Life cycle of business relationships – Empirical testing

Competitive paper

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Abstract

The paper aims at a quantitative analysis of the time perspective business relationships development have. Development of business relationships is a long standing focal research question, which always had to deal with the problem of time perspective (Medlin, 2004; Sutton-Brady, 2008). The treatment of time in these researches has been conceptualized in four different ways (Ford et al., 2008): The first and most simple approach is using the assumption of independent exchange situations. This approach practically ignores the effect exchange episodes on the interaction and on the development of business relationships have (Williamson – Ouchi, 1981). The next three approaches have the common assumption that exchange episodes between cooperating parties have an influence on business relationship development. One of these approaches describes the effect of exchange episodes on the relationship as an evolution having different development stages (or states) and generating a kind of business relation life cycle (Porter, 1980; Utterback - Abernathy, 1975; Ford, 1980; Dwyer et al., 1987; Ford - Rosson, 1982; Larson, 1992; Kanter, 1994; Ford at al., 1996; Batonda – Perry, 2003). The third approach emphasizes the cumulative nature of the effect exchange episodes on the development of interaction and relationship in time have. In this interpretation cooperating parties invest in each other as the relationship develops (Dyer et al., 1998; Anderson et al., 2003). Among these investments the relation-specific ones have an accentuated importance because they not only connect the parties in the relationship but also fix them to each other. Last but not least other researchers take a historical view of how business relationships develop in time. Assuming path dependency they look at the concrete mechanism different episodes influence the development of a relationship (Söderlund et al, 2001; Håkansson – Waluszewski, 2002).

Our paper combines two of these latter approaches. Using data of an internet based questionnaire and applying quantitative analysis we investigate the question, whether development of business relationships in time could be described with the concept of life cycle. The concept of life cycle is widely used in business research. Among others the diffusion of innovation is described using this concept. All of these researches analyze the life cycle along a specific variable (for example the volume of sales or revenue in case of the product life cycle) which (except the last stage of the cycle, the decline) has a cumulative character resulting in the widely known specific shape of a life cycle.

The specific variable we use while analyzing the development of business relationship in time and testing the concept of life cycle is the relation-specific investments made in the relationship. We capture these investments along all content types of a business relationship defined in the ARA model (Håkansson - Johanson, 1992), along the actor bonds, activity links and resource ties.

Keywords: business relationship development, life cycle model, relation-specific investments, empirical testing, quantitative analysis

INTRODUCTION

Our paper focuses on the way business relationships – especially relationships between customer and supplier firms in the supply chain – develop over time. These relations are important building blocks of today's network economy (*Håkansson* [1997]). The content of the relationship between these two cooperating parties of the supply chain is mainly determined by the interactions taking place between them. These interactions are cooperative processes, which influence, shape and configure the specific resources and the operation of the participating companies. We are aware of the fact that interaction is not a simple dyadic concept; it has to be interpreted in a network context, because interactions in a dyadic relation usually have direct influence on other players in the network. We still will restrict our analysis onto the dyadic relationship level because we think it is vital to understand first the operational rules and development characteristics of the elemental building block of networks, that is the dyadic relationship itself. Interaction is a process through which cooperating parties continuously and systematically correlate, link and combine their resources and operation (*Ford et al.* [2003]). These interactions determine the content of the business relationship. Both interactions and their impacts can be very different in nature; consequently the content of specific business relationship is also very different. In some cases due to ongoing intense interactions business relationships develop quasi organizational characteristics (*Blois* [1972]). These relationships are also called cooperative or strategic partnerships (*Dyer* [1996], *Dyer et al.* [1998], *Bensaou* [1999]).

Interactions take place in time, so the development of business relationships also has a time dimension. This time dimension of relationship development is a long-standing research topic. The research focusing on the development business relationships have over time has been investigated mainly using qualitative research methods (Sutton-Brady [2008]). Our paper also deals with the question, how business relationships develop over time but uses quantitative research methodology. Based on an on-line questionnaire we analyze the development of a specific relationship attribute and the pattern this attribute develops over time. This specific relationship attribute is the *heaviness* of the relationship. Our objective is to test empirically to what extent the development of relationship heaviness over time can be described with the traditional model of life cycle.

After the Introduction, in the first section of the paper we give a summary about previous research results related to the problem in our focus. Afterwards we introduce and describe the survey carried out in 2008 using an on-line questionnaire. We also interpret the key relationship attribute: heaviness and describe how it was captured and operationalised in the questionnaire and reason why we had chosen the way we did that. As a next step we present in details the analysis carried out and finally exhibit, interpret our research results.

CONTENT AND DEVELOPMETN OF BUSINESS RELATIONSHIPS

Inducement of business relationship development is the interaction. As already mentioned interactions and so the development of business relationships always has a time dimension (*Ford et al.* [2003]). Analyzing the development of business relationships over time is not without analytical difficulties. One of these difficulties is due the fact that interactions in any relationships are not evenly distributed. Very intense interaction periods may be followed by interactions with much lower level of intensity. Other difficulty arise, when we try to understand the internal build up of interactions and try to describe their elements, e.g. transactions, episodes (*Holmlund* [2004]). Even more interaction is difficult to delimit in time, it has no easily definable start and end.

Ford et al. [2003, page 19] argues that researchers have conceptualized the problematic characteristic of interactions and the method they try to overcome the problem and treat the time perspective of interaction and relationship development in four different ways:

1. The simplest way to cope with the problem is to put aside the fact that interactions develop over time, assuming independency between interactions and ignoring the effects between episodes, interactions. This is *the assumption of the independency* and is typical in the transaction-cost economics (*Williamson-Ouchi* [1981]).

