4 Environmental Analysis: *Porter's Five Competitive Forces Concept*

Strategic environmental analysis

Environmental strategic analysis presents an analysis of the *competitive forces of environment*. An industry should be the focal point of the analysis since overall changes in *competitive strengths* are seldom reflected in all industries equally. This is particularly related to diversified companies operating in several industries. After an industry is defined and determined, other factors reflecting competition need to be analysed. The reliability of industry analysis is highly dependent on the experiences of successful corporations on one side, and unsuccessful ones on the other side. Competitive strengths are active in the industry which is defined as a *group of companies producing products and selling them to customers*.

An industry (branch or company) is a group of companies offering a product or a type of product classified as an industry. Industries are classified according to the number of sellers, the level of differentiation, possible mobility, cost structure, degree of vertical integration and degree of globalisation.

The starting point in activity definition is defining the number of competitors and the degree of product differentiation.

Market and technology have a decisive effect on the formation of an industry. Industry borders are constantly expanding and reducing depending on the behaviour of its participants. According to Porter and van der Linde (1995a), the new paradigm of national economy competitiveness is dynamic and based on innovation.

He accentuates that a desirable goal should be a high life standard achieved through high competitiveness measured as the competence of a company to export a significant part of its final product while conducting business in a globally connected economy environment (Porter and van der Linde, 1995b).

Michael Porter (1990) advocates the idea that there is no success on an international market without success on the domestic market. That implies the creation of high standards and demands for business which can be placed in the context of four key groups of factors which correlate and interact to form competitive advantage of national economies. Michael Porter (1998) labelled those network-based relationships as clusters,

DOI: 10.4324/9781003359173-4

considering a cluster to be a manifestation of a diamond in practice. His analysis is based on case studies, rather than on economic analysis. Analysing clusters through the diamond model, he proved that their existence continuously aids the competitiveness of the market.

Clusters are a form of cooperation affecting the profitability positioned on a level between the sophistication of a company and the business climate. *Clusters are geographical concentrations of mutually connected companies, specialised suppliers, companies in associated industries and other organisations (universities, agencies, organisations) competing and cooperating together.* Michael Porter states several examples of clusters. He (Porter, 1990) believes that they influence national economies in three ways: First, by increasing the number of companies in that area; second, by accelerating the speed of company innovation in that area; third, by stimulating the foundation of new companies in that area.

Michael Porter (1980) believes that the sources of competitive advantage of a national economy can be found in the following[1]: (a) The conventional competitive advantage; (b) economy of scale or the curve of learning expanded above the cumulative realm that can be reached at an individual market of a national economy; (c) the advantages of product differentiation; and (d) public good or technological information coming from the market to be used at an individual market of a national economy. Such an aspect requires the formation of a strategy of business internationalisation, since Michael Porter recognises international market success as a primary indicator of the competitiveness of a national economy.

One of the analytical frameworks for success on the international market was actually developed by Michael Porter (1980) by identifying the following international business strategies:

1. Orientation towards global competitiveness by utilising the full capacity of industry product production and a tendency of competing at a global scale;
2. Global focus, in a sense of company orientation towards a particular segment of industry activities to be competed at globally;
3. Focus on the entire market with an idea that competitive advantage can be achieved through concentration on specific needs of a particular country;
4. Orientation on a protected segment, i.e. to enter the market of countries which have implemented a series of regulations to disable competition or make it difficult to achieve.

That fact, according to Michael Porter (1980), created a dilemma *whether to focus on a broad base strategy or a focused base strategy.*

The strategies of national economy growth rely on the competitive strategy of cost leadership or competitive strategy of differentiation. In order to find a different competitive position for different competitive strategies, competitiveness variables for different business strategies have been assigned a different degree of value. Therefore, it is highlighted that competitiveness and strategy need to be understood, designed and applied at different levels of classification of products, companies, industries and countries. This means that companies are transferring from a phase which Michael Porter (1991) labelled as factor-driven economy (where the most significant thing is the input price, i.e. the price of natural resources and workforce) to a phase Michael Porter (1991) labelled as innovation driven economy (where the most significant thing is the competency to produce innovative products using the most modern technology).

