalanced pair»: $\delta = \alpha - \beta = 0$, so, there is no sense to push "luck" [11]. Such price guarantees the most effective strategy of business. Existence of a saddle value (a condition of equal satisfaction of partners) isn't obligatory. In games the result extremely depends on a factor of subjective choice of strategy. The saddle value in matrix games will be rather an exception, than a rule.

If the saddle value isn't present ($\alpha < \beta$), in such situation it is necessary to choose a course in a random way [5]. Such choice of a course received the name of the mixed strategy. Application in game of the mixed strategy with a casual choice of a course optimum under condition of repeatability of a large number of parties and possibility of averaging of results as in game there is no saddle value, and is absent information on the strategy chosen by the opponent. The task is reduced to definition of probabilities of a choice of initial strategy. P_i– probability of a choice *f-number* strategy, $\sum P_i = 1$.

Conclusion

Mathematics and logic application at the solution of problems of rationalization of "expectation" and "hope", search of favorable outcomes in the conditions of uncertainty and instability (modes with aggravations) systems allows to lower risks of mistakes, subjectivity in decision-making to avoid a negative effect of resulting divergence «the knowledge – opinion». This result is important from the point of view of negotiation and formation of suitable conditions for the implementation of contractual relations in the particular case. But even more important result is a taxonomy contractual relationship between the tour operator and hotelier to create web ontologies. The web ontology expands the scope of the presented design from professional activities to educational. The material presented can be used to create web ontology contractual relations in the corporate knowledge management system, training programs, business games, test tasks.

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