2. In the next three approaches it is common that researchers assume dependence among transactions, episodes and interactions between the cooperating parties in the relationship:
   a. According to the first approach the way episodes, interactions are related to each other over time can be described with the process of development that comprises a life cycle consisting of different specific periods/stages of the development. As far as the life cycle development of business relationship is concerned one can distinguish between to basic interpretations: The first, the so called classic life cycle approach differentiates between specific phases of the life cycle (*Porter* [1980], *Ford* [1980], *Dwyer et al.* [1987], *Larson* [1992], *Kanter* [1994]). In their argumentation the development of a life cycle is predetermined and linear. The second interpretation argues that though specific stages of the life cycle can be interpreted, but the development along these stages is not linear and predetermined (*Ford-Rosson* [1982], *Ford et al.* [1996], *Batonda-Perry* [2003]). This latter approach is also called the theory of life cycle stages.
   b. The next approach points out that the episodes and interactions over time are dependent and have a cumulative character. This approach practically interprets interaction over time as an investment process. The understanding of interaction as an investment process is prevalent in the literature dealing with the relation-specific investments in business relationships, for example when strategic partnerships are analyzed and described (Dyer et al., 1998; *Anderson et al*. [2003]).
   c. Another approach is to take a historical view. This is relevant in research programs based on the evolutionary theory of the firm, where the cause and effect relations of interactions are essential part of the analysis. The concept of development path reflects the essence of this approach (*Söderlund et al.* [2001], *Håkansson – Waluszewski* [2002]).

It is obvious for both researchers and practitioners that interactions, just like their building blocks, e.g. episodes are not independent from each other. To our opinion the three different approaches (from 2.a. to 2.c.) mentioned above are neither contradictory nor exclusive; on the contrary they are complementary to each other. In our empirical research we apply the 2.a. approach and conceptualized the development of business relationship using the life cycle concept, but also apply the 2.b approach saying that relationship development throughout this life cycle is characterized by a joint investment process into the relationship. The relation-specific investments are connected to specific episodes, interactions between the two cooperating parties and have a cumulative character.

The life cycle model plays a crucial role in several disciplines (*Bass* [1969]). Among these disciplines one will find the management-related disciplines too, where the life cycle model has been proved to be applicable and useful. Think for example of the diffuse character the spread of innovations has (*Utterback-Abernathy* [1975]), or think of the product life cycle model in marketing management, which captures relevant characteristics of a product market penetration (time and the sales volume or increase in revenues). The cumulative character of the variable analyzed lies at the hart of the life cycle model. (Cummulativity in time is present basically in the first three stages of a typical life cycle and is missing in the stage of decline.) To sum up, applying the life cycle model in a business relationship context inevitably leads to the fact that the cumulative character of investments generated through interactions in the business relationship has to be analyzed.

In order to be able to capture the cumulative nature of investment in the life cycle of business relationships, we had to choose an essential characteristic of the relationship; a characteristic having a cumulative character over time in the life cycle. The concrete characteristic chosen is the *heaviness of the business relationship*. Heaviness of a business relationship is measured by the cost arising when the business relationship is terminated for some or other reason, this is practically the total cost of exit from that given business relationship (*Håkansson-Ford* [2002]). This cost is the sum of the relation-specific investments cumulated in the relationship over time in its life cycle. When a relationship is terminated this investment is sunk. The heaviness of relationship is captured in our research by the overall relation-specific investments generated in the business relationship until termination. These relation-specific investments are very diverse (e.g. embodied in human resource dedicated to that specific relationship or dedicated assets) and are generated in different ways. The ARA model developed by *Håkansson-Johanson* [1992] is based on empirical research and identifies three different building blocks of a business relationship: actor bonds, resource ties and activity links. These building blocks are specific articulations of connections developed in the relationship. Developing and strengthening these connections need effort and investments that are tied to the relationship; they need relation-specific investments. The ARA model practically identifies three different ways relation-specific investments are generated in the relationship.

Social bonds evolve among the employees of the two cooperating companies. The strength of these bonds depends on the extent cooperating employees trust each other, are satisfied with each other's work, the level of mutual commitments (*Wilson-Jantrania* [1994], *Wilkinson-Young* [1994]). Developing trust, increasing satisfaction level and mutual commitment generates relation-specific investments over time and increases the heaviness of the relation itself. *Activity links* are different types of processes carried out in the relationship. Activities in a relationship are also varied. Negotiations, information exchange, joint problem solving are specific forms of activities carried out in a relationship. Common is that these activities also generate investments that are relation-specific. The more intense, the more collaborative and integrated these activities are, the stronger activity links will be but also the more relation-specific investments are needed and generated. These different activities carried out within a relationship become more and more institutionalized as relationship develops in time (*Batonda-Perry* [2003]) also generating relation-specific investments. *Resource ties* also have to be developed in all kind of business relationships. According to the resource dependence theory of the firm (*Pfeffer and Nowak* [1976]; *Pfeffer and Salancik* [1978] the overall objective of any type of business relationships is to match and combine different but supplementary resources creating unique resource boundless capable to fulfill relevant customer requirements and increase the competitiveness of the collaboration. Matching these supplementary resources needs adaptation from both sides and so generates investments in the relationship. Combined resources are also the basis for joint development projects creating new ones. Resource combination is a source for both increased efficiency but also for innovation (*Ford et al.* [2003]).
In practice developing social bonds, activity links and resource ties go hand in hand. The stronger actor bonds, the richer resource ties and the more intense activity links are in a relationship, the more relation-specific investment is generated and at the same time is stuck in the relationship. Heaviness of the relationship is determined by the sum of relation-specific investments generated over time in that specific relationship. Our objective is to test to what

extent the life cycle model interpreted as a diffusion model (*Bass* [1969]) is useful to describe the development pattern of relationship heaviness over time.

RESEARCH METHODOLOGY AND THE CHARACTERISTICS OF THE SAMPLE

The research carried out was part of a comprehensive research program called "Supplier firms position and its effect on competitiveness - small and medium size companies in focus" and was carried out at the Competitiveness Research Center at the Corvinus University of Budapest in 2007 - 2008. In this program a questionnaire was developed, where questions suitable to catch relation-specific investments generated by different connection type defined by the ARA were also included.