One of the most important innovations significantly affecting the paradigm change is the Internet.[2] Internet has radically changed the boundaries of business. A company can achieve success outside its national economy if it uses the Internet complementary, rather than separately, to its existing operations while simultaneously applying new combinations of virtual and physical activities which were impossible in the past.

Internet has finished the reconfiguration of industries and value chains facing high costs due to communication, information collection and the conduction of activities. Michael Porter (2001) believes that the relationship between the Internet and business strategy needs to be clarified. If companies wish to be competitive outside the borders of their national economy, they have to accept the Internet to improve their business strategy. Porter unambiguously confutes the argument that the Internet leads to the inertness of a business strategy. He argues that it does the opposite; it makes business strategy more important. Companies will fail to operate without it, but it will not be the source of their competitive advantage. The Internet technology can reinforce traditional resources of competitive advantage, simultaneously altering the activities of a company into a more personalised system, but without the capability to substitute them. Although the use of Internet can expand the market, it often results in the reduction of average profitability (Milisavljević, 2012).

The Internet has an influence on operative effectiveness and business strategy in a completely different manner. The Internet creates a situation where it is harder for companies to sustain advantage in terms of profitability, but it opens up a vast number of new possibilities for establishing or reinforcing an adequate strategic positioning.

An increase in profitability does not automatically ensure competitive advantage. Companies can achieve competitive advantage only if they are able to create and sustain profitability higher than that of their competitors. The nature of Internet application is to make it harder than ever to achieve advantage in terms of profitability. The advantages of using the Internet, according to Michael Porter (2001), are as follows:

1 The Internet reduces the negotiation factor of middlemen since information technology enables companies to access buyers in a completely different way which is significantly simplified than before.

2 The Internet can increase the average profitability of an industry in different ways: by increasing the overall size of the market and increasing its position in relation to markets with features such as the existence of traditional substitutes.

The disadvantages of using the Internet, according to Michael Porter (2001), are as follows:

1 The Internet technology has provided an easier access to information on products and suppliers for the buyers, increasing their negotiation power.
2 The Internet reduces the need for resources such as regular sales staff or access to existing middlemen, reducing barriers to potential entries.
3 It provides the fulfilment of needs in a new way, as well as the completion of certain functions in a different way by creating completely new substitutes.
4 Being an open system, companies are having increased difficulties in maintaining individual, limited offers, intensifying the rivalry among existing competitors.
5 The use of Internet leads to a geographical expansion of the market resulting in an increased number of companies competing among each other.
6 Internet technologies often lead to the reduction in variable expenses by shifting the focus towards the increase of fixed expenses creating a significantly higher pressure on companies to apply destructive price competitiveness.

The Internet affects generic strategies. The strategy of cost leadership shall become more relevant for some companies, although the use of Internet reduces the transaction costs and increases the efficiency of operations. It will become more difficult for many companies to follow the strategy of differentiation, since the Internet downgrades some of their most important assets. Internet creates an opportunity for an increased capability of mass adaptation of a higher number of competitors. The strategy of focus will receive increasing significance, since the Internet enables lower costs for aimed, narrow and specialised markets (Dess et al., 2007).

The Internet helps to reinforce the strategy of cost leadership and differentiation by using timely communication to programme production, manage warehouses, reduce stock and control costs. Unfortunately, all of the mentioned activities can be copied by other companies. Undoubtedly, the Internet enables all the companies to have an effect on the reduction of their costs and the enhancement of their differentiation (Lancolla and Suarez, 2012).

Several approaches for industry determination can be found in different literature. Derek Abell (1993) points out to the complexity where the problem of industry determination is approached through a strategic standpoint (Jarillo, 2003).

Derek Abell (1993) concluded that there is not a clear and doubtless definition of industry and the approach to its definition attempt depends on the aim of the analysis. Today, industry definition is becoming increasingly difficult since the borderlines between traditional industries are becoming vaguer, which is a consequence of the innovative approaches of company in creating competitive advantage and their transfer to other industries. Andrej Vizjak (2007) argues that such circumstances make it difficult to make a causable classification of the product of a company (e.g. whether it is a watch or piece of jewellery produced by Swatch, or whether it is coffee or pleasure offered by Illy), or to effectively determine the industry type of the company production (e.g. whether does Swatch operate in the industry of watches, fashion or trade).

