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DATA MINING TECHNIQUES AND BUSINESS INTELLIGENCE TOOLS FOR BARRIERS TO ENTRY ANALYSIS AND MANAGEMENT

Abstract: Barriers to entry are considered an important feature in enterprise's everyday strategy. This is because they may enable or disable to gain a competitive advantage over other participants in the market. Moreover, they may give an enterprise a strong market position, if they are properly built. Because barriers to entry are so important, and because they change in time (as many other elements of the economic environment) it seems justified to use computer tools in the process of managing barriers to entry. In the paper some advantages of data mining and Business Intelligence systems used for barriers to entry management are pointed out.

Key words: barriers to entry, data mining, Business Intelligence.

1. Introduction

Barriers to entry are a very important element of enterprise's environment. While planning market expansion, an enterprise has to estimate properly whether there exist any barriers to entry and if so, whether it is possible to overcome them. On the other hand, an enterprise may consider building barriers to entry to protect its market position from competitors.

As many other elements of enterprise's environment, barriers to entry are not stable, but change in time. Some appear, some disappear, also the height and strength change over time. It is therefore not possible neither to analyze barriers to entry, nor to manage them without taking the temporal dimension into account. But unfortunately adding this dimension surely makes the management of barriers more complicated.

The next problem is in the diversity of barriers to entry as the features to be described, formalized and analysed. Some barriers are quantitative in type, some – qualitative, and some are mixed.

Having in mind how complicated is the domain of analysis, it seems justified to use modern computer methods and tools for this task. In the paper the possibilities given by data mining techniques and by BI systems will be analysed.

These two groups of tools will be analyzed together because – as it will be shown below – they complement one another: knowledge discovered thanks to the data mining techniques may be then analysed by a BI system.

The reminder of the paper is organised as follows. In Section 2 basic notions of barriers to entry are presented, it is also shown what role do barriers play in enterprise's strategy. Section 3 is devoted to defining the notion of "barriers to entry management" and to describing the tasks of this management process. In Section 4 the most outstanding features and applications of data mining techniques and BI systems are presented in short. Section 5 presents some advantages of using these techniques and tools for barriers to entry management. In Section 6 advantages and disadvantages of both techniques are presented in the context of temporal analysis of barriers to entry. Conclusions are in the last part of the paper.

2. Barriers to entry to a market space

The simplest and the most intuitive definition of a barrier to entry is the one saying, that a barrier to entry means everything that makes entry to a branch or market space difficult for economic entities [*Barriers*... 1994]. Next, Stigler, Baumol, and Willig define a barrier to entry as an expense that has to be borne by an enterprise to enter the market space, but that does not have to be borne by economic entities already operating on the market (*ibid.*). Their definition is similar to the one of Gilbert, who defines a barrier to entry as "a rent that is derived from incumbency" [Gilbert 1989].

Taking into account the type of cost that has to be borne by an enterprise wishing to enter the market, the following types of barriers may be distinguished [*Barriers*... 1994]:

- absolute cost advantage that an incumbent possesses over a potential entrant. One can talk about such a barrier if future (potential) costs per unit of production of a potential entrant are generally higher than those of the incumbents. The main sources of this barrier are patents, resources control, monopolisation of specific knowledge;
- strategic advantage – here we can distinguish the following groups of barriers:
  - sunk costs and economies of scale – the necessity to bear the costs of the entry, that would not be paid off in case of failure; the necessity of entering on the big scale if the venture is to bring profits;
  - product differentiation and advertising. In the simplest case it means that the product space is filled with so many brands, that a potential rival has not enough place to enter and to get back his sunk costs. Advertising at a great scale is expensive, not every entrant can afford it;
  - capital requirements;
- vertical foreclosure – for example exclusions, supply contracts. These are practices because of which rivals can not access important production means or can

not access clients (consumers) on equal rights (that is, within the same conditions as incumbent firms);
- predatory behaviour. This concerns pricing practices which consist of reducing prices in the short term to eliminate rivals from the market or to discourage potential entrants from entering the market space. An incumbent having enormous financial resources can threaten a rival suffering from financial deficiency.