The sample for analysis was gathered using a web-based, on-line questionnaire. We sent out the questionnaire via e-mail to 170 firms. The sample contains data about 72 companies; however, the questions related to our focal research question – relationship heaviness generated by the different relational ties – were answered only by 46 respondents. Because of the low amount of responses, the sample can not be regarded as representative. The effective rate of return was 26%. The majority of the respondent companies are large, international companies, mainly from processing industry (see Table 1 and 2). This is not disadvantageous for our analysis, because the relationship ties investigated are usually more extensive in case of large companies and offer a deeper insight for researchers than the case of smaller firms would do. The database developed using this on-line questionnaire was investigated through multivariate statistical analyses using SPSS.

As mentioned we investigate in our paper the question, whether the life cycle model is suitable for capturing the pattern of relationship development over time. In concrete we analyze to what extent can the development of relationship heaviness – that is the sum of all relation-specific investments generated over time in the relationship – be described with the traditional life cycle model? Although life cycle model has long been understood as a potential instrument describing the development pattern of business relationships over time (see the 2. section of this paper), quantitative verification is still lacking.

1. Table Characteristics of the firms in the sample

	Minimum	Maximum	Mean
Headcount 2007	2	14000	963
Net revenue 2007 (HUF)	12 000 000	12 134 797 986	293 306 346
Ratio of export in the total revenue (%)	55	100	43

2. Table Distribution of sample by industry segments and the ownership structure

Industry segment	%
Agriculture	2.8
Extractive industry	1.4
Food industry	25.0
Light manufacturing industry	11.1
Chemical industry	16.7
Machine industry	12.5
Other industry segments	5.6
Building industry	4.2
Trade	8.3
Services	12.5
Total	100.0

Majority Ownership	%
State	2.8
Privately owned - Hungarian owners	30.6
Privately owned - Foreign owners	66.7
Total	100.0

In our analysis we built on the ARA model and used it for defining and measuring relation-specific investments generated in a given relationship. Actor bonds, resource ties and activity links all lead to relation-specific investments. It is not obvious how to construct such a questionnaire. In buyer-supplier relationships there are many activities carried out for example in order to build and maintain a relationship. These activities include for example partnership selection and evaluation, negotiation, problem solving and information exchange. From these activities the information-sharing ones play crucial role and lead to intensive relation-specific investments (*Dyer et al.* [1998]) and are consequently relevant from the relationship heaviness point of view. Therefore we focused our attention on these information sharing activities when measuring the relation-specific investments generated during and by the development of *activity links*. We listed several specific types of information exchange activities from everyday operational to more sensitive R+D and cost data exchange activities. Evaluation was done according to a 1-5 point Likert scale. (See all questions applied in the analysis in the Appendix.)

Social bonds were examined through the relationship norms developed in a given partnership [Duffy-Fearne, 2002]. These norms were: level of customer satisfaction, level of commitment and trust. We also asked the respondents to directly evaluate the strength of social bonds between the supplier company and its major customer (questions A27). Again evaluation was done according to a 1-5 point Likert scale.

Mapping *resource ties* between cooperating parties and the relation-specific investments caused by them can be carried out from different perspectives too. In our questionnaire we listed the following different types of resource ties between supplier and its main customer (question A24):

- dedicated human resource to main customer,
- dedicated machinery to main customer,
- dedicated routines to main customer,
- dedicated facility to main customer.

We again asked respondents (representatives of the supplier side) to evaluate the resource ties using again a 1-5 point Likert scale.

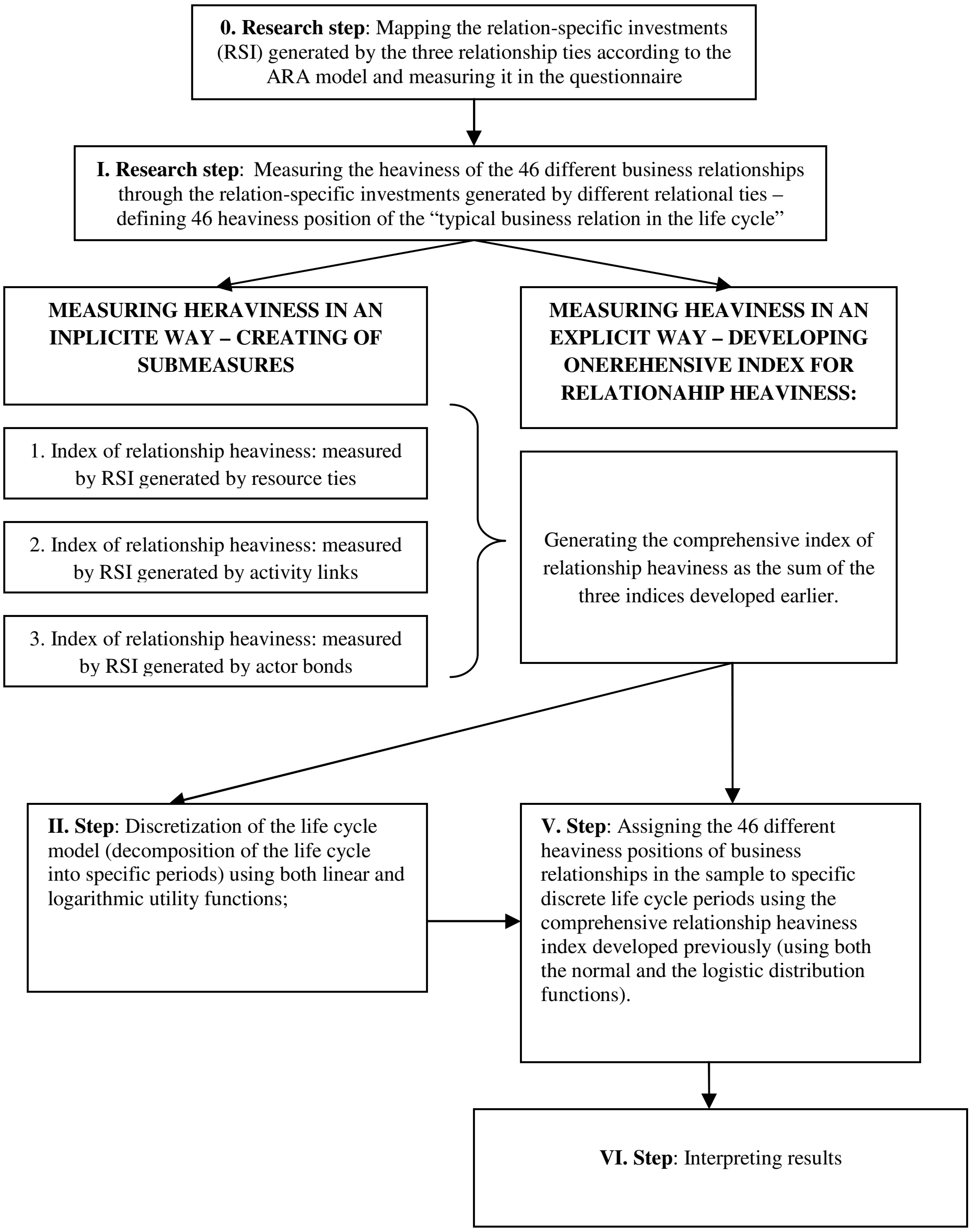
3. Table Three types of links in a business relationship according to the ARA model and their specific variables in the questionnaire

