Transaction costs of innovative enterprise

E. Antonenko[1,*], and *I.* Baev[1]

[1]South Ural State University, Chelyabinsk, Russia

Abstract. The article deals with essence and classification of transaction costs, their distinctive features in case of innovative production. Transaction costs classification by necessity criterion is presented, components of information searching costs and negotiation costs as the most relevant groups of innovative production transaction costs are considered. The mathematical model of negotiations is suggested. This model defines the optimal number of negotiation rounds, determines exact total value of the contract with respect to transaction costs, and estimates the amount of transaction costs for each round. This model has practical significance and it can be used by innovative firm at the stage of commercialization. We conduct a computer experiment for finding the optimal number of rounds by minimal contract value criteria. Our results can be directly extended to real-life negotiations.

1 Introduction

Examination of transaction costs essence and their estimation draw great attention of scientists and experts. It can be explained by two reasons. Firstly, these costs and losses arise from interaction between business partners under free market economy. Secondly, transaction costs are a great part of total costs both at country level [1,2,3,4] and at micro level [5,6]. Moreover, transaction costs are much harder to estimate and difficult to manage since they depend on environmental parameters. Management decisions affect this type of costs not so obviously as on operating costs. It is clear that difficulties in definition and estimation of transaction costs increase in case of innovative enterprise. This article provides variety of definitions and classifications of transaction costs. We explore distinctive features of transaction costs of innovative enterprise and propose a model to determine the optimal contract value to increase commercialization efficiency.

2 Significance, scholarly importance and literature review

A. Transaction costs definition

The problem of transaction costs identification and estimation is one of the key challenges of modern economic science. The acknowledgement of this type of costs marks transformation from perfect market economy to enterprise activity consideration under real-life conditions. Transaction costs theory is significant aspect of current new institutional economy. Transaction costs economics as an independent concept finalized in the late 1970s thanks to Oliver Williamson's paper [7], but the background of the establishment of this theory appeared in a few decades earlier. It is assumed that origin of this conception occurred after Ronald Coase published his paper "The nature of the firm", despite the fact that the term "transaction costs" in this article has not been used [8]. At the same time, John Hicks compared the cost of transferring assets with friction [9]. In 1969, Kenneth Arrow, also came to conclusion that, contrary to theoretical assumptions, the market operation costs cannot be zero [10], so transaction costs are the costs of "running the economic system". Douglass North defined transaction costs as "the costs of measuring the valuable attributes of what is being exchanged and the costs of protecting rights and policing and enforcing agreements" [11]. Oliver Williamson suggested the next definition: "comparative costs of planning adapting and monitoring task completion under alternative governance structures" [12]. Douglas Allen associated transaction costs presence with creation of property rights and retention of title [13]. Steven Cheung [14], Jensen and Meckling [15], Barzel [16], Goldberg [17], Alchian and Woodward [18] are the followers of the definition of transaction costs from the perspective of property rights approach too. Niehans [19] defined transaction costs as «property rights transferring costs». Stavins [20] gave the similar definition: "…transaction costs are ubiquitous in market economies and can arise from the transfer of any property right…".

Great variety of transaction costs definitions give evidence of ambiguousness of their nature. Every scientist applies the definition according to the field of research and commitment to scholarly traditions. However, all definitions have a number of common features. Firstly, this type of costs arises from

---

* Corresponding author: Elizaveta.Antonenko@susu.ru

interaction of market participants. Secondly, they are connected with the imperfection of the transmitted information. Therefore, from our point of view the most relevant definition is the following: "Transaction costs are the costs originating as a result of market interaction between enterprise and external environment under passing the barriers arising from information asymmetry, administrative barriers, as well as real and opportunity costs carried by firm through this interaction" [24].

B. Transaction costs classification

Transaction costs classification depends on scientist's point of view as their definition does. According to the most accepted classification, transaction costs are divided into seven groups:
1) Costs of administrative barriers overcoming;
2) Information search costs;
3) Negotiation costs;
4) Costs of measurement;
5) Costs of specification and property rights protection;
6) Costs of opportunism;
7) Lobbying costs.

Besides the basic classification, transaction costs can be divided by necessity criterion. Thus, we have two groups: necessary costs and transaction losses. Necessary costs are the costs which enterprise bears in any case for maintaining its activity in process. Transaction losses are a type of transaction costs, which contains losses of time and resources and arises from wrong management decisions. In the context of negotiation costs, necessary costs are the costs of preparing the information for negotiations, representational expenses, business trip expenses, costs of a lawyer, notary officer services and the costs of expert support. Transaction costs in this case are losses from unfavourable terms of bargain, losses due to loss of a partner, goodwill decrease.