Companies are constantly changing their production programme, whereas buyers are constantly changing their behaviour. The attractiveness of a particular industry is measured by average profitability. According to Michael Porter (1985), the profitability of the industry is influenced by the so-called competitive forces. Different intensity of competitive forces leads to different levels of profitability. The biggest profits are achieved in industries with a directed action of competitive forces, whereas industries with extremely high values of competitive forces suffer from profitability crisis.

Constructs of environmental strategic analysis

Environmental strategic analysis includes the following:

1 Industry analysis;
2 Strategic group analysis;
3 Competitors analysis from the environmental perspective.

Industry analysis

Michael Porter (2008) suggest the following procedure for industry analysis: (1) Define the relevant industry; (2) identify the participants and classify them according to corresponding criteria into strategic groups; (3) evaluate the background of every strategic strength to determine the strong and weak strategies; (4) determine the general industry structure and consider the strengths influencing the profitability; (5) analyse recent and possible changes in each of the five competitive forces individually, the positive ones, as well as the negative; (6) identify the aspects of industry structure which can be influenced by current competitors, new industry competitors or your own company.

Industry analysis is important for shaping the business strategy of individual competitors since it has a vital effect on the behaviour of the company. It is evident that industry factors influence all the companies within an industry, but each company, in its idiosyncratic way, reacts to them (Milisavljević, 2012). In order to be compared to others, a corporation needs to be highly informed on the *key success factors –KSF,*[3] which vastly influence the overall competitive position of a company within the industry. They are tied to each specific industry and differ from one industry to another.

Michael Porter (1980) differentiates four types of industries, which are as follows:

1 *Developing industries*: Developing industries are at the initial phase of their life cycle as an industry. Their basic feature is that they are completely new or completely altered industries.
2 *Mature industries*: Mature industries are at a critical phase of their life cycle as an industry. Their basic feature is that they have a wide spectre of possibilities for solutions ranging from cost leadership to differentiation or focusing.
3 *Falling industries*: Falling industries are at the final phase of their life cycle as an industry. Their basic feature is that they are completely atrophic or completely impotent industries.

After passing through the industry life cycle phases (from developing, though mature to falling), a company faces the following strategic alternatives (Figure 4.1; Harrigan and Porter, 1983): *(a) Harvest, (b) fast exit, (c) leadership and (d) niche guardian*. Disinvestment is the basis in case of strategic alternatives of harvest and fast exit and investment and disinvestment are the basis of strategic alternatives of leadership and niche guardian.

The strategic alternative of harvest or divest quickly includes the tendency to reduce market share to achieve the goal of maximising cash flows. Companies give up on investing and consider the option of liquidating some of its businesses. This strategic alternative can be implemented by companies which are able to survive more turbulent fluctuations on the market for a shorter or median period of time. *The strategic alternative of divest quickly* implies the achievement of the highest yield to invested capital in case of the sale of the company at the initial phase of a downfall in an industry. The biggest challenge for owners is to determine the right moment to sell, i.e. to timely react to industry trends. The essence is to create the highest possible sales price of the company. *The strategic alternative of leadership or niche* implies reaching the leader position in a falling industry. A leader can become dominant on the market, and it is often a company with rich experience in market operating. Mergers, i.e. external growth is sometimes practiced in order to achieve absolute and irrefutable dominance. *The strategic alternative of niche or harvest* implies the focus of attention towards the location of a niche without featured negative tendency in comparison with other niches. This strategy is actually the very final

	Has competitive strenghts for remaining demand pockets	Lacks competitive strenghts for remaining demand pockets
Favorable industry structure for decline	**LEADERSHIP OR NICHE**	**HARVEST OR DIVEST QUICKLY**
Unfavorable industry structure for decline	**NICHE OR HARVEST**	**DIVEST QUICKLY**

Figure 4.1 Strategic alternatives in a postindustrial cycle.

Source: Adapted from Harrigan and Porter (1983:118).

attempt at sustaining the life cycle of the company. Niche identification calls for investment which is expected to be recovered in the shortest possible period. The significance of selecting a strategic alternative in a falling industry is to determine whether it is more useful for a corporation to stay within an industry or to exit it in the shortest possible period. In addition, the understanding of the strategy by acknowledging the barriers of industry exit can be useful when determining the relative position of a company. Industry analysis is important for the selection of a strategic alternative of every industry participant (competitor) since the industry has a decisive effect on the behaviour of the company. Industry analysis is aimed at the analysis of the market structure which is used to determine the number and size of existing competitors.

