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ARTIFICIAL INTELLIGENCE IN DETERMINATION OF MARKETING CUSTOMER STRATEGY

UMJETNA INTELIGENCIJA U ODREĐIVANJU MARKETINŠKE STRATEGIJE KUPACA

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Abstract

Artificial intelligence is a computer-based analytical process that tends to create computational systems which we would incline to be called intelligent. Expert systems are the most important part of the artificial intelligence from economic perspective. Expert systems attempt to mimic the human thought process including reasoning and optimization. "Knowledge" is represented by a set of "if-then" rules in a form of knowledge base. The results of artificial intelligence system implementation in refining marketing customer strategy based on five customer behaviour factors: revenues, profit margin, market share, liquidity, long term value, and retention probability are presented in the paper. Customer marketing strategy depends on the combination of the value of these five attributes. Expert system helps a marketer to "drill down" into data and identify the most loyal customers, separates the customers into groups, and plans the adequate marketing strategy. Expert system for determining adequate marketing customer strategy is developed using Visual Prolog programming language. Visual Prolog has shown satisfactory application and developing power.

Sažetak

Umjetna inteligencija je na računalu temeljen analitički proces koji nastoji kreirati računalne sustave koje obično nazivamo inteligentni. Ekspertni sustavi su najvažniji dio umjetne inteligencije s ekonomskog aspekta. Oni pokušavaju oponašati čovjekov proces mišljenauključujući rasuđivanje i optimozaciju. Znanje se prikazuje u obliku skupa „if-then" pravila u obliku baze znanja. Rezultati primjene sustava umjetne inteligencijeje oblikovanje marketing strategije prema kupcima pomoću pet faktora koji opisuju njihova ponašanja: prihodi, postotak razliie u cijeni, tržišni udjel, likvidnost, vrijednost kupca u dugom roku i vjerojatnost zadržavanja kupca. Marketing strategija prema kupcu ovisio kombinacijam vrijednosti tih atributa njihova ponašanja. Ekspertni sustavi pomažu „uroniti" u podatke i identificirati najlojalnije kupce, klasificirati kupce u grupe, i planirati odgovarajuću marketing strategiju. Ekspertni sustav za određivanje adekvatne marketing strategije je razvijen uporabom programskog jezika Visual prolog. Visual Prolog je pokazao zadovoljavajuću primjensku i razvojnu moć.

1. INTRODUCTION

Artificial intelligence is a branch of computer science that deals with intelligent behavior of a computer. Its aim is to develop computer programs that will solve the task at the level of people who are experts in some area. Such programs are also called expert systems. They are the most important part of artificial intelligence for business processing. Nowadays arti-

ficial intelligence has found its application in a business process within different functional areas and business functions. One area of its application but also development stimulation is marketing. Marketing, among other things, deals with customers' analysis to define special strategy according to an individual customer or more of them, according to certain characteristics of similar customers. Strategy development relies on quantitative but also qualitative elements and techniques. Qualitative analyses are of symbolic nature, and system that concludes logically is adapted to them based on set of rules and facts. Exactly such system is an artificial intelligence. It uses declarative programming languages applicable for symbolic, numeric processing. Programming language Visual Prolog can solve problems described by objects and relations between them using clauses and applying formalized predicate of the first order is used in this paper.

On the other hand marketing strategy defines long term marketing aims, possibilities and means for their realization in conditions of limited resources. Marketing strategy has hierarchical levels. It can be at the level of business unit, product or service but also towards the customers. The customers are the most valuable part of assets of every marketing-oriented organizational system. Strategy towards the customers therefore must be individualized. Conceptual model of artificial intelligence's contribution to customers' analysis in order to form different marketing strategies towards the customers has been shown in this paper. The model can be extended and applied to different organizational systems.