3 Transaction costs in innovative production

C. General descriptions of information search costs

Innovative products manufacturing has some specific features, the main one is high sales uncertainty. "Push" strategy application is too risky for innovative enterprises, their marketing focuses primarily on the identification of a potential buyer's needs. Relationship between the company and environment is unstable due to the lack of established links and high uncertainty. As concerns the value and structure of transaction costs, one mentions some specific features about innovative product manufacturing. An enterprise inevitably faces with the costs of licensing, registration and certification while launching a new product. At the same time, in addition to the ordinary

types of costs (registration fees, consultancy fees, etc.) costs of specification and protection of property rights (cost of restoration of violated rights, cost of protecting intellectual property, and loss from bad specification) are added. Nevertheless, key components of transaction costs for innovative enterprises are, in our opinion, information search costs and negotiation costs. Information search costs consist of the costs of information search for market situation, information about potential counterparts and losses associated with the incompleteness of received information.

Innovative enterprise activity start with market monitoring for finding a free niche. In this aspect, the information quality is critically important as it rates the reasonability of production startup and direction of enterprise's activities. Losses caused by incomplete information are inversely related with the information quality level whereas in contrast searching costs rise with the growth of information quality requirements. The natural problem of information management is to achieve a balance between the value of information and its utility [25]. The utility of information is not equal to its quality, since generally information of the highest quality is excessive for the company. Components of information search transaction costs are presented in Table 1.

Table 1. Components of information search transaction costs.

Costs	Components
Costs of information search for potential business partner	Costs: of access to database, of obtaining communication services, of attendance professional expositions and events. Losses: of obtaining excessive information.
Costs of information search for market situation	Costs: of access to database, of obtaining communication services, of communication services, of ordering/conducting market research. Losses: of the missing the participation in the free messages (e-mailing, etc.), of obtaining excessive information.
Losses associated with incomplete-ness of received information	All losses arising from: choice of business partner with unfavorable conditions at the market (price, service), choice of an unreliable business partner (delays, incomplete deliveries, etc.), forecasting error due to inaccurate description of the market situation (overproduction, underproduction, incorrectly exposed prices, etc.).

Information search costs management determines the management of costs in general. Using high quality and correct information an enterprise can lower the probability of disputes with business partners and reduce their opportunism.

D. Negotiation costs

After finishing the process of searching information for potential business partners, company starts negotiations. Table 2 shows components of negotiation costs.

Table 2. Components of negotiation transaction costs.

Costs	Components
Costs assotiated with organisation and conducting of negotiations	<u>Costs arising from:</u> representational activities, business trips, using lawyer services, notary officer services, expert support, salary payments to relevant staff. <u>Losses arising from:</u> unreasonably high level of representational expenses, too frequent business trips (compared with the accepted rate in the industry or economic effect of the trip), breakdown of negotiations, overpayment to lawyers (lawyers' fee in comparison with similar qualifications).
Losses associated with failure of negotiations	<u>All losses arising from:</u> loss of a business partner (this follows with losses of discounts; increase of information search costs for a new business partner, etc.); unfavorable terms of bargain (the difference between the desired and the real contract price, level of service, etc.); drawing a loan under unfavorable terms; surplus of stored goods (also related to forecast errors);bargain's failure due to problems with the law, intentional and unintentional errors in the contract on the part of both contracting parties.
Legal registration costs	<u>Costs:</u> of consumables, of coordination with authorities. <u>Losses:</u> from improper execution of documents (amendment of a document, re-signature, and repetitive visits to the authorities).

Let us define the negotiation process. Two players negotiate about a contract of some issues (price, deadline, prepayment, etc.). Negotiations consist of multiple rounds. Players make offers in order, one by one. In every time period the "active" player can do the following:

1) Accept the previous offer;
2) Reject the previous offer and propose a new one;
3) Quit the negotiations.

Players maximize their utilities and rationality is a common knowledge.

A specific feature of innovative enterprise as a side of negotiation process is its "weakness". Under weakness, we consider weak ability to influence on the outcome of negotiations. The objective of any negotiations is to achieve a result in the best possible conditions. For the seller, those will be the highest possible price, acceptable delivery time and the maximum prepayment. For the buyer, on the other hand, it will be the lowest possible price, the shortest delivery time and the minimum value of prepayment. Everything in the contract except time can be specified in terms of monetary value. It becomes possible to define a utility function to compare different contracts. Reservation utility of a player is the minimal acceptable outcome of the negotiation. Therefore, player will refuse to take part in negotiations if their outcome is less then reservation utility.

