

Artículo de investigación

Modern problems of diversification of the activities of high-tech enterprises in the context of economic growth**Современные проблемы диверсификации деятельности высокотехнологичных предприятий в условиях обеспечения экономического роста**

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The purpose of this article is to highlight the modern problems of diversification of production in the context of the General concept of economic growth and competitiveness of engineering enterprises.

The main objective of the study of diversification of high-tech enterprises is the analysis and practical use of methods for evaluating the processes under consideration to ensure their development in the future. In the era of orientation of enterprises towards an innovative development in the economy and the fullest use of production capacities, diversification allows expanding the planning considering changes in the market conditions of products and assessing the efforts of enterprises to improve their activities.

When conducting analytical and research work, the following methodological principles were used: integrity of the diversification policy; structuring of work; complexity; economic feasibility, prospects, etc. that need to be considered when building a unified strategy for the development of the enterprises.

The content of the study is determined by clarifying the concept of diversification and expansion of its application in the field of

Аннотация

Целью статьи является освещение современных проблем диверсификации производства в условиях общей концепции экономического роста и повышения конкурентоспособности машиностроительных предприятий.

Основной целью исследования диверсификации многопрофильных высокотехнологичных предприятий является анализ и практическое использование методов оценки рассматриваемых процессов для обеспечения их развития в перспективе. В эпоху ориентации предприятий на инновационный прорыв в экономике и наиболее полное использование производственных мощностей, диверсификация в широком смысле позволяет расширить горизонты планирования с учетом изменения рыночной конъюнктуры выпускаемой продукции и оценить усилия предприятий по совершенствованию своей деятельности.

При проведении аналитических и исследовательских работ использовались следующие методологические принципы: целостность политики диверсификации; структуризации работ; комплексность; экономическая обоснованность,

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production, application of capital, production cooperation of the market aspect, technologies and others.

Modern types of diversification of production are considered in detail: nomenclature, assortment and innovative ones. The main reasons of diversification by modern machine-building enterprises are analyzed.

The document shows the main indicators determining the level of diversification of the enterprise and the efficiency of its implementation. Furthermore, this article studies the analysis of the dependence of the stages of the life cycle of goods of the enterprise. Also, it evaluates the concepts and indicators that divide the effectiveness of diversification and the prospects of its implementation. According to the results of the study, the authors concluded that it is necessary to develop methods that analyze the economic aspects of the types of diversification in machine-building enterprises.

Keywords: Diversification of capital application, diversification of production, diversification strategies, efficiency and prospects of diversification, technological diversification.

Introduction

The development of market competition forces producers of high-tech products to restructure the existing social and technical division of labor, which in the modern economy is not so much based on the specialization of production as on its ability to diversify. In a competitive struggle the manufacturer who is able to react flexibly to changes in the external environment and market conditions wins, can consistently expand the nomenclature and assortment of let out production (Englichaninov, Kuznetsov, Shukshin, 2007).

Under the modern conditions, the enterprises develop all kinds of diversification that contribute to the current and strategic objectives. An integrated approach involves the expansion of the range and assortment of products, the use

перспективность и другие, которые необходимо учитывать при построении единой стратегии развития предприятий.

Содержание исследования определяется уточнением понятия диверсификация и расширение ее применения в области производства, приложения капитала, производственной кооперации рыночного аспекта, технологий и других.

Подробно рассматриваются современные виды диверсификации производства: номенклатурная, ассортиментная и инновационная. Анализируются основные причины проведения диверсификации современными машиностроительными предприятиями.

Приводятся основные показатели, определяющие уровень диверсификации предприятия и эффективность ее проведения. Акцентируется внимание на анализе зависимости проведения со стадиями жизненного цикла товаров предприятия. Рассматриваются понятия и показатели, разделяющие эффективность проведения диверсификации и перспективность ее реализации. По итогам проведенного исследования авторами сделан вывод о необходимости разработки методик, анализирующих экономические аспекты проводимых видов диверсификации на машиностроительных предприятиях.

Keywords: диверсификация приложения капитала, диверсификация производства, стратегии диверсификации, технологическая диверсификация, эффективность и перспективность диверсификации.

of various technological processes that reduce the complexity and quality of work performed, wisely use real capital in profitable innovative projects, and maneuver with various forms of organization of production, labor, etc.