Links in the business relationships	Specific representations of the different ties generating relation-specific investments in the questionnaire	Number of question in the questionnaire used
Actor bonds	Different characteristics of relational norms (degree of commitment, satisfaction, level of trust, etc.)	A27
Activity links	Extension and intensity of specific activities related to information exchange in the relationship	A25
Resource ties	Types and extent of different relation-specific investment in the relationship	A24

It is important to note that the respondents were professionals of companies in a supplier's position. Professionals like key account managers, logistics and supply chain managers, who had the necessary knowledge and overview. We asked the respondents to think of *one specific, ongoing and important business relation with a prominent customer* and evaluate the variables all along the questionnaire from the perspective of that specific relationship. The relationship characteristics described in our questionnaire are therefore describing an ongoing, important business relationship in supply chains. We note here that in the questionnaire we asked for evaluation of relation-specific investments of both sides in the cooperation, that is we asked for evaluation of the relation-specific investments made by the supplier and by the customer too. We analyzed the two sides of these investments and revealed a strong association between them. Therefore in our life cycle analysis thereinafter we only will use the data describing relation-specific investments generated by the supplier side of the analyzed relationship.
e are aware of the fact that this measurement is subjective, but most of these relation-specific investments can not be measured in an objective way, measuring them is usually done by subjective evaluations, perceptions (Dyer et al. [1998]).

We had 46 concrete relationships described along the relation-specific investments in the sample. This is a cross-sectional data sample and consequently it is static: it does not describe the specific dynamic development of these relationships in time, but give information about their actual, static status as far as relation-specific investments and level of heaviness is concerned. Life cycle on the contrary is a phenomenon having a time aspect and is dynamic. This problem had to be solved in our analysis.

1. Figure Sequence and internal built up of the research program



Time series analysis of business relationships in general is not without problems because the structure of these relations is very turbulent, showing heavy changes within a short time period. Analyzing the life cycle of one specific business relationship is burdened by this turbulent character relationships in general have. We had to overcome this problem, the problem how to collect reliable dynamic data about ever changing business relationships and make our static sample applicable for further analysis. We applied a methodology that made it possible to use this cross-sectional, static sample for testing our life cycle hypothesis. *We assumed that the development of heaviness business relationships have over time can be described by a typical (, but not known) development pattern. Therefore we can interpret the 46 concrete relationships in our sample as 46 different observations, 46 specific representatives of this typical development pattern*. Using this assumption we were able to analyze to what extent our data fit to different possible such development patterns, among them the pattern of life cycle. The logic of our analysis, the sequence and internal built up of our research is described in Figure 1.

DIFFUSION PROCESSES

The concept of life cycle is widely used in business research for modeling diffusion processes. We use in our analysis the model of life cycle developed to catch diffusion processes in marketing management. In marketing management the product life cycle analyses the development pattern (diffusion process) of revenue or of the sales volume generated in time by the specific product analyzed. This life cycle was first described and expressed using mathematical model by *Bass* [1969]. He suggested using the differential equation resulting in a logistic curve. Applicability and generalization possibilities of Bass' model are described by *Radas* [2005]. Our description of the life cycle model is based on the latter article.

The life cycle hypothesis in Bass' model focuses on one product and analyzes the question, how its sales volume develops over time. According to Bass this sales volume describes an S curve. This hypothesis is also backed by empirical research. The model is actually a differential equation with the following formula:

$$\frac{dF(t)}{dt} = \left(m - F(t)\right) \cdot \left(p + \frac{q}{m} \cdot F(t)\right),$$

where parameters p and q represent innovation and imitation, while $F(t)$ is the cumulated number of sold products at a point t in time, m denotes the size of the market (the maximum number of products that can be sold on the market). The solution of this differential eqution in case of an initial value of $F(0)$ is the following:

$$F(t) = m \cdot \frac{1 - \frac{p}{q} \cdot e^{-(p+q)\cdot(t+c)}}{1 + e^{-(p+q)\cdot(t+c)}},$$

where the value of c can be calculated according to the following eqution:

$$c = -\frac{1}{p+q} \cdot \ln\left(\frac{q}{p}\right).$$

The $F(t)$ solution function gives a logistic curve demonstrated in Figure 2. The curve consists of three well defined phases. The first phase is characterized by a relatively low growth rate, in the second phase growth rate is much higher and the last phase growth slows down again.
In both marketing and innovation management such diffusive processes are not always connected to a variable continuous and easily measurable, like the sales volume or revenues in case of the product life cycle model. In some instances these variables are interpreted and measured on an ordinal scale. The sales volume in the product life cycle is also usually braked down into phases. Market introduction, growth, maturity and decline are the generally used phases of product life cycle (Kotler [1988]).