Let us determine the so-called zone of agreement. Zone of agreement is a set of all feasible price values, which are acceptable to both players [21]. Player's strength affects the part of the zone of agreement where the contract will be signed. It is reasonable to assume that in case of negotiations between a weak buyer and a strong seller contract price will tend to shift to the upper point of the zone of agreement. Successful negotiations directly affect the commercialization of goods.

There are two main classes of strategies: time dependent strategies and behavioral strategies. To evaluate the round in which negotiations are expected to finish we have used a behavior-type strategy [21], specifically tit-for-tat strategy. However, implementation of this type of strategy for evaluation of intermediate offers of players is not acceptable, though it can be used in case both players have equal "strength". In order to consider different values of player's "strength" we have modelled the negotiation process using time-dependent strategy (as was mentioned we got the estimation of the expected duration of negotiations).

It is well known that three general types of strategies exist in time-dependent class of strategies: aggressive, flexible and linear [22]. Aggressive means that the player maintains his initial offer until he reaches the deadline, then he concedes up to his reservation utility. Flexible means that the player quickly concedes and maintains his reservation utility. However, these are too extreme to be used in real negotiations. In real life players tend to use less extreme strategies even if they are not optimal (it is proved that above three dominate the rest strategies). Outcome of negotiations will be determined in accordance with the theorem: "At the deadline, rational agents will offer their reservation utility" [23]. That is the way, how players come to agreement.

We have developed a mathematical model of negotiations, which allows determining the number of rounds of negotiations, total value of the contract, and value of transaction costs for each round. In addition, it is capable to estimate the optimum total contract value, taking into account transaction costs. We have written a computer program using MatLab environment, where total price of the contract is determined according to "strength coefficients" of players (these coefficients are estimated using the method of expert evaluation of players on a number of parameters).

So, to determine the expected number of rounds behavioral strategy is used, in other words, player's behavior is based on a symmetric behavior of the other. In other words, this strategy tries to match the behavior of the counterparty. If the side makes a large concession, the response will be with large concession

too, opposite is true – small concession of the one side will be followed by a small concession of the other.

The program estimates the expected number of negotiation rounds. Then using this estimation the program switch to a time-based strategy and compute intermediate players' offers with the help of trigonometric functions.

As discussed, the distinguishing feature of the innovative enterprise is its weakness in the negotiation process. We set up the model experiments in which the strength of the innovative enterprise is fixed at a low level (20% of the possible maximum) and find the expected number of rounds, depending on the strength of the other side.

Figure 1 shows which round is considered as the best in relation to the price of the goods. Consider a point with a maximum strength (100) of the counterparty. Ending negotiations in the fifth round will give players maximum satisfaction.
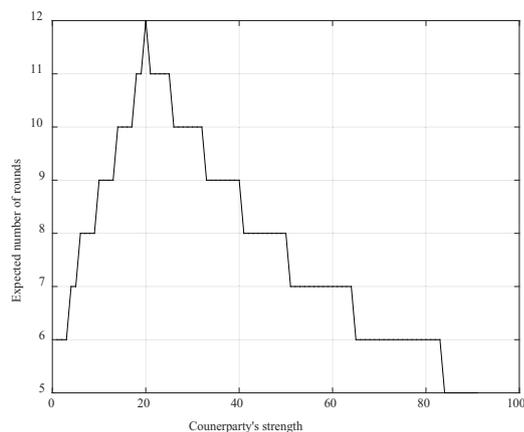

Fig. 1. Expected number of rounds vs counterparty's strenghth.

However, if we look at Figure 2 we see that the minimum value of the contract is achieved in the third round, not in the fifth one. This happens due to the presence of transaction costs. Thus, it makes sense to agree with unfavorable conditions in the third round and do not continue negotiations, as the benefit derived from achieving the desired price in the fifth round, will be neutralized because of the transaction costs.
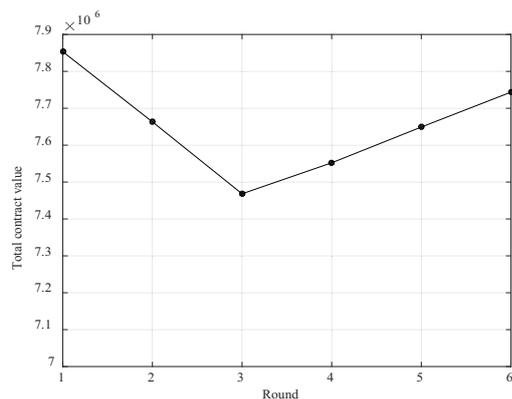

Fig. 2. Total contract value vs number of rounds.