According to Hill and Jones (1998), the industry structure can vary in terms of a higher or lower number of competitors which have to or do not have to be differentiated by their strength and market share.

Michael Porter (1980) labelled such an industry structure (a variable structure) as:

1 Fragmented;
2 Consolidated.

A *fragmented industry* is a form of industry with low concentration and a large number of small and medium companies without domination and influence on the shaping of events within the industry, whereas a *consolidated industry* is a form of a densely concentrated industry with a single or several big companies dominating and influencing the shaping of events within the industry.

Industry concentration is defined by the number and size distribution of companies within an industry. Such a classification opens up the possibility

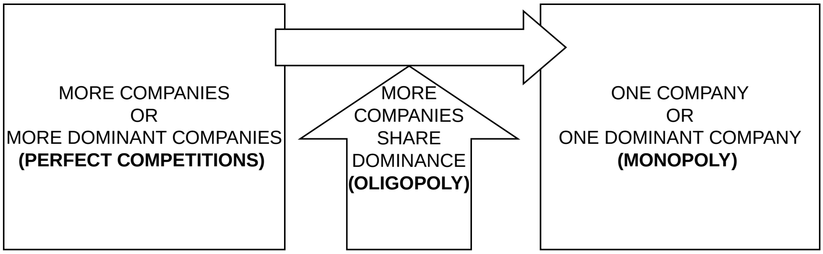

Figure 4.2 Market structure.

Adapted from Hill and Jones (1998:77).

of discussing *industries with a higher degree of concentration* with a small number of companies with a small share controlling a smaller part of the market and *industries with a lower degree of concentration* with a bigger number of companies with a smaller market share controlling a smaller part of the market. Michael Porter (1998) adapts the traditional neoclassical claim that the industry structure, i.e. multiple companies competing at the same market, demands technology advancement, cost minimisation, innovation development and similar.

He argues that a simple index of industry concentration is an insufficient gauge of the degree of rivalry among competitors. He thinks that the competitive structure of the industry does that job. Three basic forms of market structure are shown in Figure 4.2.[4]

a Perfect competition;
b Oligopoly;
c Monopoly.

Perfect competition describes an ideal competitive structure including a host of companies selling a product which cannot be differentiated at no other feature but price. The advantage of perfect competition is that all companies are in the same position, selling the same products and using the same middlemen. The disadvantage is that the lack of product differentiation keeps the profitability rate low for all participants.

Oligopoly describes the regular competitive structure where a small number of competitors control the market, particularly the price. In addition, the input barriers are so high that only a handful of companies can join in the competitive battle.

A small number of companies determine the price. The level of product differentiation is low and the market entry requirements are high. The key factor is the interdependence of the companies. Since a small number of companies share market control, each of them is always aware what the others are up to. The presence of few competitors forces the company to shape its business strategies to be aimed at achieving competitive advantage over others. Due to a small number of producers, price-based competition is not favourable since it leads to a decrease in profit for all producers.

Monopoly describes a common structure where a single company completely controls the product offer with no exact substitute. Since there is no competition, the company can form the price of the product on its own. The entrance of new competitors is made difficult. The advantage of monopoly is that a single company is in the same position as others, selling the same products at the same price using the same middlemen. The disadvantage is that the lack of product differentiation keeps the profitability rate low for all participants.

Ccompany core competence is attached to a particular industry which forms the surrounding. For example, a faculty, as an educational facility, belongs to the higher education business (industry), whereas a hospital, as a health facility, belongs to the business (industry) of health. Following this idea, it is necessary to have all the information on the respective industry of the business. Certo and Peter (1991) offer a very detailed manner of attaining the source of general information on an industry. An important source of information can often be found in the form of different headlines and regular content found in newspapers.[5] For example, *New York Times*, *Financial Times* and other similar newspapers covering particular topics can be a valuable source of industry information or data. When discussing the sources of information on an industry, it is worthwhile to mention Michael Porter's attitude on sources and information needed for industry analysis (Wheelen and Hunger, 1990).