The only measure for diversification is the effectiveness of their implementation and the prospects for the development of the enterprises and the correspondent industry.

Literature review

The term diversification comes from Latin words *diversus* - different and *facere* - to do. In the most general sense of the word, diversification can be defined as a measure of diversity in a certain

aggregate. One of the first terms "diversification" was coined by Harry Markowitz in his article "Portfolio selection" published in the Journal of Finance in March 1952. At the beginning of the article, he uses the expression "diversified portfolio", which in literal translation from English means "diverse, different portfolio". Marcovitz further explains that diversification is a phenomenon that is simultaneously observable and perceptible; it is a rule of conduct that does not mean that diversity is superior, but is rejected as both a hypothesis and a principle (Markowitz, 1952).

The problem of diversification during a long period of time was studied by many Russian and foreign researchers. It is necessary to note the work of Vorotilova V.I., Zakharova V.G., Egorova E.N.

Among foreign authors there are the following: Ansoff I., Brun M, Kono T., Kotler F., Porter M., Poston T., Stewart I., Tarsen V., Hayek, they made serious developments in this direction.

Almost all authors agree that diversification is a rather important and complex component of competition and market relations.

The authors are interested in studying the diversification strategies of enterprises and firms. R. Leman concludes that the main factor determining the diversification strategy of enterprises is competencies that are related to

their industry specialization, accumulated experience in this field, within which diversification must be implemented (Leman, 2007).

G. Nemchenko offers a wider approach to diversification depending on the financial situation of the company.

M. Pasquier, focusing on the issue of efficiency, there is the conclusion that it is necessary to divide enterprises into the following: those who are only approaching diversification and those who have significant experience in its implementation (Pasquier, 2007).

Based on the generalization of a large empirical material, M. Pasquier concludes that diversification strategies changed the goals: from enterprise growth, risk reduction, and internal distribution of capital to achieving a synergistic effect of various types of activity and increasing competitiveness. He refers to the synergistic effect, which is a result of the relationship between advertising and other events to promote one product and market others.

Methodology

When creating and developing an integrated system of diversification at an enterprise, it is very important to use methodological principles given in the Table 1.

Table 1. Methodological principles for the construction and operation of an enterprise diversification management system

Principle name	Principle content
Diversification policy integrity	Comprehensive diversification as a method and direction of development of an enterprise should have a definite unified with the goals and objectives of diversification correspond to the goals and objectives of enterprise development.
Diversification focus	Each type of diversification or combination of several types should have a specific purpose for its implementation, for example, to achieve market stability of the enterprise, increase work efficiency, achieve leadership in certain industry projects, etc.
Structuring by types of diversification in the enterprise	Each type of diversification has its own characteristics that must be considered when building an enterprise development strategy. Diversification should be based on forecasting the growth of capital-forming indicators of the enterprise during its implementation.
Unity of management theory and practice	Managerial decisions on diversification should be based on advanced management methods in order to obtain the best practical result.
Complexity	Mutual linking of all formed elements of the system with the stages of the product life cycle with the possibility of its extension, regulation of prices and marketing activities.

Science	Development and implementation of diversification measures should be based on modern methods for predicting the risks and diversion of funds for its implementation.
Economic feasibility	Effective diversification should be economically justified for the introduction of new goods, technologies, etc. in terms of costs of its implementation and economic effect, considering the payback period.
Perspective	Orientation not only to current technical and economic tasks, but also promising given the forecasting of its use.
Optimality	Multivariate study of managerial decisions and selection, in accordance with a certain criterion, of an optimal set of manufactured goods, markets, prices, suppliers, etc.
Flexibility	Ability to change the planned indicators of diversification and the timing of its implementation under the influence of environmental factors.

When conducting diversification and assessing its scale and effectiveness, economic and mathematical methods are used based on comparing the diversification results of the analyzed enterprise with the main competitors, industry leaders and other enterprises.

The need to diversify production may arise for the following reasons:

- Company makes a technical and technological breakthrough in the field of production of specialized products;
- Company plans to produce new competitive products for export or to demonstrate the level of scientific research in the world market;
- Company experiences difficulties in the implementation of the current range of products;
- Majority of goods are in a declining life cycle (LC) phase;
- Need to make the most of production capacity (due to its full or partial downtime);
- High level of competition in the market for relevant goods and there are similar goods (including imported ones) that quickly capture the market;
- Company purposefully reduces the risk of dependence on the market conditions of individual goods;

- Company is pursuing a diversification strategy as an important development area;
- Use of production wastes, illiquid circulating assets and others.

