



Marek Ciesielski

*Department of Logistics and Transport, Faculty of Management,
Poznań University of Economics and Business*

SUPPLY CHAINS – A THEORETICAL AND METHODOLOGICAL PERSPECTIVE

Abstract

This paper generally indicates the need to improve the methodological order in the studies on supply chains. It discusses the following issues: defining, hypotheses and detailed theorems, generalizations, existing theoretical achievements, hypothetical models in research, usability of the theory for economic practice. This approach towards the research process allows to view it globally, from defining the object of research to the practical application of its results. Thus, the article proposes several recommendations for beginning researchers. The overall result of this study is to identify the need for greater order of methodological research on supply chains.

Keywords: model, order research, supply chain, theory, methodology

Introduction

This article mainly aims at expanding the discussion on theoretic and methodological grounds of research into supply chains. The assessments and recommendations have been presented in an unconditional form so to facilitate the criticism thereof. The criticism might primarily pertain to the list of such major issues as:

- defining,
- hypotheses and detailed theorems, generalizations,
- the achievements in the field of theory,
- research – explanations (hypothetical models),
- usability for economic practice.

It needs to be remembered that numerous processes intertwine in academic research. Formulating hypotheses intertwines with explaining; the research might

lead to rejecting hypotheses as well as to falsifying theories, and a correctly formulated definition is essential for providing accurate explanations.

This approach towards the research process allows to view it globally, from defining the object of research to the practical application of its results. Thus the article proposes several recommendations for beginning researchers. These, however, need to be read independently as this article is not a textbook (basic categories have been marked in bold).

1. Defining

The term definition contained in this theoretical and methodological toolkit seems to be surprising. However, many years of experience with the issues of defining within the area of research into supply chains and in the whole management studies makes the author devote a few sentences to the notion of defining. Let us brush upon the definition of definition. A real definition is a sentence characterizing an object or objects of a certain kind which can only and exclusively be ascribed to these objects (Ziembiński, 1995). A nominal definition, however, is as an expression which, in some way or another, provides information on the meaning of a word or words (the words being defined) (Ziembiński, 1995).

There is one more task that the authors of the definition expect it to perform. They want it to contain at least basic knowledge about the defined notions, particularly about the aims of using and managing supply chains. It may happen that the idea of supply chain management is hidden inside the definition of another notion. For instance, "As we see it, logistic management is an activity which creates an all-embracing concept of logistic projects which deals with their course within an organization as well as at its partners' side. The concept also involves coordination of its broadly understood realization by appropriate organizational units by means of appropriate instruments of management and supervision" (Krawczyk, 2001, p. 68).

Even very accurate definitions contain unnecessary conditions, e.g. "Supply chains are networks of partners who collectively transform the basic raw material (the phase of supply) into finished products (the phase of distribution) of a concrete value designed for the end buyers and take care of returned products at each stage" (underlined by M.C.) (Harrison, van Hoek, 2010, p. 34).

The described phenomenon causes chaos as regards even the elementary issues. The authors' intentions are good. One needs to take care of returns. This, however, is just a reflection of wishful thinking, the faith in the magic of the words; if we include certain values in the definition, then they will be realized. The only explanation which could exclude the magic would be an assumption that it is easier to write a wishful definition than a real one. And this definitely is not the case.

2. Detailed hypothesis of the theorem and generalizations

The term science is commonly associated with the word theorem. With respect to research into supply chains, certain reservations must be introduced though. A theorem is a sentence containing an implication where the first part is an antecedent reason and the other a consequence. On the other hand, law is a justified and verified general statement (of universal importance). For the sake of clarity, let us assume that a structured set of laws is called a theory. In the area of research into supply chains one cannot formulate such theorems and laws. In all of the management studies either sentences with a small quantifier are constructed or hypotheses. There are primarily detailed theorems and the so called historic generalizations. As far as the detailed theorems are concerned, the subject constitutes a general name whereas the object pertains to but a few of its referents. The so called historic generalizations, “which just as the law of science may have a general (with no exceptions) or a statistical nature, have one distinctive feature, i.e. the fact that their subject is a general historic name or the scope of their subject is additionally limited by time and space coordinates or, equal to these coordinates, historic or geographic terms” (Nowak, 2017, p. 207).

