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market segmentation strategy and
competition on organizational
performance – a simulation study

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The influence of interactions between market segmentation strategy and competition on organizational performance – a simulation study

Abstract

A computer simulation study is conducted to explore the interaction of alternative segmentation strategies and the competitiveness of the market environment, a goal that can neither be tackled by purely analytic approaches nor is sufficient and undistorted real market data available to deduct findings in an empirical manner.

The fundamental idea of the simulation is to increase competition in the artificial marketplace and to study the influence of segmentation strategy and varying market conditions on organizational success. Success/failure is measured using two performance criteria: number of units sold and survival of firms over 36 periods of time.

Three central findings emerge: (1) the more competitive a market environment, the more successful the concentrated market segmentation strategy, (2) increased levels of marketing budgets do not favour firms following a concentrated segmentation strategy and (3) frequent rethinking and strategy modification impairs organizations that concentrate on target segments.

Keywords: market segmentation, market condition influences, simulation

1 Introduction

Within the field of strategic management, both “market segmentation” and “dealing with increasingly competitive environment” have received a lot of attention over the past decades and gained practical importance due to structural market changes, especially globalization. Management decision quality depends on the ability to understand the functioning of the market served, with the strongly interrelated strategic marketing issues of competition and market segmentation representing crucial issues of market knowledge.

Both topics have been extensively studied in the past. Within the field of segmentation research three main streams can broadly be identified: (1) research on and improvements of segmentation methodology (Aldenderfer & Blashfield, 1984; Bailey, 1994; Dolnicar & Leisch, 2000; Ketchen & Shook, 1996; Krieger & Green, 1996; Lilien & Rangaswamy, 1998; Mazanec & Strasser, 2000; Milligan & Cooper, 1985; Milligan, 1981; Myers & Tauber, 1977; Punj & Steward, 1983; Thorndike, 1953; Wedel & Kamakura, 1998), (2) research on the usefulness of different kinds of background variables (Abbey, 1979; Frank, Massy & Wind, 1972; Haley, 1968; Wedel & Kamakura, 1998, Wind, 1978) and (3) empirically based reports on segmentation studies (these segmentation applications dominate in terms of quantity, a summarizing report including 243 studies of this kind published in academic journals is provided by Baumann, 2000).

Among the studies centring around segmentation, few attempts have been made to simultaneously account for the issue of competition thus implicitly suggesting that the target segment can be chosen without taking the specific competitive environment into consideration. This interaction has been taken into account in the case of ideal point preference mapping, where not only perceptual positions of competing brands are mapped in typically twodimensional space but also ideal perceptual locations for different segments are included (Myers & Tauber 1977, Myers 1996).

The study of competition is not only as extensive as the body of knowledge concerning market segmentation but also far more heterogeneous in nature. Competition research can broadly be classified into general approaches studying the issue in an isolated manner, pure case studies and investigations of interactions between competition and other aspects of marketing

General investigations into the phenomenon of competition: Porter (1980) describes different forms of competition in different market settings and suggests generic strategies to choose from. In the tradition of exploring competition in an aggregate manner Urban, Johnson & Hauser (1984) suggest a quantitative criterion to determine the competitive market structure as basis for managerial decision making, later extended by Novak & Stangor (1987) and Kannan & Wright (1991). Putsis & Dhar (1998) systematically outline different types of competitive interaction in the marketplace from a game theoretic perspective. Henderson (1983) lists fundamental principles for competition analysis deduced from natural sciences.

Case studies based on specific industries: E.g. Wesson & De Figueiredo (2001) explore the microbrewery market and find that aggressive entry is most successful when no budget constraints are faced and the degree of focus chosen by the new entrant significantly influences market success. Clearly the limitations of such studies lie in low generalizability.