He divided all the information resources into six basic groups, i.e. resources,[6] which are as follows:

1 Observers or overseers;
2 Suppliers or provisioners;
3 Sellers or distributors;
4 Buyers or users;
5 Competitors or adversaries;
6 Services or assistance.

Michael Porter particularly developed the resources from the first, fifth and sixth groups.

Michael Porter argues that the most important information resources in *group 1*, which consists of observers and overseers, include: (a) Networks, (b) unions, (c) publishers, (d) board, (e) associations, (f) agencies, (g) organisations and similar.

He argues that the most important information resources in *group 5*, which consists of competitors and adversaries, include: (a) Staff, (b) departments, (c) organisations, (d) employees, (e) agencies and similar.

He argues that the most important information resources in *group 6*, which consists of services and assistance, include: (a) Associations, (b) banks, (c) consultants, (d) supervisors, (e) auditors, (f) agencies and similar.

All the stated resource classifications (explained comprehensively and in detail) reinforce the hypothesis that there is a vast number of potential resources as well as the importance of their successful utilisation. A reaction is therefore needed based on the collected information on an industry.

When reacting to gathered information on an industry, it is necessary to *understand, interpret and correlate the information to reach relevant conclusions on the value of available information.* The information concerning the given industry is important since the industry has a direct impact on the company (Mašić, 2009).

According to Michael Porter (1983), the relative environment is considerably broad and it includes the respective social and economic factors and it is a key aspect of the environment of the industries (or an industry) which is the competing field of the organisation.

An analysis of the definition reveals that, in modern conditions, an industry does not have demarking lines. This means that each company can be both *a rival* and *a competitor*, simultaneously.

However, the partner relationship can be easily transformed into a competitive relationship. For example, if a buyer starts producing items which it formerly bought or if a supplier starts using products for his own business, rather than for sales. If we add potential competitors and the possibility of substitution to this scenario, it can be concluded that the competitive outreach, i.e. the range of contact with competitors, is much wider than the range indicated by the industry analysis.

However, the definition offered by Michael Porter is not accepted by contemporary theoreticians and practicians. Hence, he approached it from a broader aspect and expanded the competitive context beyond the industry (i.e. the competition among existing companies) to include suppliers, buyers, new competitors and substitute producers. He called it extended rivalry and he used it to set the boundaries of an industry. Considering his analysis of these five variables, there can be a so-called good and bad environment (Table 4.1; Bateman and Zeithaml, 1990).

Table 4.1 "Good" and "bad" environment

Factors	*Industry surrounding*	
	So-called "bad"	*So-called "good"*
Competitor rivalry	Numerous low industry growth	Few; high industry growth
Entry possibility	Numerous low industry growth	Few; high industry growth
Substitute possibility	Numerous	Few
Supplier strength	Few; strong negotiation power	Numerous; low negotiation power
Buyer strength	Few; strong negotiation power	Numerous; weak negotiation power

Source: Adapted from Bateman and Zeithaml (1990:228).

The level of profitability in an industry depends on the action of the competitive forces. The highest value is achieved in industries with a directed activity of competitive forces (oligopoly), whereas the lowest value is achieved in industries with extreme activities conducted by competitive forces (perfect competition on one side, and complete monopoly on the other side). Namely, when observing an industry environment from a company viewpoint, it is recognised as adverse if: *There are a lot of competitors, a lot of growth rate, a reduction of the entry barriers, lots of product substitutes, high negotiation strength and similar.* However, an industry surrounding is favourable if: *There is little competition, high growth rate, high entry barriers, few product substitutes, low negotiation strength and similar.*

However, the government needs to, directly or indirectly, manage the entry and exit terms, encourage the development of industries and substitutes, relativise the strength of suppliers and buyers and similar.

After almost 30 years, Michael Porter (2008) returned to his old magazine where he wrote about the five competitive forces. In his opinion, it is necessary to understand competition confrontation. Industry structure drives competition and profitability forward disregarding the character of the product or industry. When the industry structure is changed, new and promising strategic positions start emerging since the structural changes create new needs and new ways to meet the existing needs. Industry leaders have to predict such changes creating an opportunity for smaller companies to make profit. A careful definition of the relevant industry is suggested, one that is neither too narrow nor to broad, using two main dimensions of broadness of the industry in the process (Milisavljević, 2012): (1) Production broadness and (2) geographical broadness. The accent is on identifying the industry with good future opportunities.