The objectives of diversification of production can be very diverse, for example (Baumung, 2012):

- Ensuring economic growth and increasing the market stability of the enterprise;
- Preventing certain losses in the future;
- Reducing the dependence of the enterprise on the stages of the life cycle of goods;
- Eliminating the imbalance between resources and capabilities of the enterprise;
- Increasing the efficiency of production and economic activities, and others.

The greater the variety in various fields an enterprise can provide, the higher the level of diversification of its economic activities. Table 2 shows the main areas of application of the concept of diversification.

Table 2. Main areas of application of the concept of diversification

Type of diversification	Field of application
Diversification of production	Expansion of nomenclature and product range by the enterprise
Diversification of capital application	Allocation of financial resources to various innovative projects or investment funds between securities with different returns and risks
Diversification of production cooperation	Expansion of the sphere of economic relations on delivery of components and semi-finished products
Market diversification	Expansion of sales markets for products
Technological diversification	Expansion of technologies and know-how used by the enterprise
Industry diversification	Expansion of economic relations and implementation in other sectors

Diversification of production is especially important for the future development of the enterprise. It is usually defined as an increase in the range of goods produced.

In theory and practice, diversification of production is usually divided into (Figure 1):

- Nomenclature, which implies an increase in the types of output corresponding to the main specialization of the enterprise (i.e. specialized diversification);
- Assortment, at which there is an increase in subspecies of products corresponding to the main specialization (profile diversification);
- Innovative, when the increase in the nomenclature of products is carried out through the development of new products that may or may not

correspond to the main specialization of the enterprise (specialized and non-core diversification).

The nomenclature of manufactured products is understood as the general list of manufactured goods.

The range of products produced is formed within the nomenclature and represents varieties of main products with certain characteristics.

For example, the company produces electric motors for a wide range of technical means, which are its nomenclature position. However, electric motors may differ in power, size and other characteristics that make up the product range. The more the assortment of the goods produced, the more the company has the opportunity to find its own consumer.

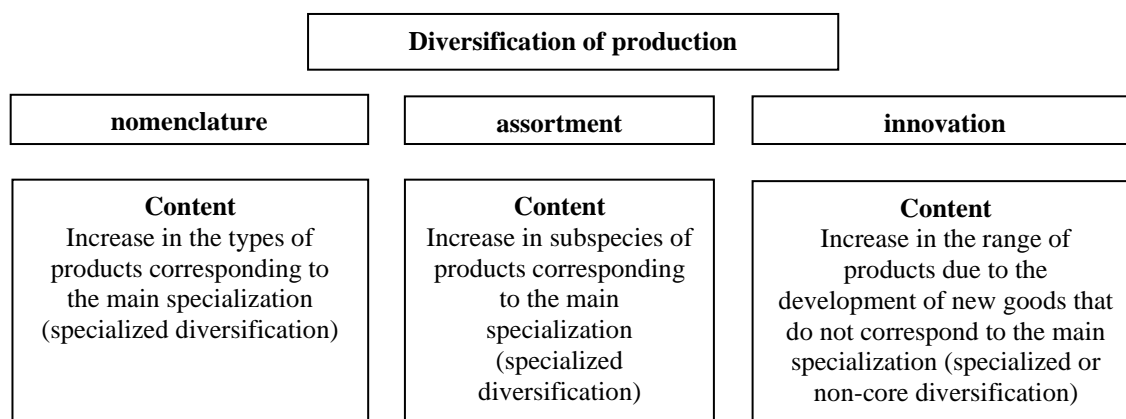


Figure 1. Main areas of production diversification

When forecasting the stage of decline in the life cycle of certain goods, the enterprise often upgrades its products to offer the consumer a more perfect modification and extend the stage of growth or maturity. This strategy should be based on a forward-looking innovation and marketing policy with financial, technical and technological resources (Nemchenko, Donetskaya, Dyakonov, 2008).