Interactions between competition and other aspects of marketing: Interaction between positioning and competition was studied by Hotelling (principle of minimum differentiation) and d'Aspremont et al. (principle of maximum differentiation) (cited in Moorthy 1985) focusing on the case of unidimensional product feature space including price in a duopoly market setting. Vandenbosch & Weinberg (1995) extended the one dimensional Hotelling model to two dimensions, still assuming uniform distribution of consumer preferences and looking at the duopoly situation exclusively resulting in an equilibrium positioning where one attribute is at its maximum level and the second one at the minimum level for one firm and exactly the opposite for the competitor. Carpenter (1989) investigated the same interaction emphasizing firm expenditures for advertising and distribution, finding that positioning and optimal marketing mix in terms of these expenditures are highly dependent. Stearns et al. (1995) studied the effect of different positioning approaches under varying competitive market

situations using empirical data of new entrants and found significant interaction with inconsistent findings for different settings. The interaction between competition, positioning and segmentation (heterogeneous consumer preferences) was studied by Hauser (1988) in his extended Defender model (two dimensional attribute space, heterogeneous consumer preferences) in a competitive environment, revealing conditions where equilibria exist and maximum differentiation maximizes profits. Ansari, Economides & Ghosh (1994) explored the interaction of positioning and price in a competitive environment in a game theoretic manner. They relaxed the assumption of uniformly distributed consumer preferences (illustrating the difference in results if this assumption is made). The investigation included competitive situations with different numbers of competing firms, finding that differentiation reduces price competition and increases profits, optimal positions depend on the number of firms and the level of consumer heterogeneity. Interaction between product quality and competition was studied by Moorthy (1988) in one dimensional product attribute space. And finally, interdependency of advertising expenditures and competition was investigated by Erickson (1985) under the condition of both non-growing and growing markets.

The interplay between the organizational market segmentation strategy and different competitive market situations has so far not received much attention, although recommendations for managerial decision making on strategic level cannot be made in an isolated manner. Lilien & Rangaswamy (1989) introduce the STP approach, a stepwise procedure integrating target segment choice and positioning in a sequential manner. Mazanec & Strasser (2000) and Buchta, Dolnicar & Reutterer (2000) propose and illustrate an integrated approach of analysis including segmentation, positioning and competition based on empirical three way data (PBMS, perceptions based market segmentation). Wesson & De Figueiredo (2001) relate the issues of competition and market segmentation to each other in a case study, empirically finding that new entrants into the microbrewery industry are better off serving small market segments.

The aim of this article is to investigate the interaction between organizational market segmentation strategies and the intensity of competition in the marketplace. As opposed to prior research in both fields, a computer simulation analysis is used to systematically explore this interaction. As contrasted to the line of segmentation research dealing with interaction effects, a performance-oriented perspective is taken rather than a static analysis at a certain point in time. As opposed to case studies based on real data, the level of generalizability is increased by choosing the systematic computer simulation experiment approach (no intervening variables, complete control over independent variables). In contrast to studies within the field of competition taking segmentation into consideration the typical limitations of economic and game theoretic approaches are overcome: uniformly distributed consumer preferences are not assumed, the number of products is not limited, purely rational firm behaviour is not modelled and firms are not fully informed about all parameters of the world they are living in. All in all this makes the simulation approach a more realistic setting for studying interaction effects and thus deducting managerial recommendations although clearly a tradeoff has to be made between extent of realism and model simplicity.

The article is structured as follows: After deducting hypotheses concerning the interaction of segmentation strategy and market environment competitiveness from literature ("Hypotheses on the interaction of segmentation strategy and competition"), the simulation environment for the computer experiments is explained both from the perspective of the artificial world in which the simulation takes place ("The simulation environment: an artificial consumer market") and the artificial agents that are constructed specifically for the purpose of the study ("Prototypical organizational strategies"). Next performance criteria used to evaluate success strategies under different market conditions are explained and formalized ("Measures of organizational performance") and the experimental design is outlined ("

Experimental design”). Finally, results for both performance criteria are provided and discussed (“

Results”) and conclusions on the findings resulting from the simulation study are drawn (“Conclusions, limitations and future work”), limitations are pointed out and fields of future work are suggested.

2 Hypotheses on the interaction of segmentation strategy and competition

Based on the literature review provided in the previous chapter a number of hypotheses can be deduced.

H1 (interaction between the level of competition and segmentation strategies): Under increasing competition the concentrated market segmentation strategy becomes more attractive. It is expected that increasing competition (represented by a high number of competitors) favours companies with a clearly defined target segment as opposed to mass marketers the strategy of which is supported best in a situation with low market competition.