2. CUSTOMERS' ANALYSIS INDICATORS AND MARKETING STRATEGY

Model of marketing customers' analysis is formed based on conversation, opinion and knowledge of the marketing experts, business analysis and business informatics. Model is always the means of reality simplification that observes just those components that are important for analysis aims. Therefore model of marketing customers' analysis identifies the following variables[2]: business results' share of organizational system that comes from a certain customer with regards to expected share, total sales to a customer (revenues), amount of profit, customer loyalty, his/her liquidity, and estimation of market strength of a customer. Marketing strategy towards the customers depends on values of those variables. In theoretical sense it is possible to form numerous of indicators that can aid in diagnosing customers' behavior, his/her economic and market strength, his/her importance for growth and development of organizational system. The indicators can have financial nature (revenues of a certain customer, realized difference in price (profit margin)). Other indicators use fuzzy values (they are a result of certain quantitative analysis and that numerical value is converted into qualitative values and are described in words: small, high i.e. fuzzy values[3]), and some can be a result of marketing expert's estimation (customer's long term value) and retention probability of a customer.

Basic hypothesis of this paper is that marketing strategy towards a certain customer depends on combination of those indicators' values. Values of those indicators are dynamically observed in this paper in a way that their values in current (observed) period of time are compared with values of earlier period (previous year for example). That is new numerical value which can be smaller or equal to one. Since the number of observed indicators of customers' analysis to determine marketing strategy is six, then the total number of combination of their dynamic values is $2^6=64$. The assumption is that a company applies the same marketing strategy, for example strategy of attracting with lower prices, /**1**/ for all new cus-

[2] Other variables are abstracted. Of course, model can be extended with other variables such as number of orders in a week, average value of an order of a certain customer, customer satisfaction etc. It is possible to form different strategies towards each individual customer. According to Porter there are three generic strategies that ensure sustainable competitive advantages: 1. Low expenses and low prices strategy towards a customer (to be price competitive), 2. Differentiation strategy (to be different towards a customer with regards to a competition), 3. Focusing – segmentation strategy (turn on to a certain customer or to a group of similar customers (segment) and become specialised in satisfying their needs).

[3] Liquidity depends on average number of days of paying bills with regards to agreed terms. Average number of days can be for example 56. If the average number of days for paying the bills is between 45 and 60 days then that interval is described with fuzzy value of satisfactory liquidity.

tomers (customers that appear in current period of time). Each combination of indicators' values is accompanied with one of eight possible marketing strategies that need to be transformed into a plan, and a plan in certain types of communication with a market. The company uses the following marketing strategies:

a) Decrease of marketing resources engaged for a certain customer (1),
b) Researching opportunities to increase sales to a customer when the sales are a part of total customer's needs (2),
c) Decrease of products' assortment at market when an offer has elements of oligopolistic market structures – assumption is that price can relatively rapidly increase and profitability of both the customers and total profitability can increase (3),
d) Refocusing marketing efforts on new manners of communication with the customers (4)
e) Re-attracting customers – the assumption is that a customer is not loyal enough (5),
f) Increase marketing resources (6),
g) Apply and pursue existing marketing strategy – the assumption is that the measures to promote sales do not give satisfactory results (7), and

Extend products' assortment (market distinct product portfolio) – the assumption is that the customers' needs are far higher than our share in their satisfaction (8).

The selection of indicators for customer's analysis and appropriate strategies that are associated with their combinations of values is complex and critical step in development of expert system knowledge base in Visual Prolog. Marketing theory offers numerous indicators (marketing metrics) to estimate financial reliability and market strength of a customer /**2**/, and his/her competitiveness.

Indicators of customer's analysis to define one of eight strategies are calculated from data stored in operational databases. Six indicators are calculated for every customer. The first indicator is revenue.

Revenue is a sum of all accounts without settled value added taxes i.e.:

$$R_{ek} = \sum_{i=1}^{n} R_i \quad (1)$$

where R_{ek} presents total revenue for number k customer, and R_i is for number i account, ***n*** is number of an account for k-customer in certain period of time.

1. Profit margin of number k customer is total amount of profit divided with a revenue of a k-customer:

$$P_{mk} = \frac{\sum_{i=1}^{n} TP_{mi}}{\sum_{i=1}^{n} R_i} \quad (2)$$

where P_m is profit margin, TP_{mi} is absolute amount of total revenue for number k customer, and R_i is for number i account.