Subsequent research might increase the scope of importance of historic generalizations which are sentences with a small as well as large quantifier and sentences of various levels of assertion (the conviction that they are true). Detailed sentences are those with a small quantifier, e.g. some companies view supply chain management as the basis of competition (some is the key word here). Most sentences with a large quantifier, e.g. all companies compete by means of supply chains have a low level of assertion.

In view of the above it might be assumed that all sentences referring to theory are merely hypotheses and thus the Ajdukiewicz rule of rational justification might be accepted as it says that each sentence should be uttered as powerfully as its justification is (and on the same level of assertion). Therefore the word hypothesis might refer to each and every sentence formulated within scientific research or simply be understood as an assumption. It is recommendable to pay attention to the definition provided by Babbie: “hypothesis is a defined and testable expectation regarding the reality, formulated against a more general statement; more broadly, it is predicting the nature of things based on theory. It is a statement that if a variable is accurate, then a particular phenomenon should occur” (Bogdanienko, 2008, p. 150). It clearly refers to such logic where a thesis is formulated and proven by testing its logical hypotheses.

The above remarks are decisive on the manners of testing hypotheses or theorems on supply chains. These either confirm or disconfirm such hypotheses.

The literature on supply chains does not specify whether a theorem was formulated or a generalization. This may be exemplified by the following sentences:

- 1) Companies dependent on key external resources can improve their economic stability through vertical coordination;
- 2) Companies which encounter uncertainty regarding key external resources can improve their stability through vertical coordination;

3) There is a positive relation between vertical coordination and interaction of uncertainty and dependence on resources (Carter, Rogers, 2008, pp. 372–373).

The above cannot be considered as the laws of science due to the use of such expressions as “they can” as well as the fact that the described interdependencies and relations pertain solely to contemporary economic conditions.

To sum up, the research into supply chains produces sentences such as “Benetton is the best manager of supplies and deliveries” as well as such detailed sentences as:

- at most some A are B (at most but not all),
- at least some A are definitely B.

There are also the so called placement sentences where the subject is a universal notion and the object is of a historic nature.

In management studies abduction is a particularly reasonable way of thinking, including the studies of supply chains. Abduction can be the main instrument of explanation in these studies. Concluding by means of abduction involves searching for either the most probable explanation for a given set of facts, or simply creating explanations for a given set of facts. In the former case, the principle of the best explanation is employed. Abduction can lead to understanding surprising explanations or to explaining information which evokes curiosity (Urbański, 2009, p. 10). When Charles Darwin explained the reasons for different shapes of beaks of various species of birds during a sea voyage on H.M.S. Beagle, beyond any doubt, he employed abduction.

The scheme of abductive reasoning is as follows:

- a surprising phenomenon C is observed,
- we state that if A was true, the occurrence of C would be obvious,
- we suppose that A is true.

This reasoning is therefore different from the basic explanatory scheme which can be presented as follows:

- the applied theoretical achievements,
- explanans:
 - the level of oil prices influences the speed of ships on major marine routes,
 - in the period under examination, the speed of ships decreased.
- explanandum:
 - in the period under examination, the prices of oil grew.

The conclusion drawn (explanandum) certainly needs to be tested.

In the case of abduction the reasoning would look as follows:

- we notice a decline in the speed at which ships go,
- if the prices of oil grew, the decline in the speed would be obvious,
- we suppose that in the period under examination, the prices of oil grew.

It is extremely vital that whilst studying supply chains, the basic methodological assumptions were always defined and that the background theoretical achievements were cited. This is the minimum condition of knowledge development by formulating and rejecting hypotheses. In the area of study on supply chains these have been largely neglected.