This hypothesis is suggested by Wesson & De Figueiredo (2001) who find that entrants into the microbrewery industry are better off serving only a small well-focused segment of the market. D'Aspremont, Grabszewicz & Thisse (1979) conclude from their study that maximum differentiation from the competitor leads to each firm's equilibrium in a marketplace and Stearns et al. (1995) investigate an empirical data set revealing that narrow strategic foci increase survival chances of new entrants in metro locations.

H2 (interaction between budget levels and segmentation strategies): Higher budget levels favour the concentrated market segmentation strategy more than the mass marketing strategy (because the advertising expenditure cost per customer is increased over-proportionately).

With regard to this assumption no prior investigations into the particular interaction between segmentation strategy and advertising budget could be found. Only the success of high advertising expenditures when entering a market have been studied in detail and are comprehensively provided by Wesson and De Figueiredo (2001).

H3 (interaction between strategy modification intervals and segmentation strategies): The possibility to revise the own strategy more often, favours the concentrated market segmentation strategy (because the customization to the target group chosen can be optimized steadily).

3 The simulation environment: an artificial consumer market

The computer simulation is based on an artificial consumer market environment (SIMSEG/ACM by Buchta & Mazanec, 2001) that is roughly outlined in Figure 1. The main purpose of this environment is to provide a realistic framework which supports *ceteris paribus* experiments in order to gain insight on how successful certain corporate strategies are in a competitive marketplace. The central research question is formalised within this environment by constructing artificial actors (agents) that compete each other. In this article actors are designed that make use of different decision rules concerning their market segmentation strategy. These actors meet in the marketplace, the competitive conditions of which are systematically varied. By simulating a long period of time, insights are gained about superiority and inferiority of particular strategies under given conditions. These conditions are defined *a priori*. In this experiment following components of the artificial world are used:

The product: The product consists of 12 attributes that can be perceived by a customer. They load on four hidden dimensions (factors), three attributes per dimension. All dimensions represent information that is purely influenced by advertising action, as the production is not of fundamental importance for the question under investigation.

The customers: The world consists of hundred consumers. These customers have heterogeneous preferences with regard to the 12 product attributes they perceive. All in all, six market segments are modelled, the preferences of which are given in

Table 1.

Table 1: Consumer preference segments

	Factor 1	Factor 2	Factor 3	Factor 4
Segment 1	I	I	R	R
Segment 2	R	R	I	I
Segment 3	R	I	R	I
Segment 4	R	R	R	R
Segment 5	I	I	I	I
Segment 6	I	R	I	R

Every column represents one hidden dimension (factor), every row represents one segment. An 'I' indicates that the dimension is irrelevant to the segment described, whereas an 'R' stand for relevant. Thus, segment 1 does not care about the first three items, whereas the information about the last three items is studied very carefully by this group of customers when they make a buying decision. The preferences remain fixed during the entire simulation. Segment sizes are unequal (with segment 3 including 50 percent of the customers and every other segment 10 percent). Each customer buys exactly one product in each period (non-purchase is no option).

The competitors: Two kinds of firms compete in the marketplace, each one offering one product. They are modelled as artificial actors or agents and described in detail in the section on 'Prototypical organizational strategies'.