In diffusion processes the above mentioned four phases are typical. In case of the logistic curve the last phase – decline – is missing, logistic curve is monotonously increasing, there is no decline. In the different management disciplines life cycle phases are differentiated based on the characteristics of the logistic curve: introduction and maturity is relatively flat, the phase of growth shows a sharper increase. In case we do not want apply a proportion scale (just like in the case of modeling the development pattern of sales volume in time), than we can dedicate numbers to the phases from 1 to 3, carrying out a transformation into an ordinal scale. With this we interpret the logistic curve as time dependent life cycle phases on an ordinal scale. This interpretation is illustrated in Figure 2. $F(t)$ function represent the logistic curve, while $G(t)$ function is the transformed discretized version of $F(t)$.

2. Figure The discretized logistic function

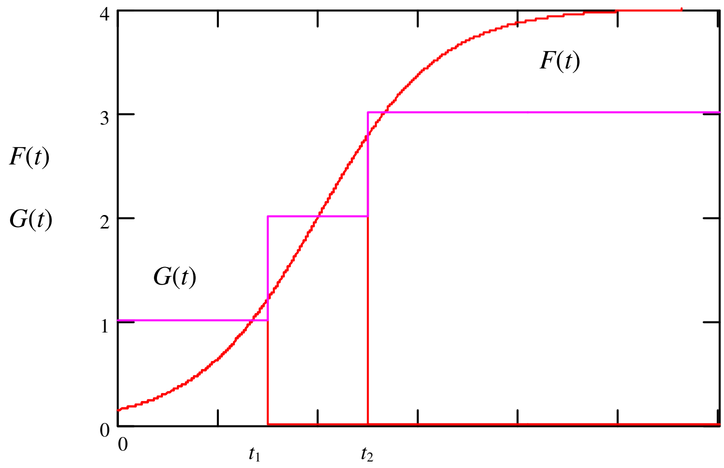


Figure 2 shows that in the $(0,t_1)$ time interval the product is in phase of market introduction. This phase is identified with value 1. (t_1,t_2) time interval indicates the growth phase of the product's life cycle. This phase is identified by value 2. Value 3 is dedicated to the maturity phase of the life cycle on $(t_2,+\infty)$ time interval. Whit this transformation we define a time dependent function suitable for analyzing the development pattern of the product sales volume or sales revenue over time. The starting point of our transformation was the logistic curve; the transformed version of it is interpreted as the discretized version of that logistic curve.

THE LIFE CYCLE MODEL

The objective of our analysis was to test whether the well known life cycle model is applicable to describe the pattern business relationship heaviness development shows over time. This development is a dynamic phenomenon. As mentioned above we had a static, cross-sectional type of data base. But we interpreted the 46 concrete relationships in our sample as 46 specific representatives of the pattern business relationship development have. Than we tested the fit of our actual data to different development patterns, among them the pattern known as life cycle model.

The life cycle model assumes that the chosen distinguishing variable – relationship heaviness in our case – develops along a logistic distribution curve over time. We note here that logistic and normal distribution curves are very similar; therefore we used both of them in or empirical testing. The shape of the logistic distribution curve can be described as follows:

$$F(x) = \frac{1}{1 + e^{-\frac{x-m}{s}}},$$

where m is the expected value of the population and $s = \frac{\sqrt{3}}{\pi} \cdot \sigma$, where σ s is the standard deviation of the population and x is the variable analyzed. In our analysis the 46 concrete observations about relationship heaviness was dedicated to the discretized three life cycle development phases. (We ignored in our analysis the last phase of the traditional life cycle, the decline phase, because relationships evaluated by the respondents were ongoing relationships with strategic importance. Such relationships necessarily can not be found in the decline phase of the relationship development.) This dedication process was carried out in four different analytical ways. These analytical ways were different (i) along the methods used for measuring the level of relationship heaviness and (ii) the applied utility function. The level of relationship heaviness was measured in two different ways. We measured it in an implicit way, using a set of different submeasures of the overall relationship heaviness, than we measured it in an explicit way, using one complex measure. Three submeasures were developed according to the three different relationship ties defined by the ARA model (actor bonds, activity links and resource ties). Utility functions applied in the analysis were the logarithmic and the linear utility functions (see Table 4). Du to space restrictions we restrict our review in this paper only to the detailed description of the 1. and 2. types of analysis.

We looked at to what extent the four different analysis lead to similar or on the contrary to different results. We tested our hypothesis: to what extent the development of relationship heaviness over time follows the pattern of the life cycle model, the logistic curve suggested by the model.

4. Table Overview of the analyses carried out

Type of the utility function The way heaviness is measured	Linear	Logarithmic
Explicit (with concrete index)	1. analysis	2. analysis
Implicit (with a system of indices)	3. analysis	4. analysis

From these four analyses the third and the fourth one carries out only the dedication process described above (linking our 46 observation to one of the three life cycle phases) and do not test the fit to any of the used distribution functions. The dedication of the 46 observations to life cycle phases was carried out using non hierarchical cluster analysis. Three submeasures were created in order to express the level of heaviness generated by the development of actor bonds, activity links and resource ties. Cluster analysis was carried out using both logarithmic and linear utilities of these three submeasures. We used Quick cluster analysis built in the SPSS program, because using it made it possible to fix the number of created groups in advance.

The first and second analysis – we describe here in details – was carried out using one complex measure for relationship heaviness. This complex measure was defined as the sum of the previously mentioned three submeasures. In case of this complex measures – indicating the overall level of heaviness of the relationship analyzed – we not only carried out the above mentioned dedication process but tested the fit of the effective heaviness pattern of our sample to the shape of the mentioned two distribution functions (normal and logistic). The shape of both the normal and the logistic distribution functions is very similar to the solution of the differential equation describing the shape of the life cycle model. In the following section we described the applied research methodology in more details.

DEVELOPMENT PATTERN RELATIONSHIP HEAVINESS - TESTING THE LIFE CYCLE HYPOTHESIS

As mentioned previously we used question 24, 25 and 27 for capturing the relation-specific investments generated by the development of the three different types of relational ties in any relationships. Question 24 asked respondents to evaluate the level of relation-specific investments generated by resource ties, question 25 mapped the investment level generated by activity links and question 27 the relation-specific investments generated by developing actor bonds. All of theses relation-specific investments increase the heaviness of the relationship. We developed three submeasures indicating the level of relation-specific investments generated by these three different relational ties in case of all relationships in our sample. These submeasures were interpreted as preference relations, utilities. As a next step the heaviness of a given relationship was expressed as a function of these three utility values. In this way we dedicated to each of the relationships in our sample one specific overall utility value, indicating the overall level of relationship heaviness. We dedicated our 46 relationships according to these overall utility values to specific life cycle phases (see the previous section of this paper and the discretized logistic curve).