In order to occupy an optimal strategic position in the environment as a form of strategic behaviour leading towards the creation of sustainable competitive advantage, Michael Porter (2008) recommended the concept of five competitive forces. The concept provides a way of conducting the *company analysis* versus *environment analysis* to form future business strategies in the *company-environment interaction*.

Namely, Michael Porter (1983) believes that the main goal of the analysis is to locate the strategic position in the industry where a company can have the best and most successful defense against the influence of other competitors in the industry and/or where it can have the best influence on them for their long-term benefit. The mutual power of the five competitive forces determines the basic potential of industry profitability and defines the inter-industry differences in the scenario of above the average profitability. The most powerful competitive forces prevalently determine the profitability of an industry.

On the one side, the profitability of an industry is *higher* if an industry has a stable competitive structure, a more favourable position in relation to suppliers, buyers and substitute industries and a lower degree of danger caused by the entrance of other companies. On the other side, the profitability of an industry is *lower* if it has a variable and undefined competitive structure, weaker position in relation to suppliers, buyers and substitute industries and if there is a high degree of danger caused by the entrance of other companies.

The concept introduced by Michael Porter (Kippenberg, 1998) requires conducting an exhaustive analysis of industry structure to reach a satisfying understanding of industry profitability and to locate the sources and incentives of each competitive force and to determine the possibility of a long-term influence on the profitability of the industry.

Understanding the industry structure alongside a conducted intern analysis of the company helps to gain a better insight into the real strengths and weaknesses of a company, develop the framework for positioning a company in an industry, identify the area where a strategic change is most beneficial and shed light on factors which offer the biggest chance for opportunities and threats according to industry trends.

The aim of conducting the analysis is directly linked with the process of shaping the business strategy. The strategic actions of a company in an industry (e.g. price policy, production manner, innovative capacity and similar) depend on the existing and future industry structure (e.g. competitive structure, production differentiation, industrial barriers and similar). Hence, the aim of the company during an industry analysis is clear: *Locate the industry position where a company can form the best defense against all of these forces and/or where it can have the best influence on its long-term benefit.*

Understanding the five competitive forces is the basis for evaluating the company position within the industry leading two fundamental goals (Barney, 1991):

1 *Maintaining the position* – if a company is content with its position (e.g. if it scores highest among its competitors);
2 *Repositioning* – if a company is not content with its position (e.g. if it wants to be distinguished among its competitors).

The constructs of the five competitive forces concept represent a somewhat threat to a company. Threats increase expenses, reduce income and reduce profit. The threats are identified as forces leading to an increase in the overall level of competitiveness in an industry, levelling the degree of created value with the national economy average. In other words, the competitive environment is determined by the following (Figure 4.3; Porter, 1985):

1 Rivalry among existing competitors;
2 Threat of new entrants;
3 Threat of substitution;
4 Bargain power of suppliers;
5 Bargain power of buyers.

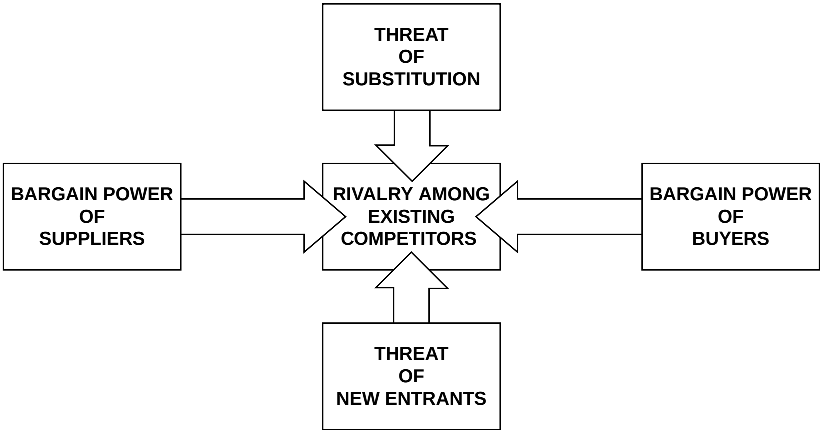

Figure 4.3 Porter's five competitive forces concept.