Knowledge on what kind of barriers our enterprise creates or could create, as well as the knowledge on barriers that can be possibly met by our firm, will significantly determine the process of elaborating corporate strategy and decisions on entering a market. An enterprise has to evaluate precisely:
– investment costs,
– additional investment costs to overcome structural barriers,
– expected cost of incumbent firms [Porter 1999].

Linking the analysis of barriers to entry with the temporal dimension is crucial. Barriers to entry – as many other elements of enterprise's environment – are not steady, but change in time. For example, the type of existing barriers changes, some of barriers appear and some disappear, also barriers' strength (height) changes. Dynamics of barriers to entry results from several reasons. First, basic structural features of the market may change [Bain 1993] and this in turn may cause changes in the entry conditions and in barriers. Second, each entry to a market occurs in time – longer or shorter [*Barriers*... 1994]. It is not a single, momentary action; it is extended over a period of time. Moreover, it should be taken into account that time granularities for different industries are not the same, in other words, in some branches, because of their particular features, entries are quicker, in other ones – entries are slower. Third, putting entries to a market in a time context allows their historical analysis, that is, an analysis of a history of entries end exits in an industry, a history of profit trend in an industry, efficiency and duration of entries in the past, changes in market conditions over a period of time, etc. [*Barriers*... 1994]. Such analysis is indispensable, for example, to foresee efficiency of currently planned entry. Fourth, time differences appear not only between entries in different industries, but also within the confines of one market: entry conditions can change from one season to another – it is a so-called temporal feature of the market [Whish 1993].

Knowledge on barriers to entry in time is needed to prepare scenarios of changes in an industry [Hutt, Speh 1997], to choose a proper target market, taking into account, among others, the costs of entry, which are connected with barriers' height [Przybyłowski et al. 1998]. Moreover, barriers to entry may be perceived as an inertia factor, that narrows the possibility of changes in an organization [*Strategie*... 1998].

Summing up, while working on its strategy, an enterprise has to gain knowledge about:
– how barriers to entry were behaving in the past (historical analysis),
– what is the current state (the current state diagnosis),

– how will barriers to entry behave in the future (prognostic element),
– what are (if any) legal and economic possibilities to create and to overcome barriers to entry in the existing economical-legal system,
– in order to adapt its strategy to the situation.

3. Management of barriers to entry

Since the analysis of barriers to entry plays an important role in formulating enterprise's strategy, let us point out the aspects of this analysis. There are two aspects:
– analysis of barriers to entry as a factor that facilitates or makes difficult preserving the *status quo* of competition in the market,
– analysis of barriers as a factor that facilitates or makes difficult expansion on new markets (geographical ones, product ones, etc).

Preserving the *status quo* in the market where an enterprise operates depends on the height and efficacy of barriers to entry. Barriers to entry contribute to creating and preserving market concentration, as the higher barriers are, the more difficult for potential entrants is to overcome them. In consequence, the higher the barriers, the bigger market share for incumbent firms [Posner, Easterbrook 1981].

Barriers to entry "operate" in two directions, as it has been said. An enterprise planning to enter a certain market has to take the barriers into account. This is the second aspect of the analysis: analysis of barriers in context of planned expansion on new markets. It has to be analysed, whether the planned entry would be easy, difficult or blockaded.

In his classic concept of management, Fayol divides it into planning, organising, motivating, coordinating and controlling functions [Stoner, Wankel 1996, p. 55]. Managing barriers to entry may be perceived in a similar way, at least planning, organising and controlling functions may be similar to those in a "classical" managing task. For example, an enterprise may plan building barriers or plan how to overcome the existing ones, and it may organise activities to achieve these goals. The process of managing barriers to entry may be also perceived as a combination of the following elements:

a) identification of barriers,
b) analysis of barriers,
c) activities aimed at building barriers,
d) development of a strategy to overcome barriers.

The last two points are connected with the two aspects of barriers to entry analysis, mentioned above.

A complete analysis of barriers to entry, placed in the temporal context (see Section 2), requires:

a) a proper representation of knowledge on barriers to entry, and capturing their changes in time,

b) a representation of both qualitative and quantitative barriers to entry,

c) analysis of the current state (situation) concerning the barriers,

d) tracing the evolution of barriers' changes,

e) capturing causal relationships among barriers and other elements of the economic environment,

f) analysis of future changes of barriers to entry.