We used both the linear and the logarithmic utility functions in our analysis. We have chosen these functions because both in microeconomic theory and in decision science utilities are described using concave curves. These concave curves can fulfill the necessary and sufficient condition of maximality. From an analytical perspective the logarithmic utility function for all three questions in the questionnaire (containing several subquestions, and defining three relation-specific investment levels generated by three different types of relational ties) were defined as follows:

$$U_{\log,j}^{res} = \sum_{i=1}^{4} \ln\left(U_{ij}^{res}\right),$$

$$U_{\log,j}^{act} = \sum_{i=1}^{7} \ln\left(U_{ij}^{act}\right),$$

$$U_{\log,j}^{soc} = \sum_{i=1}^{4} \ln\left(U_{ij}^{soc}\right),$$

where $U_{\log,j}^{res}$, $U_{\log,j}^{act}$ and $U_{\log,j}^{soc}$ are the created utility values measuring the level of relation-specific investments generated by the development of resource ties, activity links and social bonds in the relationship. These values determine the overall level of heaviness a relationship has. In the formulas above *j* always indicates the identification number of the relationship in our sample; *i* indicates the number of sub questions in the questions used in our questionnaire. U_{ij}^{res} (i=1,…,4), U_{ij}^{act} (i=1,…,7), and U_{ij}^{soc} (i=1,…,4) values are derived values based on the concrete answers given to the specific questions and their subquestions by the respondents.

For measuring the levels of relation-specific investments generated by developing resource ties in a relationship we used question 24 having 4 subquestions. In case of measuring the level of relation-specific investments generated by developing activity links question 25 with 7 sub questions was used. Finally for measuring the level of relation-specific investments generated by developing actor bonds question 27 with 4 subquestions was used. The numbers of subquestions are indicated in the indices of the above formulas.

In case of a linear utility function, utilities were defined as follows:

$$U_{lin,j}^{res} = \frac{\sum_{i=1}^{4} U_{ij}^{res}}{4},$$

$$U_{lin,j}^{act} = \frac{\sum_{i=1}^{7} U_{ij}^{act}}{7},$$

$$U_{lin,j}^{soc} = \frac{\sum_{i=1}^{4} U_{ij}^{soc}}{4},$$

where $U_{lin,j}^{res}$, $U_{lin,j}^{act}$ and $U_{lin,j}^{soc}$ are linear utility values developed from the answers given to the three questions. These linear utility values are derived values and measure the level of the level of relation-specific investments in case of relationship *j*. U_{ij}^{res} (i=1,…,4), U_{ij}^{act} (i=1,…,7), and U_{ij}^{soc} (i=1,…,4) determine the overall heaviness of a relationships and are also derived from and based on the concrete answers of our respondents.

The values indicating the level of relation-specific investments generated by the three relational ties in any business relationships are characteristic utilities. The sum of all three characteristic utilities defines the overall level of heaviness of relationships in our sample. In case of a logarithmic utility function the overall level of heaviness a relationship has is calculated as follows:

$$U_{\log,j} = U_{\log,j}^{res} + U_{\log,j}^{act} + U_{\log,j}^{soc},$$

In case of a linear utility functions the formula used is the following:

$$U_{lin,j} = U_{lin,j}^{res} + U_{lin,j}^{act} + U_{lin,j}^{soc},$$

where *j* index indicates the identification number of the relationship in our sample (j=1,…,46).

We developed, calculated the 46 overall utility values for all relationships in the sample and tested their fit to normal and logistic distribution using SPSS and SPlus programs. In SPSS the fit to a distribution function can be tested visually by using the menu point Graphs, the link of P-P and Q-Q menu points. These analyses unfortunately do not answer, whether the fit is statistically relevant or not, they do not test the level of statistical fit. SPlus program on the other hand can test this statistical fit using χ^2 and Kolmogorov-Smirnov tests.

Based on the utility values (explicit measure of relationship heaviness) all 46 relationships were dedicated to specific life cycle phases: introduction, growth and maturity. This dedication, grouping was carried out based on the distance between the actual utility value and its expected utility value. Grouping was carried out using both in case of the linear and logarithmic utility values. This means that a given, calculated proportion of the deviation is added to and deducted from the expected utility value. The two values calculated in this way break down the number line into three phases. With this we have the three phases of the life cycles developed.

The method described above means that using $U_{\log,j}$ and $U_{lin,j}$ measures we expressed *explicitly* the heaviness of the customer – supplier business relationship. Therefore we call this *explicit grouping*.

We have already noted that this grouping of relationships can be realized using another methodology too. This we called *implicit grouping*. In this case we do not calculate the complex measure of heaviness of relationships, but use only the specific variables developed for measuring the level of relation-specific investment generated by the three different relational ties defined by the ARA model. These variables are subutilities of the overall heaviness utility value. In case of a logarithmic utility functions these subutilities are $U^{res}_{\log,j}$, $U^{act}_{\log,j}$ and $U^{soc}_{\log,j}$,. In case of a linear utility function these subutilities are $U^{res}_{lin,j}$, $U^{act}_{lin,j}$ and $U^{soc}_{lin,j}$. In case of implicit grouping cluster analysis is carried out using these three subutilities a relationship has.

In summary grouping can be realized using four different methodologies:

1) using explicit measure of heaviness and logarithmic utility function;
2) using explicit measure of heaviness and linear utility function;
3) measuring heaviness in an implicit way (using submeasures of relationship heaviness indicated the relation-specific investment levels generated by three different relational ties) and applying logarithmic utility function;
4) measuring heaviness in an implicit way (using submeasures of relationship heaviness indicated the relation-specific investment levels generated by three different relational ties) and applying linear utility function;

We restrict our detailed description here to the first two, as mentioned already.