Source: Porter (1985:5).

Each construct in the five competitive forces concept has certain characteristics which are summed up in Figure 4.4.

> Looking at the image, it can be concluded that it is not in accordance with good economic intuition for all competitors to, more or less, follow their business strategies based on, more or less, the same resources of competitive advantage. Such an action limits the ***industrial organization*** approach which advocates that competition expresses itself through its prices. According to Joan Magretta (2012), this has led Michael Porter to oppose such attitudes in his works and suggest a new framework for analyzing the competitive game. Competition is not a war or a zero sum game where one player wins and the other loses. Competition is a win-win game.

Considering Michael Porter's contribution in that context, Joan Magreta (2012) states that there is a mindset change in rivalry among existing competitors which is shifting from the approach of beating competition to the approach of creating value. The comparison of the competitive rivalry mindset based on the industrial organisation approach and Michael Porter's approach can be seen Table 4.2.

Michael Porter's (Magretta, 2012) approach highlights the effect of the environment (industry) on the company (value chain). Namely, the profitability of the organisation is under the influence of the industry structure where the company is operating. The company must adapt to the conditions of the industry to survive and thrive. An industry with a favourable structure offers the best conditions for company profitability. A company can influence the industry structure with its innovative strategies rather than

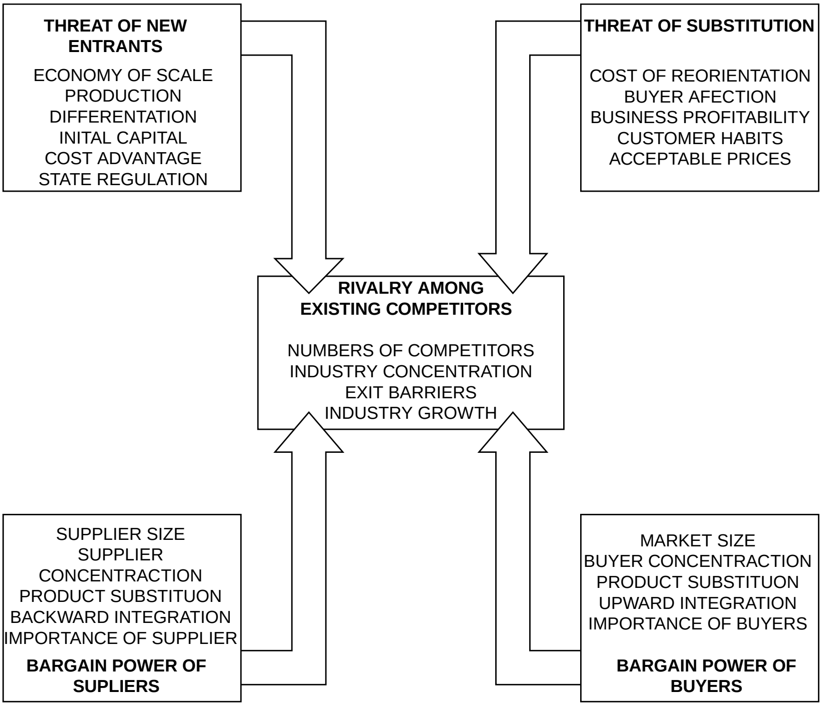

Figure 4.4 Elements of industry structure.

Source: Adapted from Porter (1985:6).

Table 4.2 Possible approaches to the analysis of the competitive game

The industrial organisation approach	*Michael Porter's approach*
Number one	Above the average profitability
Focus on market share	Focus on creating value
Serving the best buyer with the best product	Meeting the different needs for aimed buyers
Competing by imitating	Competing by innovation
Zero-sum game	Win-win game

Source: Adapted from Magretta (2012:32).

solely adapt to it. That is the reason why Michael Porter (Magretta, 2012) expands the rivalry of competitors to four additional factors widening the context of the market game: Buyer strength, supplier strength, substitute possibility and entry possibility.

This concept represents a sound analysis of flawed market structures. However, each competitive force has a different way of influencing the profit recognised as a difference between overall income (operative effectiveness) and overall expenses (operative efficiency), as shown in Figure 4.5.