2. Market share of k-customer is revenue of a k-customer divided with total revenue of all the customers.

$$M_{sk} = \frac{R_{ek}}{\sum_{j=1}^{p} R_{ej}} \quad (3)$$

where $\sum_{j=1}^{p} R_{ej}$ is a sum of all p customers.

3. Liquidity is measured with average number of days for paying bills. Lower average number of days denotes better liquidity and vice versa.
4. Long term customer value is ordinal characteristic which is estimated based on revenues, profit margin (differences in price), and market share as well as marketing expert's estimation about customer's financial reliability in the future and his/her market strength. Possible values are determined by Likert scale: very high (ordinal value ***"very high"*** is coded by numerical value (5), ***high*** (4), ***average*** (3), ***low*** (2), ***very low*** (1).

   Probability of customer's retention lower or equal to 0.5 (R_p<=0.5) is coded by ordinal value very low, 0.5<R_p<=0.625 is coded

by ordinal value low, $0.625<R_P<=0.75$ is coded as satisfactory, $0.75< R_P<=0.875$ is coded as high and $0.875<R_P$ is coded as very high.

All values of variables Re, Pm, Ms, Li, Ltv and Rp are expressed in numerical values in observed (current) period of time (most common business year). Their ratios in observed and previous period of time can be lower or equal to one or higher than one.

3. ARTIFICIAL INTELLIGENCE AND DETERMINATION OF MARKETING STRATEGY – EXPERT SYSTEM "EXMARSTRA"

Expert system "EXMARSTRA" will be developed to determine marketing strategy towards a customer. Expert systems are computer programmes (part of artificial intelligence) that are made of three parts: user interface, knowledge base, and inference engine. Inference engine, as its name says, brings its own conclusions based on one's own interpretation of represented expert's knowledge (marketing expert). Marketing expert (domain expert) has knowledge and manner to make conclusions for every decision that he/she makes. Knowledge engineer has knowledge about strategies to solve different problems and tries to identify similarities of solved problems with the problems he/she solves. He/she knows techniques of obtaining knowledge and expert systems' techniques. Acquiring knowledge (eliciting knowledge) is both complex and one of the most important steps in development of expert systems /**3**/. "EXMARSTRA" is an expert system to determine marketing strategy towards a customer. It is based on rules that are translated into account of the first order predicate of Visual Prolog language.

Rule based systems are computer programmes that represent the knowledge by production rules:

IF <condition> THEN <action>. Expert systems are rule based because they contain stored knowledge in the form of production rules. The format that a knowledge engineer uses to capture the knowledge is called a knowledge representation. The most popular knowledge representation is the production rule (also called the if-then rule).

There are 2^6=64 goal states because we have selected six indicators. The number of indicators may be bigger than six (e.g. *n*) and consequently the number of possible states increases as an exponential function (2^n). According to the given assumptions it is possible to form 64 production rules at most. The following table shows the idea of development of "EXMARSTRA" expert system of knowledge base:

Rule number	Revenues (Re)	Profit margin (Pm)	Market Share Ms	Liquidity (Li)	Long term value Ltv	Retention probability Rp	Marketing strategy
R1	<=1	<=1	<=1	<=1	<=1	<=1	Reduce marketing resources
R2	<=1	<=1	<=1	<=1	<=1	>1	Examine up-sale opportunities
R3	<=1	<=1	<=1	<=1	>1	<=1	Increase marketing resources
R4	<=1	<=1	<=1	<=1	>1	>1	Refocus marketing effort
……	……	….		…..	….	….	…….
R63	>1	>1	>1	>1	>1	<=1	Re-attract these customers
R64	>1	>1	>1	>1	>1	>1	Pursue these customers