3. The theoretical achievements

Various theories might be used for constructing theoretical basis of research into supply chains. For instance, in the following hypothetical model, a theory of oligopoly was used along with the theory of price equilibrium, the contract theory, the theory of strategic management as well as the theory of domination. Ketchen and Hult (2007, p. 575) pointed at a huge set of useful studies on improving supply chains:

- transaction costs theory,
- agency theory,
- dependence on resources theory,
- institutional theory,
- game theory,
- theory of chains,
- strategic choice theory,
- social capital theory.

All of the above mentioned theories have already been tested for their usability for explaining the supply chain related phenomena. One might expect that as the supply chains develop, it may be necessary to reach for other theories. For instance, if the processes of re-industrialization keep on developing and if supply chains dramatically change along with these processes, then the explaining thereof will call for another theoretical bases.

A generally understood theory originates in practice and refers to practice. This is illustrated in figure 1.

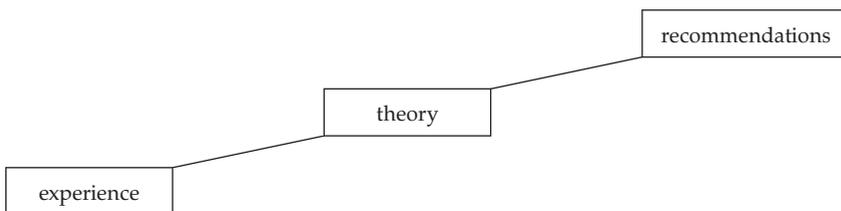


Figure 1. General approach to theory

Source: (Such, Szcześniak, 2006, p. 27)

Theory (hypotheses, generalizations) is formed as a result of observation and empirical research. The value of theory results from the value of recommendations formulated based on such theory.

The generally accepted diagram of knowledge acquisition is presented in figure 2 below.

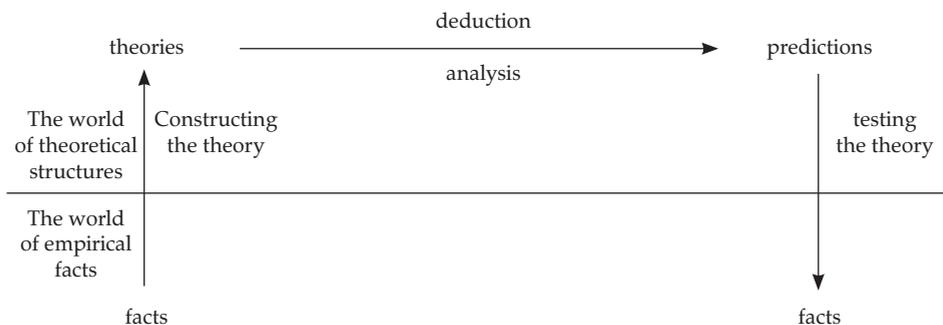
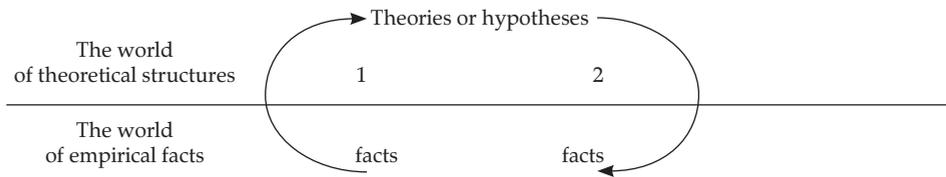


Figure 2. General approach to theory
Source: (Such, Szcześniak, 2006, p. 29)

The diagram involves building theories based on facts, deducing and making predictions based on the theory and putting the theory to test by confronting the predictions with facts. This means going through the stages of facts, theories, predictions and facts. For various reasons this scheme cannot be fully utilized. Then the results of such simplification need to be defined. If at the beginning of the cycle (at the stage of facts) a false statement is assumed (e.g. with respect to the aims and strategies of an organization), then any further stages and steps of the diagram might be false, especially deducing from theory. For instance, this happens to research on pro-ecological behavior of organizations. The next step, deducing and making predictions based on theory may, yet it does not have to, lead to discovering false statements. Deducing is a reliable way of thinking, the direction of deduction is the same as the direction of implication. Regretfully, it can rarely be used in research within economic sciences.