This model has important practical significance. Firstly, it allows innovative enterprises to forecast the expected number of rounds of negotiations and to perform their approximate calculation. Secondly, this program allows user to define the round when negotiations should be stopped, to reach the minimum contract value. The same is true for the case where an innovative company is the seller. In this situation, the model is able to find the round with maximum total contract value. Thus, the system can promote the successful commercialization of an innovative product.

4 Conclusion

Transaction costs identification and estimation is an important part of an enterprise management, the ability to enhance competitive advantages. Greater focus should be placed on management of information search costs in innovative enterprises, as the quality of received information affects the all further enterprise activity. Another important element - costs of negotiating and contracting. Suggested mathematical model allows the estimation of this type of costs and increases efficiency of negotiations, thereby increasing the probability of a successful launch of an innovative product. The computer program based on this mathematical model allows estimating the expected number of rounds of negotiation process and estimating the total contract value with respect to transaction costs. This program recommends finishing the negotiation process in specific round given the optimal outcome of negotiations and can be a part of decision-making systems for support innovative industrial enterprises. Further stage of our study will be devoted to the creation of a mathematical model for management of information search transaction costs.

References

1. F. Da, The Journal of Quantitative & Technical Economics, **8**, 123-134 (2009)

2. *Dagnino-Pastore, Transaction Costs in Argentina* (ISNIE, 1999)

3. Dollery, Australian Economic History Review, **38(3)**, 207-231 (1998)

4. J.J. Wallis, Long-term factors in American economic growth, (1986)

5. S.S Hosseini, J. Agr. Sci. Tech., **14**, 243-256 (2012)

6. M.M. Polski, *Measuring Transaction Costs and Institutional Change in the U.S. Commercial Banking   Industry*. http://www.spea.indiana.edu/ids/pdfholder/ISSN-01-3.pdf.

7. O. Williamson, Journal of Law and Economics, **22(2)**, 233-261 (1979)

8. R. Coase, Economica, **4(16)**, 336-405 (1937)

9. J.R. Hicks, Economica, **2**, l-19 (1935)

10. K.J. Arrow, The Analysis and Evaluation of Public Expenditures: the PBB System, Joint Economic Committee Compendium, 91st Congress, 1st Section, **1**, (1969)

11. O.E. Williamson, American Journal of Sociology, **87**, 548-577 (1981)

12. D.C. North, *Institutions, Institutional Change, and Economic Performance* (Cambridge University Press, New York, 1990)

13. D. Allen, *Transaction costs. In Encyclopedia of law and economics, volume I: the history and methodology of law and economics* (Cheltenham, Edward Elgar, 1999)

14. S.N.S. Cheung, Economic Inquiry, **36**, 514-521 (1998)

15. M. Jensen, W. Meckling, Journal of Financial Economics, **3**, (1976)

16. Y. Barzel, Journal of Institutional and Theoretical Economics, **141**, 4-16 (1985)

17. V.P. Goldberg, Goldberg, Readings in the Economics of Contract Law, 395-402 (1989)

18. A.A. Alchian, S. Woodward, 26 Journal of Economic Literature, 65-79 (1988)

19. J. Niehans, Journal of Money, Credit, and Banking, **1**, 706-726 (1969)

20. R.N. Stavins, Journal of Environmental Economics and Management, **29**, 133-148 (1995)

21. G. Lai, C. Li, K. Sycara, J. Giampapa, *Literature review on multiattribute negotiations* (Technical Report CMU-RI-TR-04-66, 2004)

22. S. Fatima, M. Wooldridge, N. Jennings, Artificial intelligence, **27**, 381-417 (2006)

23. S. Fatima, M. Wooldridge, N. Jennings, Artificial intelligence, **152**, 1-45 (2004)

24. E.V. Antonenko, Bulletin of the South Ural State University. Ser. Economics and Management, **9**, **1**, 74-80 (2015)

25. E.V. Popov, *Institutes of Minieconomics* ("Economics" Publishing, Moscow, 2005)