As it can be seen, the problem is complicated and complex, therefore it is worthy thinking of using modern computer techniques to solve it. In the following sections two of such modern tools, namely data mining techniques and Business Intelligence systems will be analysed.

4. Data mining and Business Intelligence – features and applications

The origin of data mining techniques and methods lies in an observation, that data kept in enterprise's computer systems stores more knowledge than the knowledge gained by traditional methods, e.g. database queries. Therefore data mining is often identified with knowledge discovery in databases, although it is only one of its stages [Kwaśnicka, Śmiałek 2004]. The main goal of data mining is to gain useful knowledge from various data sets, if for example statistical techniques are not enough. Data mining is used with such data sets as relational and object databases, text or spatial data, and of course with data warehouses – as discovering new knowledge makes sense only in case of big data sets [Abbey et al. 2002; *Zarządzanie…* 2004]. Using data mining techniques, one may discover in such sets causal relationships, data groups, sequences, etc., relationships between variables. Also forecasting and prediction is a classical task for data mining techniques [Wolny 2004].

Mining temporal data is a special category of data mining techniques, especially in the context of analysing dynamical domains. It is aimed at discovering knowledge containing explicit or implicit temporal references. Two main directions of using temporal data mining techniques are discovering temporal causal relationships and discovering temporal knowledge in the form of trends, cycles, sequences or temporal patterns [Roddick, Spiliopoulou 1999a; 1999b]. The methods of temporal data mining allow also to analyse information on events and processes [Kania 2003], as well as modelling temporal relationships.

The Business Intelligence systems, in turn, are designed for advanced data analysis, such as forecasting, "what-if" simulations, trend analysis, and to provide the results of the analysis in a proper form and time [*Business…* 2003; Kiczmarowski 2003; Orzechowski 2005]. BI systems are used mainly for getting strategic information and for its presentation, for monitoring the situation and for mining data stored in other information systems [Matouk 2004]. A general architecture of a BI system is presented in Fig. 1.

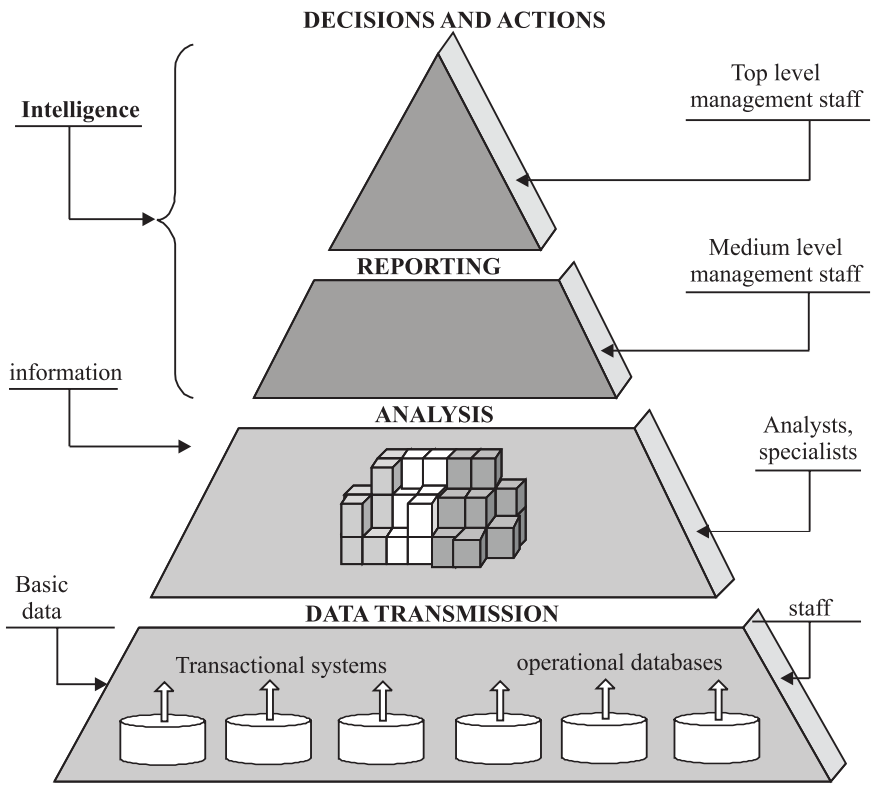

Fig. 1. Architecture of a BI system

Source: [Matouk 2004, p. 230].