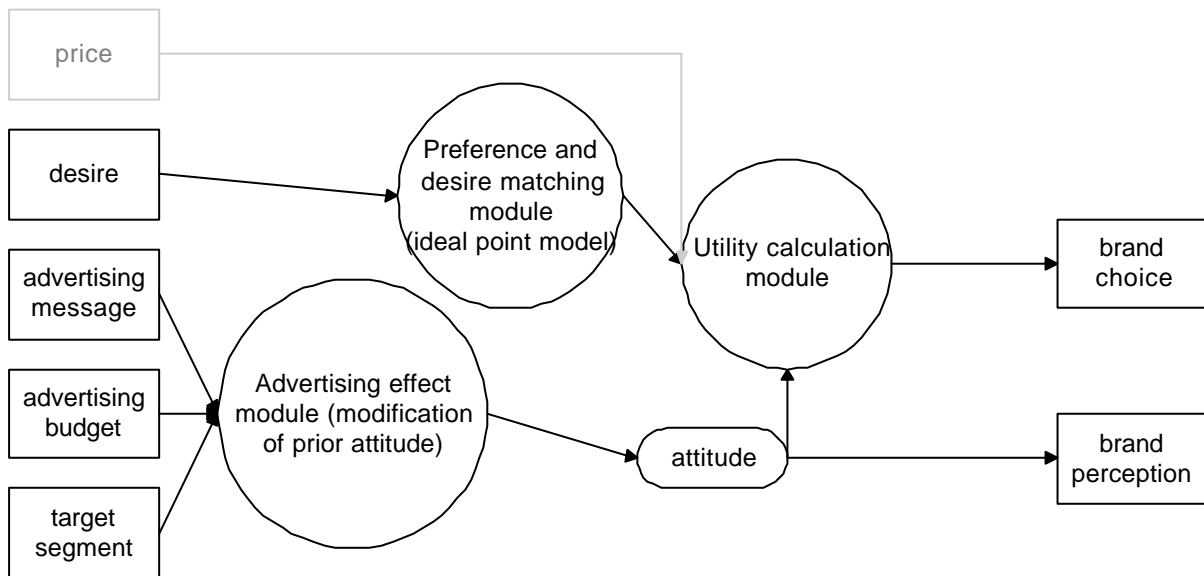


Figure 1: Outline of basic SIMSEG/ACM functioning

One simulation period starts with organizational decisions that are fed into the artificial consumer market. These decisions include the profile that is communicated to the customers by means of advertising and the target segment chosen. After all computations within the artificial world are executed (customers match their preferences with the perceptions of the products in the marketplace as influenced by advertising action), the actors receive an summary of market performance including consumer choices (who bought which product), and the beliefs or perceptions of the customers on all 12 product attributes.

4 Prototypical organizational strategies

Two kinds of organizations are modelled in the simulation assuming bounded rational firm behaviour. For this reason these two agents are held very simple in their decision rules.

The **mass marketer** does not construct consumer market segments. All potential buyers are addressed with the communication message. The mass marketer creates the advertising message by accentuating those product attributes that are strongly perceived to exist among the buyers of the mass marketer's product in the past period assuming a continuing causal relation between attribute perception and buying act in the following period. The functioning of this firm (the bounded rational behaviour rule) is outlined in Figure 2.

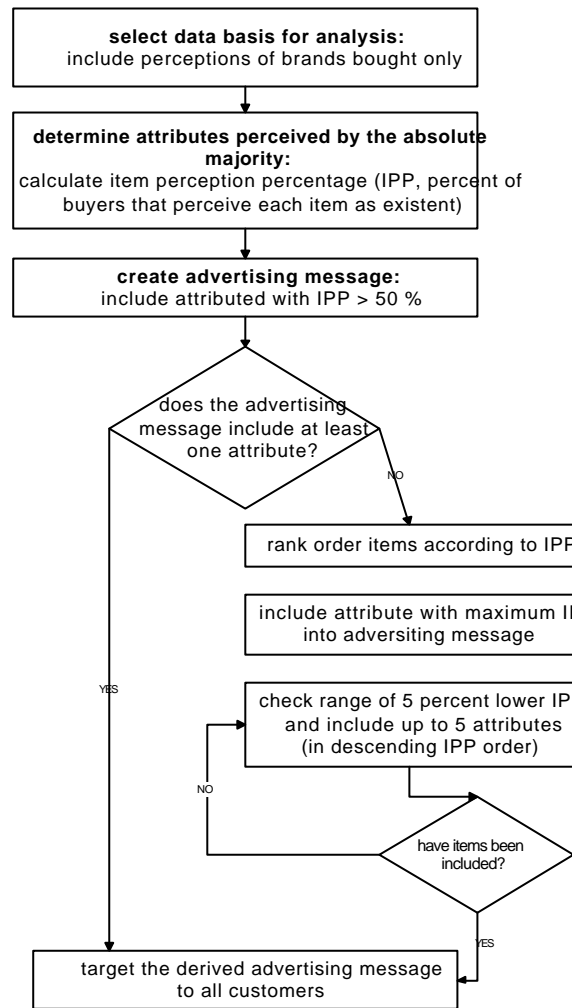


Figure 2: Organizational behaviour under the mass marketing strategy

The **segmenter** creates a partition of the consumers' perception of the own brand and chooses the group of individuals with the highest number of buying acts as basis for designing the advertising message: every product attribute which is perceived by more than 50% of the chosen segment is advertised to all buyers of the own brand. An outline is provided in Figure 3.