Table 1. Production rules in "EXMARSTRA"knowledge base

In practical solutions the number of different values of every customer behaviour indicator is higher than two, so number of production rules for six indicators is bigger than 64. Therefore Table 1 illustrates that artificial intelligence can only be used to determine marketing strategy based on six indicators of his/her behaviour. Production rules are translated into

clauses in Visual Prolog language. One such clause to determine strategy towards a customer has the following form:

```
strategyS1():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),(Re>1, Pm<=1, Ms>1, Li<=1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy: decrease customer marketing resources ", Cn), stdIO::nl,fail.
```

A head of the clause is: strategyS1() and body: indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp), (Re>1, Pm<=1, Ms>1, Li<=1, Ltv<=1, Rp>1),stdio ::write("You can apply the strategy: decrease c ustomer marketing resources ", Cn), stdIO::nl,fail.
It is also possible to use another approach that would code numerical values of every indicator into fuzzy values: high, low, moderate etc. Fuzzy values would then be used in production rules. Since the number of value for each indicator is higher than two and that is the number of possible rules that describe all possible conditions and it is higher than 64. Expert system knowledge base would contain numerous rules.

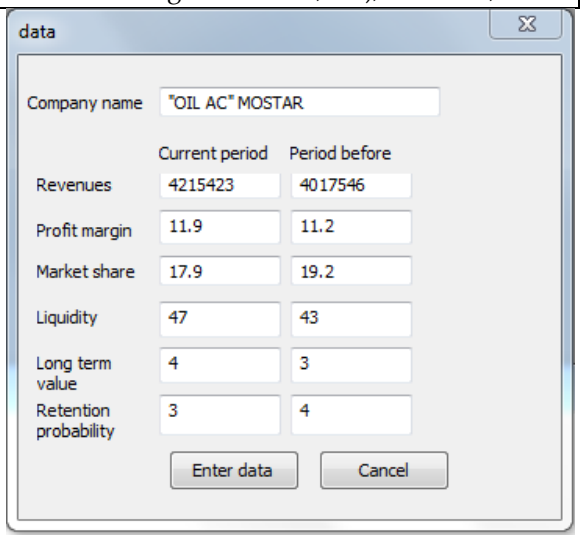

Figure 1. User interface for entering data into database

3.1 Expert system development to determine marketing strategy towards customer

The code name of our expert system for stock selection is ***„ EXMARSTRA“*** and its main task is to assign a customer to an adequate marketing strategy (one, two or more marketing strategies - mapping 1:N). The knowledge base of ***„ EXMARSTRA“*** consists of production rules presented by the clauses in Visual Prolog 7.4.[4] As was mentioned earlier a clause tests the value (dynamic indicator) of six indicators:

The user enters data for each individual company into database described by: Revenues (Re), Profit margin (Pm), Market Share (Ms), Liquidity (Li), and Long term value (Ltv), Retention probability (Rp). Database ***marketIndicatorsDB*** will be created by the statement **/4/**:

```
class facts - marketIndicatorsDB.
```

It contains one table that is described by a functor „indicatorsms“ with six arguments: the first argument is of string type and it holds company name (Company_name), the second argument is of real type and it will be referred as Revenues, and it holds a certain customer's revenues. Other arguments (Profit_margin, Market_share, Liquidity, Long_term_value, Retention_probability) can be easily understood.

```
class facts - marketIndicatorsDB
indica-
torsms:(string Copmany_name, real Revenues,
 real Profit_margin, real Market_share, real
Liquidity, real Long_term_value, real Retention_probability).
```

The clauses for inserting the record (row or tuple) into database table (predicate assertz() will add the data at the end of table) and saved

[4] Visual Prolog is a logical programming language and is using for creating applications for the Microsoft Windows platform (Windows 7, Windows Vista, Windows XP, Windows Server 2008, Windows Server 2003). It contains fully integrated fact databases, automatic memory management and it supports parametric polymorphism.

data into database Iva.txt (predicate save()) are:

```
clauses
addIndicators(Copmany_name, Revenues, Profit_margin, Market_share,Liquidity,
  Long_term_value, Retention_probability) :-
assertz(indicators(Copmany_name, Revenues, Profit_margin, Market_share,Liquidity,
                   Long_term_value, Retention_probability)),
stdio::write("Company ", Copmany_name," is added data."),
    stdio::nl.
```