It is difficult to apply this diagram to economic sciences in general and to research on supply chains in particular. Therefore, in research practice a limited diagram of knowledge acquisition is applied. This means that the step of deducing in order to make predictions is omitted. Thus the diagram consists of just two steps: building theories or hypotheses and testing the theories. Just like in the basic diagram, reasoning starts at the level of facts. It finishes at the same level, yet the theory is tested directly by confronting it with facts and not, as in the original diagram, indirectly, by confronting predictions with facts. The limited diagram is presented below in figure 3. Removing one step might not lead to discovering the falsity of facts which are found at the beginning of the diagram. The omitted step is a firewall against falsifying the subject of studies.



- 1 – building theories or hypotheses
 2 – testing theories or hypotheses

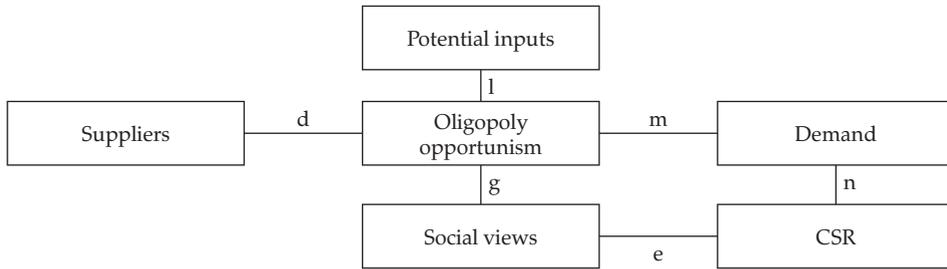
Figure 3. Limited diagram of knowledge acquisition
 Source: author's own based on (Such, Szcześniak, 2006)

In the limited diagram, testing involves finding a large number of cases supporting the theory as compared to the number of cases that were used to construct hypothesis. Then it must be considered whether the hypothesis is not a mere historic generalization or a detailed sentence.

One needs to remember that the discussed phenomena might be strengthened by the researcher's epistemological bias or by making the research excessively theoretical. Moreover, each sentence might be interpreted in various ways. On the basic level of research, the epistemological approach reveals itself as a general approach towards economic phenomena, or towards the type and force of active factors and the probability of their occurrence. A broader issue pertaining to the subject of research is also important in studying supply chains. This issue pertains to all of the management studies and economic studies and it depends on a wide acceptance of an assumption of the normal distribution.

4. A hypothetical model

One of the aims of this article is to formulate a descriptive hypothetical model of contemporary supply chains in consumer goods branches. It was assumed that the three major factors that influence contemporary supply chains include the oligopolistic nature of the market, price pressure and the phenomenon of domination within supply chains. It is recommended to use an explanatory diagram, especially the abduction, to discuss these phenomena. Such an attempt was made in this article. Numerous factors and their variability make it impossible to use more precise manners of explanation in the research into supply chains. The above discussion has resulted in creating a hypothesis regarding the increasing levels of competition amongst supply chains and within supply chains in the future.



l – keeping the limit price,
 d – suppliers look for ways of cutting the costs and prices, exerting pressure on sub-vendors,
 m – controlling the demand by the brand and marketing,
 n – low prices for the end consumers,
 g – the threat of social ostracism,
 e – actions taken in line with CSR prevent boycotting by end recipients

Figure 4. Hypothetical model of the abductive manner of thinking
 Source: (author's own)

Assuming the abductive manner of thinking, one might build a hypothetical model, as in figure 4. Let us consider the following hypotheses:

H1. Domination over the suppliers allows limit pricing.

H2. Suppliers keep low prices thanks to cooperating with environmental unfriendly subsuppliers.

H3. Price competition lowers prices and supports limit pricing.

H4. Low retail prices and CSR prevent effective social criticism (exploiting suppliers and subsuppliers).