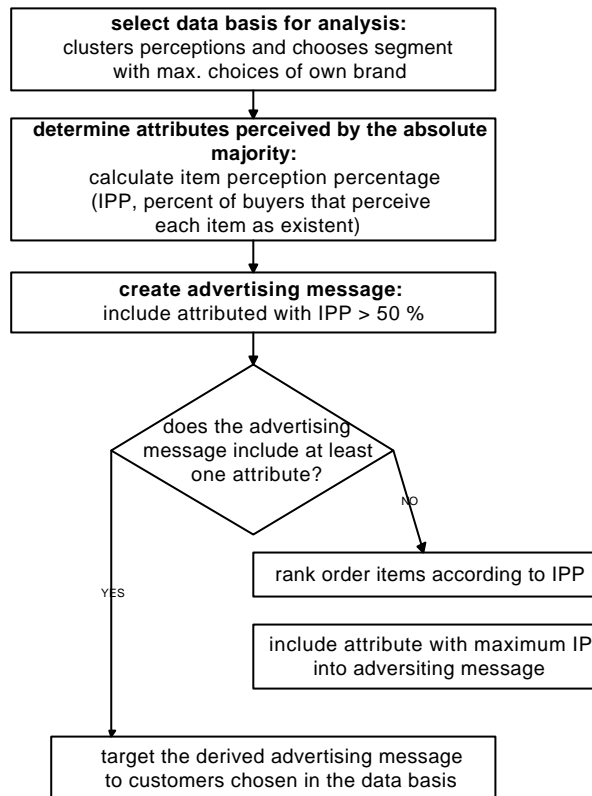


Figure 3: Organizational behaviour under the segmenter strategy

5 Measures of organizational performance

The typical performance measures used in segmentation studies are sales and market share, in competition analysis survival dominates the list of criteria explored. In this article the effect of the strategy-competition-interaction is investigated for two different performance measures representing different organizational goals encountered: the number of units sold is the general success measure (representing profit and revenues as well in this particular simulation because the price module was excluded) and survival representing the long-term perspective of the organization.

Number of units sold: The simplest way of approaching success measurement of success comparison is to take a look at the total units sold. As price is set fixed in our simulation this would be the equivalent to a sales criterion as well as a market share indicator.

Survival: The simplest way to evaluate corporate success in a competitive environment is to monitor which companies survive in the long run, an approach very typical for new venture success investigations. This criterion can be measured in a binary manner, allowing the conclusion that surviving companies acted more successfully in the marketplace in the long run than non surviving companies.

6 Experimental design

Every simulation has a duration of 36 periods (with one period standing for one month of time), the number of simulations is a result of the full factorial experimental design based on the following factors and factor levels:

- Advertising budget: low (100) and high (200 monetary units)
- Thinking cycle (this is the frequency of the possibility to revise the corporate strategy): every simulation period and every 6th simulation period
- number of agents: 2, 3, 5, 7 and 10

The entire simulation was repeated ten times. The experimental design is outlined in Figure 4, providing the exact mix of mass marketers and segmenters competing in the marketplace in each scenario.

marketing budget (2 levels)	thinking cycle (2 levels)	number of agents (5 levels)
100 monetary units	every period of time	1 mass marketer 1 segmenter
200 monetary units	every sixth period of time	2 mass marketers 1 segmenter
		3 mass marketers 2 segmenters
		5 mass marketer 2 segmenter
		7 mass marketer 3 segmenter

Figure 4: Experimental factors and factor levels

7 Results

Results based on the number of units sold performance measure: Analyses of variance were conducted assuming a linear model where units sold function as dependent variable and the amount of advertising budget and the length of the thinking cycle represent the independent variables. First order interactions are included. Separate analyses are computed for each competitive setting (consisting of ten replications under identical conditions). Exemplary results are provided for the simulation with ten firms in Table 2. The table includes estimates for the numbers of units sold under each condition in the first column, t values in the second column and the corresponding p-values in the third column. Levels of significance are coded in the following manner: *** indicates a significance level of 99.9 percent, ** stands for 99 percent, * for 95 percent and . for 90 percent. The intercept represents the experimental factor combination “mass marketer, low advertising budget and short thinking cycle”. The remaining conditions are abbreviated, where “think 6” stands for long thinking cycles and “budget 200” stands for high advertising budget.