Standard predicate ***assertz()*** enables syllables adding into a database table. Predicate saveDatabase() stores data about company name, revenues, profit margin, market share liquidity, long term company value, and customer retention probability into Iva.txt. database.

```
saveDatabase():-
    file::existFile("Iva.txt"), !,
    file::delete("C:Iva.txt"),
    file::save("C:Iva.txt", marketIndicatorsDB),
    stdIO::write("Database is storing into file Iva.txt"), stdIO::nl.
 saveDatabase() :-
    file::save("C:Ivaa.txt", marketIndicatorsDB),
    stdIO::write("The records are in database Iva.txt"), stdIO::nl.
```

After entering values of indicators Revenues, Profit_margin, Market_share, Liquidity, Long_term_value and Retention_probability for all companies the database Iva.txt is populated with necessary data and stored on a hard disk. For selection of adequate marketing strategy it is necessary to read data into a main memory which can be done with the following clause:

```
fileRead():-
file::consult("Iva.txt", marketIndicatorsDB),
stdio::write("The file Iva.txt is read from hard disk. ").
```

Marketing expert knowledge (domain expert) is then written in a form of a rule (Prolog language clause). It is expert system knowledge base ***„EXMARSTRA“*** that „holds“ knowledge about selection of the best marketing strategy for a customer. The following row of clauses shows a part of a knowledge base:

```
strategyS1():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),(Re>1, Pm<=1, Ms>1, Li<=1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy: decrease customer marketing resources ", Cn),
        stdIO::nl,fail.
strategyS1():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),(Re<=1, Pm<=1, Ms>1, Li>1, Ltv<=1, Rp<=1),
stdio::write("You can apply the strategy: decrease customer marketing resources ", Cn),
        stdIO::nl, fail.
strategyS1():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp), (Re<=1, Pm<=1, Ms>1, Li>=1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy: decrease customer marketing resources ", Cn),
        stdIO::nl, fail.
strategyS1():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),(Re>1, Pm<=1, Ms<=1, Li<=1, Ltv<=1, Rp<=1),
stdio::write("You can apply the strategy: decrease customer marketing resources ", Cn),
        stdIO::nl, fail.
strategyS1():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp), (Re>1, Pm<=1, Ms<=1, Li<=1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy: decrease customer marketing resources ", Cn),
        stdIO::nl, fail.
strategyS1().
strategyS25():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
            (Re<=1, Pm<=1, Ms>1, Li>1, Ltv>1, Rp>1),
stdio::write("You can apply the strategy: examine sale-up to customer and strategy of customer attraction ", Cn), stdIO::nl, fail.
strategyS25():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
              (Re<=1, Pm>1, Ms<=1, Li<=1, Ltv>1, Rp<=1),
stdio::write("You can apply the strategy: examine sale-up to customer and strategy
```

```
 of customer attraction ", Cn), stdIO::nl,  fail.
 strategyS25():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                  (Re<=1, Pm<=1, Ms>1, Li>1, Ltv>1, Rp<=1),
 stdio::write("You can apply the strategy:  examine sale-up to customer  and strategy
of customer  attraction ", Cn), stdIO::nl,fail.
strategyS25().
strategyS23():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                  (Re<=1, Pm>1, Ms<=1, Li<=1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy:  examine sale -up to customer and decreasing
the offer to customer  because the liquidity of customer is compromised", Cn),
stdIO::nl,fail.

strategyS23():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
          (Re<=1, Pm>1, Ms<=1, Li<=1, Ltv>1, Rp>1),
stdio::write("You can apply the strategy:  examine sale-up to customer and decreasing the
offer          to customer bacause the liqudity of customer is compromised", Cn), stdIO::nl,          fail.
strategyS23().
strategyS62():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                  (Re<=1, Pm<=1, Ms<=1, Li<=1, Ltv<=1, Rp<=1),
stdio::write("You can apply the strategy:  increasing marketing resources and resarch of
increasing the sale to  customer ", Cn), stdIO::nl, fail.