H5. H1, H2, H3, H4 set a trap which is difficult to free from. The attempts to raise prices may end up with a disaster for the company.

The dominating chains act primarily in the environment of oligopoly. On one hand, they fiercely compete with each other, and on the other, they adopt the limit price policy and keep the margins on a low level (the contestable market). Thus they:

- prevent entrances,
- intimidate substitutes,
- obtain satisfactory margins (Ciesielski, 2014, p. 4).

Domination over suppliers is the best way to create barriers against entering the branch of retail trade. (*Quasi* margins are not only charged upon suppliers, they are also created by freezing the pay on a very low level). With prices on the level of limit price and with domination over suppliers, this is the supplier who has to cope with the results of the dependencies described in the model above. The results include low prices and disadvantageous conditions of cooperation.

5. The usability of theory

In this part of the article, the question of practical usability of theory is discussed. A question arises whether the achievements of the research on supply chains allows

the use of the notion of cognitive schema which is an integrated network of knowledge, beliefs and expectations pertaining to a particular format or aspect of reality (Maruszewski, 2011). Managers, advisors and academics give various meanings to various notions and even use various sets of notions. There are various opinions (e.g. process reengineering is useful in any conditions VS the BPR concept mainly causes losses). Each of the participants of management process must construct cognitive schemes pertaining to all the elements of the process which is being managed (e.g. we have to have substantial stocks as this guarantees short time of delivery VS we can minimize stocks and still keep delivery times very short). In other words, a cognitive scheme is a network structure involving certain activity. The scheme contains mutually connected principles of operation, for instance the principles of competition. According to its assumptions, the theory of cognitive schemes refers to management. In the article regarding management as a whole Krzakiewicz (2012) mentions mental models (schemes) which give direction to managers' activities.

The concept of management is in its principle a good cognitive scheme. It may either merely point to the need and profits of looking at other companies (Benchmarking) or be based upon one opinion, e.g. the make or buy decisions are of vital importance for the company's competitiveness, thus they need to be made following a deep analysis and their effects need to be continually monitored (Outsourcing). Such concepts must be evaluated positively when:

- they offer cognitive schemes which are in line with reality,
- they ensure a better choice of topics and information and a better interpretation,
- they are fashion independent.

It must be clearly stated that the intensive development of supply chain studies and improving the methods of supply chain management has already lead to formulating numerous recommendations and proposals of varied scopes – from the logistic system of a single company to global supply chains. The concept which is being developed in companies and networks of organizations pertains to real events and depends on the current fashion to a relatively small degree. The concept of supply chain management transforms into cognitive schemes which involve all the key questions. Normative knowledge on supply chain management used to be reflected in the approach to these networks. The researchers stressed the need to assume a system approach along with process and network approach. The strategic role of supply chain management used to be underlined. Instructions how to build relation within the networks were prepared. Rapid development to knowledge justifies defining it as a concept and cognitive scheme. The concept of supply chain management has two distinctive features which make it stand out in the area of normative knowledge of management:

- it largely uses the values contained in such concepts as Lean Management,
- it employs management methods, such as SCOR, in the developing normative knowledge.

The latter feature especially favors the formation of better practice.

Conclusions

This paper generally indicates the need to improve the methodological order in the studies on supply chains. More specifically, this pertains to the need to intensify the efforts to further systematize research problems in the area of studies under discussion. The same must be applied to arranging the theoretical bases. The third proposal is of no lesser importance, i.e. the methodological issues must not be avoided in the research into supply chains.

Although the above studies have been carried out for a relatively short time, the knowledge acquired is so vast and varied that it is possible to develop it further via refuting, i.e. putting forward, defending and rejecting theses. Constructing models and refuting arguments constitutes a potential driving force of development of supply chain studies. Just to start with, bold hypotheses should be formed and hypothetical models for the most important phenomena regarding supply chains should be constructed.

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Corresponding author

Marek Ciesielski can be contacted at: marek.ciesielski@ue.poznan.pl