Figure 5 illustrates these results visualized by means of boxplots where the top two quadrants show results under the condition of high marketing budgets and the bottom quadrants for low marketing budgets. The right hand side of the plot provides results under the condition that strategic reorientation of the organization was possible in every sixth period, whereas the left hand side allowed strategy changes in each period.

Table 2: ANOVA for simulations with 10 competitors

	Estimate	t	value
Pr(> t)			
(Intercept)	35.52	8.706	< 2e-16

think6	-8.12	-1.723	0.085803
.			
budget200	-4.18	-0.886	0.376073
mass marketer	-5.50	-0.953	0.341309
mass marketer	-3.81	-0.659	0.510004
mass marketer	-11.85	-2.054	0.040655
*			
mass marketer	-5.89	-1.021	0.307999
mass marketer	-2.13	-0.368	0.712861
mass marketer	-5.82	-1.008	0.313983
segmenter	16.20	2.807	0.005260
**			
segmenter	14.68	2.543	0.011383
*			
segmenter	18.94	3.283	0.001126
**			
think6:mass marketer	3.03	0.454	0.650064
think6:mass marketer	-6.30	-0.946	0.344965
think6:mass marketer	9.02	1.353	0.176843
think6:mass marketer	1.98	0.297	0.766487
think6:mass marketer	-2.24	-0.336	0.736898
think6:mass marketer	-3.34	-0.501	0.616969
think6:segmenter	27.81	4.173	3.74e-05

think6:segmenter	27.72	4.161	3.95e-05

think6:segmenter	23.48	3.524	0.000478

budget200:mass marketer	3.87	0.580	0.562184
budget200:mass marketer	13.44	2.017	0.044386
*			
budget200:mass marketer	18.74	2.812	0.005185
**			
budget200:mass marketer	6.33	0.950	0.342675
budget200:mass marketer	3.99	0.599	0.549615
budget200:mass marketer	10.44	1.566	0.118143
budget200:segmenter	-5.99	-0.898	0.369594
budget200:segmenter	-6.64	-0.997	0.319589
budget200:segmenter	-2.42	-0.363	0.716637

residual standard error: 1490 on 370 degrees of freedom			
multiple R-Squared: 0.5204, adjusted R-squared: 0.4828			
F-statistic: 13.84 on 29 and 370 DF, p-value: 0			