In the process of planning the commodity policy taking into account the diversification of enterprises it is advisable to think over the "commodity portfolios" of products with a pre-planned shift in the stages of their life cycle. At the same time, it is possible to achieve a certain balance between financial and economic activities and the possibility of a flexible system of financing for development, considering the increased probability of obtaining the planned profit (Putyatina, Barsova, Tarasova, 2016).

Diversification of the capital application is determined by the availability of financial resources of the enterprise and alternative directions of their use on:

- Development of own technical base;
- Introduction of real innovation projects;
- Investing in other areas of activity;
- Acquisition of securities of other enterprises and organizations, etc.

Diversification of production cooperation implies the expansion of the sphere of economic relations for the supply of components and semi-finished products. This type of diversification is aimed at reducing both the cost of production and the duration of the production cycle, as specialized enterprises are able to produce components and semi-finished products at lower costs and of higher quality. The development of intra-industry, inter-sectoral cooperation provides enterprises not only with a reduction in costs, but also accelerates the turnover of capital, which, in turn, allows enterprises to increase their profits (Gort, 1962).

Market diversification largely depends on the diversification of production of certain goods, as an individual approach to customers and consumers provides the enterprise with stability of market niches and duration of economic relations. Therefore, the search for new markets for their core and newly developed products should be considered as an important direction of strategic development (Arsenieva, 2009).

Technological diversification presupposes the expansion of technologies and know-how used by the enterprise and depends on the prospects of the product range for which it is necessary. Adoption of new technologies provides better quality of goods, but most often new technologies are adopted in connection with the production of new goods, as additional funds are required, which either increase the cost of the current range of products or pay off when new goods are promoted in new markets (Van Kranenburg, 2004).

Sectoral diversification determines the expansion of economic relations and implementation in other sectors. In an increasingly competitive environment, the boundaries of certain industries are converging. At the same time, each company offers its services and goods for related industries, the development of which requires real economic growth (Tarasova, Putyatina, Lavrova, 2016).

Results and discussion

As a result of the analysis of the main types of diversification, it can be stated that diversification is a self-regulating process of expanding the capabilities of the enterprise in various directions, most of which are interrelated and mutually conditioned.

It is advisable to assess the effect of diversification of any type of activity not by the results of current activities of enterprises, but for a certain strategic period of time for which it is calculated (Novitsky, 2001).

The following parameters can be used as the main indicators to determine the scale of diversification and its effectiveness at the enterprise.

The level of diversification of production (L_{div}) (by nomenclature and assortment), which determines the quantitative assessment of diversification carried out at the enterprise. This figure is calculated:

$$L_{div} = \frac{n^{plan}}{n^{bas}} * 100\%$$

where n^{plan} , n^{bas} is the nomenclature of products manufactured by the enterprise, respectively, in the planned and basic periods.

The increase in the dynamics of the indicator means an increase in the activity of diversification carried out by the enterprise. The

most representative is the dynamics of this indicator for 3-5 years.

The level of efficiency of diversification shows the quantitative growth of key indicators as a result of the diversification of the enterprise. This indicator it is expedient to count on volume of realized production (L_{div}^V) and on profit (L_{div}^P) which are calculated accordingly:

$$L_{div}^V = \frac{Q_{real}^{new}}{Q_{real}} * 100\%; L_{div}^P = \frac{P_{prod}^{new}}{P_{prod}} * 100\% ,$$

where Q_{real} , Q_{real}^{new} is the revenue from sold products, respectively (thousand rubles);

P_{prod} , P_{prod}^{new} is the profit from the total commodity production of the enterprise for the year and from new products (thousand rubles).

The level of efficiency of profit diversification should be higher than the same indicator in terms of volume. In this case, the development of new or upgraded products is the most effective for the company.

The level of diversification of the enterprise determines its status in the industry. For example, if company's products have a fairly narrow application and the range of goods produced is small, it is specialized; on the other hand, if the range of goods finds a variety of applications and nomenclature is wide enough, it is a diversified enterprise (Arsenieva, 2009).

In the conditions of developing competitive environment, diversification in the activity of the enterprise is one of the important directions of its strategic development, as it should provide it with quantitative and qualitative economic growth (Belyakov, Ereemeeva, 2013).

In the modern theory of strategic management there is a group of diversified economic growth strategies, which has the following features:

- Enterprise actively develops new goods, which often do not correspond to its main specialization;
- Markets for products are actively expanding, and the most promising markets are being sought;
- New promising technologies are being introduced;
- Production capacity is being consistently developed considering new goods and technologies.