In the context of economic tasks, but not only in this context, it is difficult to separate data mining from BI systems, as these tools complement one another. The relationship between these technologies may be graphically presented as in Fig. 2.

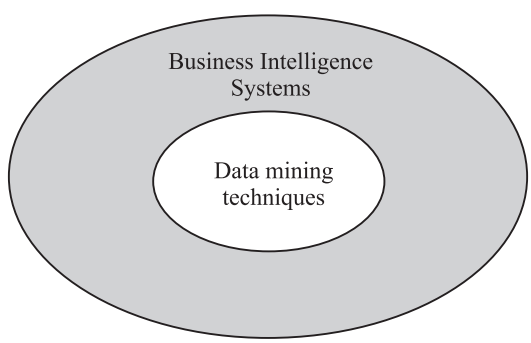

Fig. 2. Dependency relationship between data mining techniques and BI systems

Source: own elaboration.

According to Fig. 2, there are not only the possibilities offered by data mining techniques themselves, but also knowledge discovered by these techniques may be used for analysis performed by a BI system. Therefore it is justified to discuss both these tools together.

5. Advantages of using DM and BI for managing barriers to entry

Taking into consideration the general tasks of data mining, mentioned earlier, as well as the ways of using the new, discovered knowledge, several practical applications of DM in economy and management may be pointed out:

identification of a possibility to combine products' retail,

a) forecasting clients' behaviour,

b) segmentation of clients,

c) estimating credit risk – by finding models and patterns related to the risk,

d) identifying the best clients [Wolny 2004; Zakrzewska 2002].

One may easily notice that those applications refer directly to the problem of barriers to entry. For instance:

a) identifying clients that plan to leave may enable to estimate, how strong the loyalty barrier created by an enterprise (and the strategic advantage barrier at the same time) is,

b) segmentation of clients would enable more precise advertisement campaigns, and in consequence – smaller promotion costs. On the one hand this would mean lowering the ad barrier for an incumbent, on the other – raising the same barrier for potential entrants,

c) proper estimation of credit risk allows to overcome a capital requirements barrier, thanks to e.g. lower costs of credit,

d) identifying key clients is a first step to activities aimed at building the loyalty barrier, which in turn means making the strategic advantage bigger.

Table 1. Selected applications of BI tools

Area of activity	Tasks for BI systems
Sales	Sales effectiveness, optimization of income
Marketing	*Analysis of marketing campaigns*, *market segmentation*, *client profiling*
Service	*Client's satisfaction*
e-business	Demand trends, *promotions*, *ads*, analysis of www logs, additional marketing
Production	Fault analysis, *labour costs*, reservations, *optimization of production potential*
Logistics	Analysis of demand, raw materials, production effectiveness, and delivery forecasts
Finance	*Budgeting*, *planning*, profitability
Staff	Human potential, salary planning, optimization of labour force

Source: [*Generowanie*... 2004, p. 50].

One of the main application domains for the BI systems is marketing, but these systems may be useful also in other areas of enterprise's activities. Table 1 presents some of the applications of the BI systems. Those tasks, that concern or may concern barriers to entry analysis, are written in italics.

How are the tasks shown in the above table connected with barriers to entry and to their analysis?

a) analysis of marketing campaigns – connected with the strategic advantage barrier. A proper marketing campaign may raise the barrier for competitors, and may allow to lower their strategic advantage by attracting competitor's clients;

b) market segmentation – connected mainly with overcoming the already existing barriers. While choosing a market segment to operate on, an enterprise may plan activities in segments with no barriers or barriers easy to overcome, and to avoid those segments, where entry is efficiently blockaded or difficult. Therefore, market segmentation is connected with all types of barriers to entry, mentioned in Section 2.

c) client profiling – similarly to the analysis of market campaigns, also client profiling is conductive to attracting and keeping clients. This builds the strategic advantage barrier. Also tasks connected with clients' satisfaction, promotion and advertising, connected with the same type of barrier, may serve to overcome or to build a barrier to entry;

d) labour costs, optimization of production potential, budgeting, planning – relate to a group of strategic barriers, called a capital requirements barrier. For example, by lowering the labour costs, an enterprise possesses more investment capital, and may invest without crediting, or with a smaller credit. At the same time, by investing on a greater scale, the enterprise raises a barrier for competitors. This group of tasks for a BI system may be also connected with predatory behaviour barrier – with enough capital, an enterprise may take the liberty of selling its products at give-away prices, at least for some time.