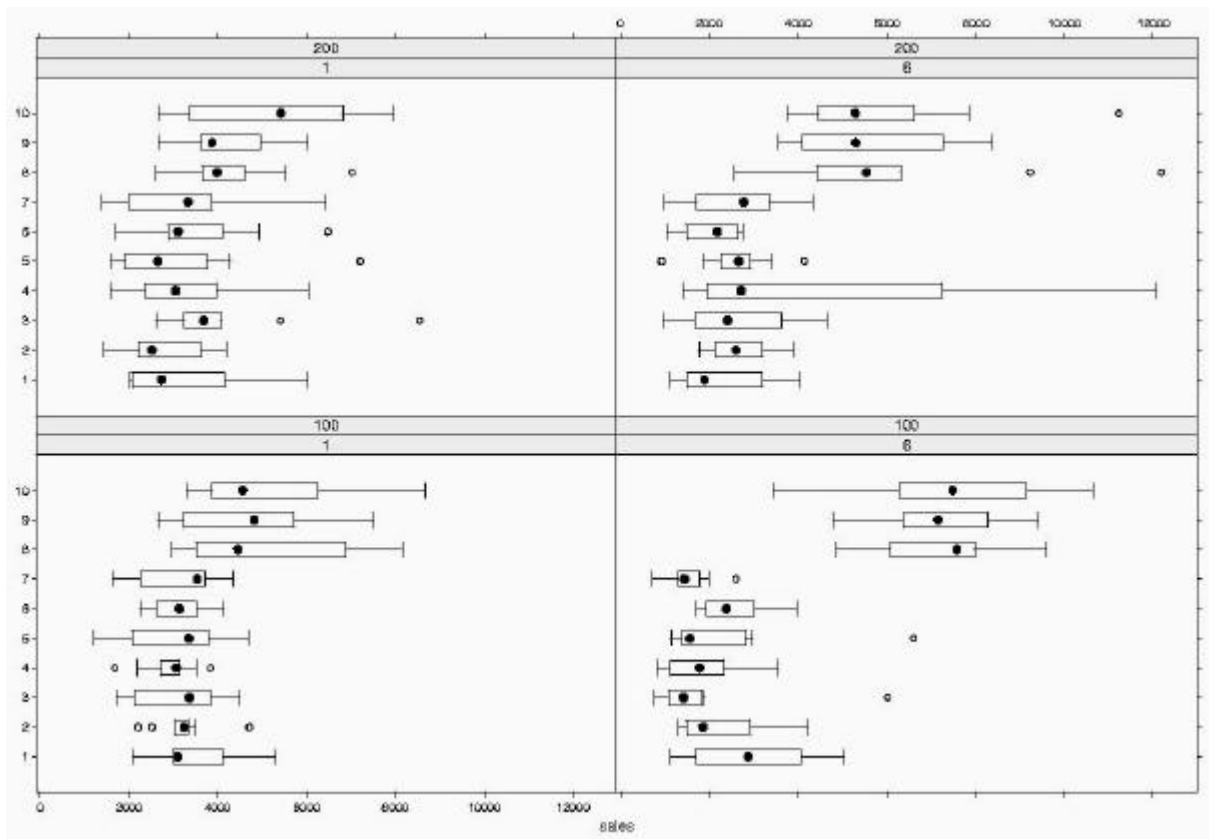


Figure 5: Boxplot of simulation results with 10 competitors (mass marketers coded as “1”, “2”, “3”, “4”, “5”, “6” and “7”, segmenters as “8”, “9” and “10”)

The major finding that results from the simulations conducted, is that organisations that choose to segment the consumers and focus on target markets are more successful in highly competitive environments: when two firms compete (adjusted R squared 0.88, p-value 0.000), the segmenter is significantly less successful than the mass marketer. In addition, longer thinking cycles (every sixth period of time) significantly favour the performance of the segmenters in highly

competitive environments. The latter effect is caused by the fact that the segmenter tends to switch market niches and the advertising profile when the choice of possible submarkets is large due to low competition.

In the case of three competing firms (adjusted R squared 0.48, p-value 0.000) the segmenter performs significantly worse than the mass marketers, with high budget additionally decreasing performance level of the segmenter (because mass marketers can more efficiently advertise to their large number of customers, whereas segmenters targeting smaller groups of potential buyers reach saturation levels). The linear model including five competitors in general does not fit very well (adjusted R squared 0.19, p-value 0.000). Significance values indicate that the segmenters' performance is inferior, longer thinking cycles favours them while impairing success of mass marketers. The same is true for the seven-competitors scenario (adjusted R squared 0.25, p-value 0.000), supporting the finding that long thinking cycles are in favour of the segmenter strategy. In the market with ten competitor (Table 2, Figure 5) all segmenters turn out to be significantly more successful. Marketing budget plays a significant role, with higher budgets impairing the success of segmenters and long thinking cycles benefiting them.

Results based on the survival performance measure: Survival was investigated in the last simulation period. Firms that did not sell any products at all (market share equals zero) failed to survive in this marketplace. The results are given in Table 3.