The main instruments of development of the enterprise of this group of strategies are all directions: development of new goods, active search of new markets, introduction of new technologies and provision of modernization and growth of production potential. At the same time, the company is concentrating its efforts on:

- Development and implementation of new products that do not always correspond to their core competencies;
- Regular modernization, improvement and purchase of new equipment, often automated;
- Large-scale marketing research on promising sales markets, active marketing policy;
- Improvement and increase of production potential.

The specific strategies of this group are considered to be specific:

- Strategy of concentric diversification is mainly based on the search for new most promising products, increasing their range for future development and adjusting all other components to the new product line;
- Horizontal diversification strategy assumes expansion of sales markets and their separate segments against the background of development of new goods;
- Strategy of conglomerate diversification provides the company with a comprehensive development, in which a large-scale introduction of innovations in all areas of activity (new goods, new subjects and means of labor, new methods of management, the use of information technologies, modernization of production potential, etc.).

Diversification strategies in the development of enterprises are the most complex, requiring a significant amount of financial resources and high professionalism of management personnel. They can be used either by large enterprises and financially independent companies or by enterprises with state support.

Diversification carried out by the enterprise should be efficient and perspective.

The effectiveness of diversification is determined by indicators such as (Putyatina, Barsova, Tarasova, 2016):

- Growth of income from the sale of manufactured products, including new and modernized goods, as well as investment in other activities;
- Growth of the company's profit from all diversified activities, including new goods and others.

To assess the prospects of diversification of the enterprise it is advisable to analyze:

- Increase in the number of long-term business contracts for the supply of products;
- Consistent increase of market share in the most popular types of renewable industrial products of the enterprise;
- Active participation in projects to develop related industries, for which an

- extended range of products is being developed and planned for delivery;
- Gradual decrease in the average age of the products produced due to the increase in the share of goods at the growth and maturity stages;
- Obtaining certificates, diplomas and other nominations of the company's products at Russian and international exhibitions;
- The fullest use of production capacity;
- Active renovation and modernization of fixed assets through profit growth, etc.

Let's consider the results of calculations of general indicators of production diversification on a specific example of a real enterprise in the dynamics given in the Table 2.

Table 3. Estimated indicators for analysis of enterprise diversification development

Years Indicators	Legend	Units of measurement	Basic	1st...	2nd...	Evaluation
Nomenclature of output products	n	species	120	140	150	↑ +
Level of production diversification (by nomenclature)	L_{div}	%		116,6	107,1	↑ +
Level of diversification efficiency:						
- in volume;	L_{div}^V	%		103,6	115,8	↑ +
- byprofit	L_{div}^P	%		101,2	125,6	↑ +
Coefficient of production specialization	C_{spec}	%		62,0	68,0	+

In this case, the dynamics of three years (base year, 1st and 2nd) is given, which can be interpreted as follows:

- Company consistently expands the range of products, which characterizes the increase in the level of diversification of production (in the 1st year relative to the basic one by 16.6% and in the 2nd year by 7.1%);
- Efficiency of the diversification is confirmed by the growth of sales volumes of new products in the 1st year by 3.6% relative to the base year with a slight increase of profit by only 1.2%, but in the 2nd year the level of efficiency in sales volumes has already increased by 15.8% with a significant increase of profit by 25.6%;

- Diversification has been accompanied by an increase in the level of specialization of production (the specialization rate has increased from 62 per cent to 68 per cent).

In general, the enterprise for the period under review conducted an active and effective diversification of products, which was implemented within the framework of industry specialization.

Diversification of the product range by life cycle stages and their share in the company's revenue is of great importance.

Let's consider this fact on a specific example, the data on which are given in the Table 2, where the data of the structure of the goods produced by the enterprise by stages of the life cycle are given.