RESULTS OF THE EMPIRICAL INVESTIGATION - Results of the analysis using explicit measure of relationship heaviness

We tested first the distribution of the utility values developed for measuring the overall level of a relationship's heaviness, called explicit heaviness measures. In case of the logarithmic explicit measure Q-Q plot in the SPSS program was used and the graphical results analyzed. A high level of fit was shown to both the logistic and to the normal distribution, therefore we can assume that the distribution of utilities (explicit measures of heaviness) describe such curves. As a next step we tested the statistical fit of our explicit heaviness measures to these two distribution curves using χ^2 test in the SPlus statistic program. In case of a logarithmic utility function our explicit heaviness measure has a mean of 3.3778 and a standard deviation of 0.72372. In case of the normal and logistic distribution function the expected value of our explicit measure is the same. In case of normal distribution the standard deviation remains the parameter describing distribution function, while the parameter describing the logistic distribution has the value of 0.399.

First we tested the statistical fit to the logistic distribution function. The fit was calculated by the SPlus program with 12 independent intervals which means that in general 4 elements were dedicated to each interval. According to this the degree of freedom of the χ^2 –test was 11. Empirical value of χ^2 was 6.6957, the probability value is 0.8232. This means that at a 17.68% level of statistical probability we can accept our assumption: the explicit relationship heaviness measure fits to the pattern of the logistic distribution curve. This also means that at a lower level than that, for example at 5% level the assumption also holds.

In case of normal distribution the SPlus program developed 12 independent intervals the empirical value of χ^2 was 7.2174 leading to 0.7812 probability value. The assumption concerning distribution can be accepted at a 21.88 % empirical probability level.

As a summary of this analytical step we can state on a high safety level (already on a 10%) that the distribution of the explicit heaviness measures analyzed can not be excluded to follow the pattern of the logistic and the normal distribution curve.

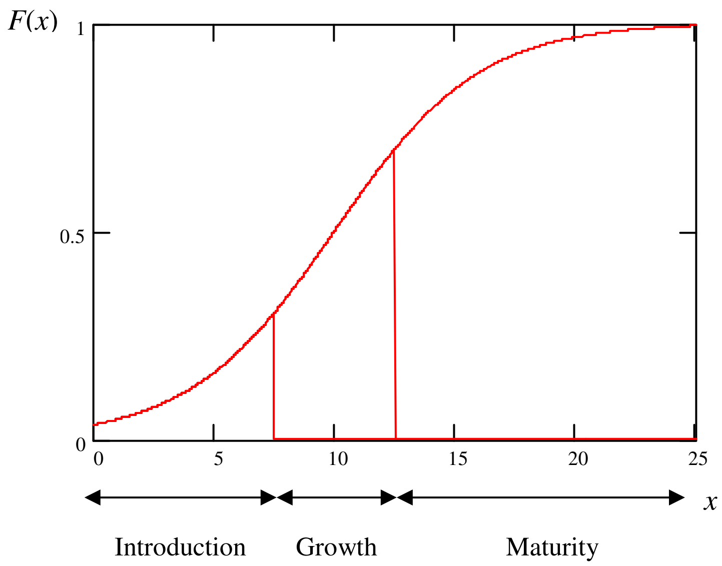
We tested the distribution of the linear utility function in a similar way. The mean of the linear utility values was 10.1578, standard deviation was 1.098. Here we also dealt with both distribution functions: logistic and normal. The number of intervals was 12 too and the degree of freedom 11. In case of the normal distribution the empirical value of χ^2 was 3.8085 meaning a probability of 0.9752 leading to a 2.48 % empirical probability level. In case of logistic distribution the empirical value of χ^2 was 6.8723 (probability level was0.8093, leading to a minimum safety level of 19.07 %).

In case of the linear utility values our previous statement also holds, namely on a high safety level the distribution of the explicit heaviness measures analyzed can not be excluded to be either logistic or normal. We have to stress that the shape of the two distribution function is very similar.

We can state that the development pattern of heaviness a business relationships has in time follows the shape of the traditional life cycle (as far as its first three phases are concerned).

Next step was to group the business relationships analyzed based on their distribution (see Figure 3). We grouped the utility values representing the complex heaviness measure of relationships in the sample.

3. Figure Logistic distribution and the specific phases of the life cycle



Grouping was based on the value of deviation from the mean. Boundaries of the three groups were defined as follows:

- introduction: $[0, \bar{x} - a \cdot s)$,
- growth: $[\bar{x} - a \cdot s, \bar{x} + a \cdot s)$,
- maturity: $[\bar{x} + a \cdot s, +\infty)$,

where $\bar{x}$ denotes the mean, and s the standard deviation of the sample. Mean and deviation was calculated using both linear and logarithmic utility values. The value of a indicates the number, how many times the deviation was added to or deducted from the mean. We analyzed two cases, when $a_1 = 1$ and the second case, when the $a_2 = \frac{1}{3}$.

In the special situation, when standard deviation is added to or deducted from the mean – i.e. $a_1 = 1$ – the result of grouping business relationships of the sample give the same result, irrespective from the fact linear or logarithmic utility function is used. Results are summarized in Table 5: 7 business relationships from our sample fall into the introduction phase, 31 into the growth phase and 8 are in the phase of maturity.

5. Table The population of specific life cycle phases as a result of the analysis using linear and logarithmic utility functions, $a_1 = 1$

	Introduction Linear: [0, 2.65)* Logarithmic: [0, 8.12)	**Growth** Linear: [2.65, 4.10) Logarithmic: [8.12, 12.09)	**Maturity** Linear: [4.10, +∞) Logarithmic: [12.09, +∞)
Identification numbers of the specific business relations in the sample	7, 18, 39, 48, 49, 71, 73	2, 3, 4, 5, 6, 8, 9, 11, 13, 20, 21, 23, 24, 26, 29, 36, 38, 40, 42, 44, 45, 51, 52, 55, 57, 61, 63, 64, 65, 66, 67	1, 12, 17, 22, 37, 50, 54, 62

* [the lower level of the interval, the upper level of the interval)

In the following you find the results of our grouping assuming $a_2 = \frac{1}{3}$. In this case applying logarithmic and linear utility functions leads to different grouping patterns. The grouping pattern by of linear utility function is shown in Table 6.