strategyS62():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                (Re<=1, Pm<=1, Ms<=1, Li<=1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy:  increasing marketing resources and resarch of
increasing the sale to customer ", Cn), stdIO::nl, fail.
strategyS62().
strategyS3():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
              (Re>1, Pm>1, Ms<=1, Li<=1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy:  decreasing the offer to customer bacause the liqudity of cust
omer is compromised ", Cn), stdIO::nl, fail.
strategyS3():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                  (Re<=1, Pm<=1, Ms<=1, Li<=1, Ltv>1, Rp<=1),
stdio::write("You can apply the strategy:  decreasing the offer to customer bacause the liqudity of cust
omer is compromised ", Cn), stdIO::nl, fail.
strategyS3():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                  (Re<=1, Pm>1, Ms<=1, Li>1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy:  decreasing the offer to customer bacause the liqudiy of cus-
tomer is compromised ", Cn), stdIO::nl, fail.
strategyS3():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                  (Re>1, Pm<=1, Ms<=1, Li<=1, Ltv>1, Rp<=1),
stdio::write("You can apply the strategy:  decreasing the offer to customer bacause the liqudiyof cus-
tomer is compromised ", Cn), stdIO::nl,fail.
strategyS3():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                  (Re>1, Pm<=1, Ms<=1, Li<=1, Ltv>1, Rp>1),
stdio::write("You can apply the strategy:  decreasing the offer to customer bacause the liqudiy of custo
mer is compromised ", Cn), stdIO::nl,fail.
strategyS3():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
                (Re>1, Pm>1, Ms<=1, Li<=1, Ltv<=1, Rp<=1),
stdio::write("You can apply the strategy:  decreasing the offer to customer bacause the liqudiy
 of customer is compromised ", Cn), stdIO::nl,fail.
```

```
strategyS3().
strategyS2():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
            (Re<=1, Pm<=1, Ms<=1, Li<=1, Ltv>1, Rp>1),
stdio::write("You can apply the strategy:  research to increase sales to the customer ",Cn),
            stdIO::nl, fail.
strategyS2():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
              (Re<=1, Pm<=1, Ms<=1, Li>1, Ltv<=1, Rp>1),
stdio::write("You can apply the strategy:  research to increase sales to the customer  ", Cn),
stdIO::nl,fail.
.....
strategyS86():-indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
             (Re>1, Pm<=1, Ms>1, Li>11, Ltv<=1, Rp<=1),
stdio::write("You can apply the strategy:  extend the offer to the customer and increase customer mark
eting  resources ", Cn), stdIO::nl,fail.
strategyS86():- indicatorsMS(Cn,Re, Pm, Ms, Li, Ltv, Rp),
              (Re<=1, Pm<=1, Ms<=1, Li>1, Ltv>1, Rp>1),
stdio::write("You can apply the strategy:  extend the offer to the customer and increase customer mark
eting  resources ", Cn), stdIO::nl, fail.
strategyS86().
```

Table 2: Part of knowledge base expert system ***„EXMARSTRA“***

The knowledge base of ***„EXMARSTRA“*** expert system includes all production rules necessary to recognize the marketing strategy. Only a part of knowledge base is shown there. The knowledge is obtained by interviewing a marketing expert and formalizing it in a form of first order predicates and clauses of Visual Prolog programming language.

4. EXPERIMENTAL RESULTS

The first step upon creation of an expert system is data input into Iva.txt. base. The values of six indicators are calculated in that base. Those indicators are associated to a customer. Data for their calculation are in financial accounting (company name, revenues, profit margin, customer's market share, liquidity) or they are a result of marketing expert estimation (long term company value, customer retention probability). A couple of rows from Iva.txt base are the following:

clauses

indicatorsms("\"OIL AC\" MOSTAR",0.049,0.932,1.093,1.333,0.75).
indicatorsms("\"Antonio commerce\" Mostar",0.030,1.059,1.097,0.941,0.8,0.75).
indicatorsms("\"Moherz\" Mostar",0.961,1.091,1.918,0.488,1.666,1).
indicatorsms("\"Branid\" Munich",0.123,1.053,0.4,0.83,0.5,1).
……
indicatorsms("\"OTP\" Zagreb",0.832,0.198,0.760,1.875,1,1).
indicatorsms("\"Sanja\" Osijek",1.413,1.810,0.549,1.575,1.75,1).