Table 3: Non-survival results

Thinking cycle	Advertising budget	Scenario with 10 competitors	Scenario with 7 competitors	Scenario with 5 competitors
each period (1)	low (100)	1 (mass marketer)	1 (mass marketer)	0
each period (1)	high (200)	0	0	1 (segmenter)
every sixth period (6)	low (100)	4 (mass marketers)	1 (mass marketer)	0
every sixth period (6)	high (200)	2 (mass marketers)	0	0

First of all it becomes apparent, that all firms survive in the marketplaces with low competition. Both in the two- and three-competitor-marketplaces all firms operate and sell their products until the last period of time simulated. In all simulation runs except for the five-competitor-scenario, exclusively mass marketers fail to survive. As can be seen, more mass marketers are unable to cope with competition in general (and especially under the conditions of low advertising budget and long periods of time without adaptation of the advertising message and the segment targeted). The reasons are twofold: First, the mass marketer in general suffers more from low budgets than the segmenter does (larger amount of potential buyers the advertising message is addressed to). Second, mass marketers suffer from the fact that segmenters perform better when strategic thinking cycles are longer (because the rule of the segmenter supports rapid change that on the long run does not optimally influence the advertising effectiveness and thus the customer perceptions). Exactly the opposite reasoning explains the one death of a segmenter in the five-competitors market environment with high advertising budget and frequent possibility to change the advertising message.

In sum, three findings can be deducted from investigating this performance measure: (1) in the simulation environment used and the market conditions modelled, non-survival is a rare event in general, (2) the segmenters beat the mass marketers with respect to the survival criterion and (3) the more competitors offer their products in the marketplace, the higher the probability of firms not surviving the entire simulation period.

8 Results regarding hypotheses formulated

With regard to the hypotheses formulated, the simulation results lead to following conclusions:

- H1: The hypothesis that the concentrated segmentation strategy is more successful under the condition of high competition is supported. This finding can be deduced from both performance measures.
- H2: The hypothesis that an increase in budget favours the concentrated segmentation strategy cannot be supported. Contrarily, higher marketing budget levels for all competitors turned out to significantly impair the success of segmenters in case of number of units sold used as performance measure. The hypothesis is also rejected when inspecting the survival information, although the contrary effect is not mirrored.
- H3: The hypothesis that more frequent opportunities to modify the strategy favour the segmenter is not supported. On the contrary, segmenters were found to suffer from the multitude of possible segments when competition is low using both performance measures.

In sum, concentrated segmentation strategy seems to provide an advantage in a market with high competitive pressure. The fundamental functioning as extracted from log-file analysis of consecutive periods is as follows: Mass marketers advertise the same product attributes (the attributes perceived most often to apply among the buyers of the total market). Additional competitors that act in accordance with the mass marketing rule thus reduce the market size for this strategy. More competition among mass marketers only therefore decreases the number of units sold for all firms targeting the entire market. Segmenters that attack mass marketers by choosing to advertise product attributes identical or very similar to those promoted by the mass marketers have stronger advertising effectiveness due to a smaller group of individuals exposed to the advertising message. Segmenters that target a niche market and therefore advertise a product profile that is very distinct in the marketplace take advantage of the fact that there is no or very low competition for the product offered. As long as competition is low, mass marketers beat segmenters because they influence a large number of consumer opinions in the favoured product perception dimensions, whereas the segmenter only influences a small number, thus generating less buying acts. With increasing competition the pure size effect vanishes and the segmenter strategy is more successful due to either increased advertising effects or niche targeting.

9 Conclusions, limitations and future work

A computer simulation study was conducted investigating the interaction of alternative segmentation strategies and the competitiveness of the market environment.

Following central conclusions can be drawn from the simulation: (1) the more competitive a market environment, the more successful the concentrated market segmentation strategy, (2) increased levels of marketing budget for all competitors does not favour segmenters, as they reach advertising effect saturation levels earlier, (3) frequently rethinking and modifying the strategy is not recommended for firms following a concentrated segmentation strategy because cumulative advertising effects over multiple periods of time are not taken advantage of if the target segment is modified too often.

These findings were based on the analysis of two different performance measures: the number of units sold and firm survival. The latter was found not to be very informative for this particular experiment, as the number of firms not surviving the simulations was rather low. The number of units sold served well as performance measure for the simulation set up.

A number of limitations can be listed, that were accepted in this simulation as appropriate simplification of the model for the central questions under investigation, but should be investigated in future simulation studies: (1) price was set equal for all firms, (2) no agent memory was modelled (learning from failures in the past therefore is not possible), (3)

consumers in the artificial world modelled have fixed preferences and therefore do not change aspiration levels in reaction to market development and finally (4) advertising budget levels were increased for all competing firms (where e.g. niche marketers would realistically have less resources).

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