6. Table The population of specific life cycle phases as a result of the analysis using linear utility function., $a_2 = 1/3$

	Introduction Linear: [0, 9.49)	**Growth** Linear: [9.49, 10.82)	**Maturity** Linear: [10.82, +∞]
Identification numbers of the specific business relations in the sample	2, 6, 7, 8, 9, 18, 26, 29, 38, 39, 43, 48, 49, 55, 57, 63, 66, 71	3, 4, 11, 20, 23, 65, 67	1, 5, 12, 13, 17, 21, 22, 24, 36, 37, 40, 42, 44, 45, 50, 51, 52, 54, 61, 62, 64

In this case 18 relationships fall into the introduction phase, 7 relationships is to be found in the phase of growth and 21 in the phase of maturity. Results by logarithmic utility function are summarized in Table 7.

7. Table The population of specific life cycle phases as a result of the analysis using logarithmic utility function, a_2 = 1/3

	Introduction Logarithmic: [0, 3.14)	**Growth** Logarithmic: [3.14, 3,62)	**Maturity** Logarithmic: [3.62, +∞)
Identification numbers of the specific business relations in the sample	2, 3, 6, 7, 8, 9, 18, 23, 26, 29, 39, 43, 48, 49, 55, 63, 65, 66, 71	4, 11, 13, 20, 38, 44, 45, 57, 67	1, 5, 12, 17, 21, 22, 24, 36, 37, 40, 42, 50, 51, 52, 54, 61, 62, 64

In case $a_2 = \frac{1}{3}$ and logarithmic utility function 19 of the relationships in our sample fall into the phase of introduction, 9 are in the growth phase and 18 business relationships are to be found in the phase of maturity.

Table 8 is the cross table of above grouping procedures. We analyzed to what extent these groupings overlap with each other. In order to measure this we calculated association indexes available in SPSS. Our data were transformed to an ordinal scale, consequently we could use for measuring association, the strength of relation between the two groupings with Kendall's τ_b and the gamma association index. Kendall's τ_b 0.681 and gamma association index was 0.883. Both of these indices had an empirical level of significance 0.000. These prove a high association between the results of the two groupings.

8. Table Comparison of the groups resulted from the explicit analysis, a_2 = 1/3

Logarithmic Linear	1. group	2. group	3. group	Total:
1. group	18	3	0	21
2. group	0	4	3	7
3. group	0	2	16	18
Total:	18	9	19	46

SUMMARY AND CONCLUSIONS

Development of business relationships is a focal question for several disciplines in business management: purchasing, industrial marketing and supply chain management too. Relationship develops over time and this creates analytical problems. These problems are also present in literature, but most of the time research programs dealing with this issue applied qualitative research methodology. Our research was also devoted to the problem of how business relationship development over time too, but – according to our present knowledge – *uniquely we applied qualitative analysis*.

We hypothesized that the heaviness of business relationship over time can be described with the life cycle model known from several previous research fields. Based on an on-line questionnaire we measured a specific relationship attribute and based on our data we analyzed the pattern this attribute develops along over time. This specific relationship attribute was the heaviness of the relationship. Our objective was to test empirically to what extent the level of heaviness – captured by the relation-specific investments generated in the relationship – fits to the logistics curve, the development pattern of the traditional life cycle. We applied a new approach to the problem of analysis a phenomenon with time perspective, such as ours: how relationship heaviness develops over time? *We assumed that the development of heaviness business relationships have over time can be described by a typical (, but not known) development pattern. Therefore we can interpret the 46 concrete relationships in our sample as 46 different observations, 46 specific representatives of this typical development pattern.*

As a summary of our analysis we can state on a high safety level that the distribution of the explicit heaviness measures developed in our research can not be excluded to follow the pattern of the logistic and the normal distribution curve. Consequently we can state that development pattern of heaviness a business relationships in time has follows the shape of the traditional life cycle. With this result we can empirically back previous researches arguing that relationship development may have a life cycle.

We think that because of our research methodology and the suggested treatment of the time-character business relationships development, our paper has a contribution to business theory.

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APPENDIX: QUESTIONS USED IN THE ON-LINE QUESTIONNAIRE

A24. Please indicate the level of relation-specific investment in the business relationship in question along all indicated investment types! (1 = very low level; 5 = very high level)

	Level of investments				
in case of human resource	1	2	3	4	5
in case of special tools and devices	1	2	3	4	5
in case of new, jointly developed methods and procedures	1	2	3	4	5
in case of facilities	1	2	3	4	5
other (Please name them!):	1	2	3	4	5

A25. Please indicate to what extent your business partner in question shares the following types of information! (1 = to a very low level; 5 = to a very high level)

	Level of information sharing				
Information related to the everyday operation (e.g. order information)	1	2	3	4	5
Information related to the planning of everyday operation (e.g.: forecast data)	1	2	3	4	5
Point of sales data	1	2	3	4	5
Actual inventory data	1	2	3	4	5
Information related to incremental innovation	1	2	3	4	5
Information related to radical innovation	1	2	3	4	5
Actual cost and other financial data	1	2	3	4	5
Data on the actual level of the cooperating partner's operational performance (e.g. logistics service level of the supplier)	1	2	3	4	5
Other information (Please name them!)	1	2	3	4	5

A27. Please indicate the level of the following characteristics of the partnership in question! (1= very low level, 5 = very high level)

a) Level of commitment 1 2 3 4 5
b) Level of satisfaction 1 2 3 4 5
c) Level of cooperation 1 2 3 4 5
d) Existence of jointly defined objectives 1 2 3 4 5
e) The existence of joint structural connections (e.g. EDI) 1 2 3 4 5
f) Level of dependence1 2 3 4 5
g) Level of trust 1 2 3 4 5
h) Strength of personal contacts 1 2 3 4 5