The tasks for which BI systems may be used, and that are explicitly or implicitly connected to the management of barriers to entry, are connected with both aspects of this management process, mentioned in Section 3. Using a BI system allows to overcome in an efficient way barriers created by competitors and to perform activities aimed at creating barriers for these competitors. Similar advantages may be expected in case when a BI system analyses not only data already present in the enterprise (e.g. in databases, data warehouses) but also new data discovered with data mining techniques. It may be expected that both groups of advantages – these of DM and these of BI – create a synergy effect.

6. Data mining techniques and BI systems in temporal aspect

In the previous section the advantages of using both groups of tools for barriers to entry management have been shown. But in the context of the analytical tasks, that explicitly have a temporal aspect, not only advantages, but also disadvantages of the tools may be pointed out. They are presented in Table 2.

Table 2. Advantages and disadvantages of DM and BI tools in the context of the analysis of barriers to entry

Method (a group of methods)	Advantages	Disadvantages
Data mining	Delivering new knowledge, including a temporal one, discovering causal relationships, temporal relations, sequences of events, maintenance of qualitative data	No representation of processes, no historical/current analysis (only delivery of input information for other tools), no possibility to capture changeability of features without additional analytical tools
BI systems	Consolidation and mining of data, delivering up-to-date and foreseen data, possibility to discover new knowledge, use of heterogeneous sources	Cost of implementation and maintenance, no explicit temporal references, analysis narrowed to quantitative features, causal relationships separated from time and change

Source: own elaboration.

Next, Table 3 presents in a concise way the usefulness of the methods for the tasks involved in the analysis of barriers to entry. It has been problematic to mark each of the groups of methods in an unambiguous way, because sometimes it happens that one method in a group performs a specific task, while other methods do not. In such cases, the whole group has been assigned a dominant feature (that is, the ability or not to perform a task), but additionally marked with a star (*).

Table 3. Methods of analysis versus detailed analysis tasks

Task	Data mining	BI systems
Explicit representation of time notion	Yes*	No
Representation of qualitative barriers	Yes	No
Representation of causal relationships	Yes	No*
Representation of processes	No	No
Historical analysis	No	Yes*
Current analysis	No	Yes
Analysis of future changes	Yes	Yes

Source: own elaboration.

Some disadvantages pointed out in Tabs 2 and 3 result mainly from the fact that operating on temporal data is not a main task neither for data mining, nor for BI systems. Such operations only widen basic functionality of these tools.

7. Conclusions

The paper aimed at presenting the usability of data mining and BI systems for analysing and managing barriers to entry, also in the temporal context. The notion of barriers to entry management has been defined, also its importance for enterprise's

strategy has been stressed. The tasks forming the analysis of barriers to entry have been formulated.

Referring to the tables presented in the previous Section, it may be said that none of the methods presented in the paper provides a complete realization of the tasks connected with the management of barriers to entry, especially in the temporal aspect. Usually the methods perform only some of the tasks formulated in Section 3.

This conclusion harmonizes with Aggarwal's observation (see [Aggarval 2001, p. 6] that in a non-deterministic environment it is not possible to use classic analytical tools, as the tasks of the analysis usually lack algorithmic structure, are complex and suffer from uncertainty. Because of the features of the domain of barriers to entry, the tools presented in the paper may be helpful for the decision makers, but do not provide a complex realization of the analytical tasks. Nevertheless, keeping in mind the advantages of both data mining and BI systems, the use of these tools for barriers management may help the enterprise to gain or to preserve its strategic advantage over its competitors. In our opinion, the full realization of the task would need more advanced tools as for example temporal intelligent systems, that use DM methods and BI techniques as knowledge sources for more sophisticated analysis. Such solution is proposed in [Mach 2007].

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