Upon data storage into a base they are copied from a disc on to main computer memory (load data option on menu) and then "Marketing strategy to customer" option is selected. It searches the base and satisfies the set question which marketing strategy should be associated to a certain customer. A proposal of a marketing strategy is written in a part Message of user's:

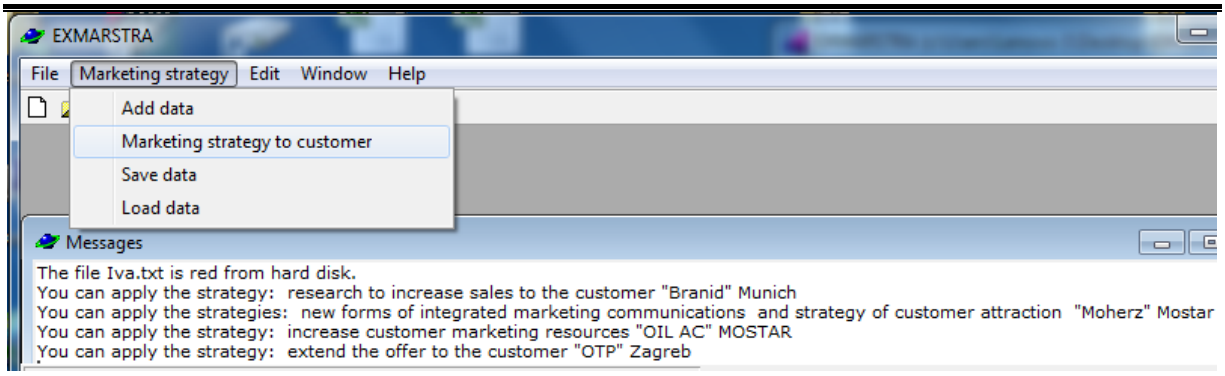

Figure 2: Marketing strategy associated to customer

Expert system "EXMARSTRA" is open for new enlargements. It is simply possible to add new customer analysis indicators as well as new marketing strategies. Data sources for customer analysis can be operational databases but also derived bases formed for analytic purposes. Those are data warehouses and expert system "EXMARSTRA" can be integrated with both relation databases and data warehouses.

CONCLUSION

Possibilities and contribution of an artificial intelligence and expert systems as a part of it in marketing to select marketing strategy towards a customer are shown in this paper. There are numerous difficulties in forming such expert systems. The first difficulty is selection of indicators for customer analysis. Namely, marketing theory uses metrics in which nowadays there are numerous customer behaviour indicators. Among them only those that will serve to select marketing strategy must be chosen. The second difficulty is higher number of different marketing strategies among which one subset must also be selected. Knowledge from the area of artificial intelligence related to expert system development in declarative programming language Visual Prolog are added to marketing knowledge (or are integrated) with them.

Knowledge base can use six, nine, twenty or more such indicators. Adding new indicators in an expert system "EXMARSTRA" is just extension of knowledge base without application of the main idea: value of indicators is field of condition (body of a clause in Visual Prolog). Marketing strategy is part of production rule action (head of a clause). Visual Prolog 7.4 has shown excellent application and development power. Further research will focus on expert system base extension and its incorporation into marketing plan of organisational system.

Notes

/1/ Porter, M., (2008), *The Five Competitive Forces That Shape Strategy*, Harward Business Review.
/2/ Farris, Bendle et al. (2006) Marketing Metrics: 50+ Metrics Every Executive Should Master, Wharton School Publishing.
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