Table 4. Structure of the enterprise's goods by life cycle stages

Life cycle stages	Share of goods in nomenclature of enterprise (%)		Share of goods in company's revenue (%)	
	Based year	Planned year	Based year	Planned year
Introduction to the market	25	30	15	24
Growth stage	40	45	55	60
Maturity stage	25	20	12	10
Stage of decline	10	5	8	6
Revenue growth rate (%)		120		
Profit growth rate (%)		132		

The Table 2 shows the data for the two periods (baseline and planning) for which the following conclusions can be drawn:

- Due to the introduction of new and modernized goods, their share at the stage of introduction of goods to the market consistently increases in both nomenclature and revenue, which determines the prospects of their development;
- Goods in the growth stage also increase in both nomenclature and revenue share;
- Products at the maturity stage are consistently reduced both in terms of weight and revenue, as they are being replaced by new products;
- Decline stage is characterized by the same tendency both in the specific gravity and in the share of revenue.

As a result, diversification should be recognized as promising and effective for the enterprise, taking into account the growth of revenue and profit for the period under consideration.

Conclusion

The main objective of the study of diversification of multidisciplinary engineering enterprises is the analysis and practical use of methods for evaluating the processes under consideration to ensure their development in the future.

The need for diversification of production may arise due to the following reasons: most of the goods are at the stage of decline in LC; the need for the most complete use of production capacities; high level of competition in the market for relevant goods and analogous products (including imported ones) that quickly capture the market; company pursues a diversification strategy, as an important direction of development, etc.

The goals of diversification of production can be very different, but the most important and perspective is to ensure economic growth and increase the market stability of the enterprise.

The main modern types of diversification include industrial diversification (in the field of capital investment), industrial cooperation, market, technology, industry, etc.

Now the diversification is a self-regulatory process of expanding the capabilities of an enterprise in various directions, most of which are interconnected and interdependent.

To assess the breadth of coverage of the processes under consideration, it is advisable to use quantitative indicators that determine the level of diversification of production at the enterprise, which should correspond to the level of effectiveness of the diversification.

The diversification carried out by the enterprise should be effective and perspective.

The effectiveness of diversification is determined by the following indicators: growth of income and profits from the sale of manufactured products, including new and modernized goods, and investment in other activities.

To assess the prospects of diversification of the enterprise, it is advisable to analyze the following: consistent increase in market share for the most popular types of updated industrial products of the enterprise, increase in the number of long-term business contracts for the supply of products, active participation in projects for the development of related industries, for which an expanded assortment of products is being developed and planned for delivery, most difficult use of production capacities, and many others.

The diversification of the activities of machine-building enterprises now is an objective reality

and a necessity conducive to their future development.

References

- Arsenieva N.V. (2009). Main problems of the machine-building complex enterprises at the present stage and perspective ways of their solution. *Economics and management in machine-building*. 6, 38-41.
- Baumung E.V. (2012). Stages of development of the production diversification. *Young scientist*. 3, 144-150.
- Belyakov G.P., Ereemeeva S.V. (2013). Concept and essence of the innovative potential of the science-intensive enterprise of the rocket-space industry. *Theory and practice of social development*. 11, 474-477.
- Englichaninov V.V., Kuznetsov V.P., Shukshin M.A. (2007). *Mechanisms to ensure the competitiveness of industrial enterprises on the basis of the strategy of business diversification: monograph*. Nizhny Novgorod: VGIPU Publishing house.
- Gort M. (1962). *Diversification and Integration in American Industry*. New Jersey: Princeton University Press.
- Leman R. (2007). Diversification based on company profile. *Problems of management theory and practice*. 1, 89-95.
- Markowitz H. (1952). Portfolio selection. *Journal of Finance*. 7(1), 77-91.
- Nemchenko G., Donetskaya S., Dyakonov K. (2008). Diversification of production: goals and directions of activity. *Problems of theory and practice of management*. 1, 107-113.
- Novitsky E.D. (2001). *Problems of strategic management of diversified corporations*. Moscow: ABC.
- Pasquier M. (2007). Diversification and efficiency. *Problems of management theory and practice*. 3, 79-82.
- Putyatina L.M., Barsova T.N., Tarasova N.V. (2016). Business activity of enterprises as a factor in the economic growth of Russian industry. *Bulletin of Moscow State Regional University. Economics Series*. 2, 122-126.
- Tarasova N.V., Putyatina L.M., Lavrova L.A. (2016). An integrated approach to the analysis of the position of the enterprise in the industry. *Bulletin of the State University of Management*. 3, 49-52.
- Van Kranenburg H.L. (2004). *Diversification Strategy, Diversity and Performance among Publishing Companies*. 6th Media Economics Conference. Montreal, Canada.