

## HOLISTIC SYSTEM THINKING IN SUPPLY CHAIN MANAGEMENT - 3PL (MEANINGFUL SOLUTION WITH HALF OF RESOURCES)

HOLMAN David, LENORT Radim, WICHER Pavel, STAŠ David, FAMIN Dzmitry

*ŠKODA AUTO University, Mladá Boleslav, Czech Republic, EU, [david.holman@savs.cz](mailto:david.holman@savs.cz), [radim.lenort@savs.cz](mailto:radim.lenort@savs.cz), [pavel.wicher@savs.cz](mailto:pavel.wicher@savs.cz), [david.stas@savs.cz](mailto:david.stas@savs.cz), [fomin1991@gmail.com](mailto:fomin1991@gmail.com)*

### Abstract

What is the purpose of actual SCM concepts such as LARG SCM, SCM 2.0, Supply Chain Becomes Demand Chain? Is it maximising profit, quality, lead time, market share? All these maxims are supported by reductionistic way of system thinking, which declares that the whole is just sum of its parts and the best way which could be done is maximising the output of particular parts. Holistic way of system thinking declares, that this assumption is the same mistake as to lean the ladder against the wrong wall. Or in other words there is wrong assumption that disassembling the best possible components from best possible cars must bring together the best possible components able to create the best possible car. But it is nonsense. The car is not sum of its parts, same as businesses or supply chains. Reductionism way of thinking is responsible for the situation that maximal output of individual parts of any system leads to maximally average output of the whole system. Holistic system thinking organisation is customer-oriented so the purpose of its supply chains is maximal customer satisfaction, which derives the optimal output of its parts and its interactions. Customer-oriented solution consumes around 50% less resources than the reductionism system thinking maximising the output of particular parts.

**Keywords:** SCM, System Thinking, Holism, 3PL

### 1. INTRODUCTION

System thinking and system theory are currently used in a wide variety of subjects in fields such as computing, engineering, information science, health, manufacturing, management, sustainable development and the environment. However, the whole potential of systems thinking has not been fully extracted yet, especially in the understanding of the essential properties of the systems, wholes, located outside the system, for optimal (not more, not less) output of particular parts and their interactions. The theoretical and practical world have not yet applied the research of essential properties of the wholeness. Social system properties are derived from the upper system which is the researched social system a part of. The essential property of the upper system, society and environment need to be defined, researched and these properties should derive why and how the researched social system should be proceeded to get optimal quantitatively and qualitatively output.

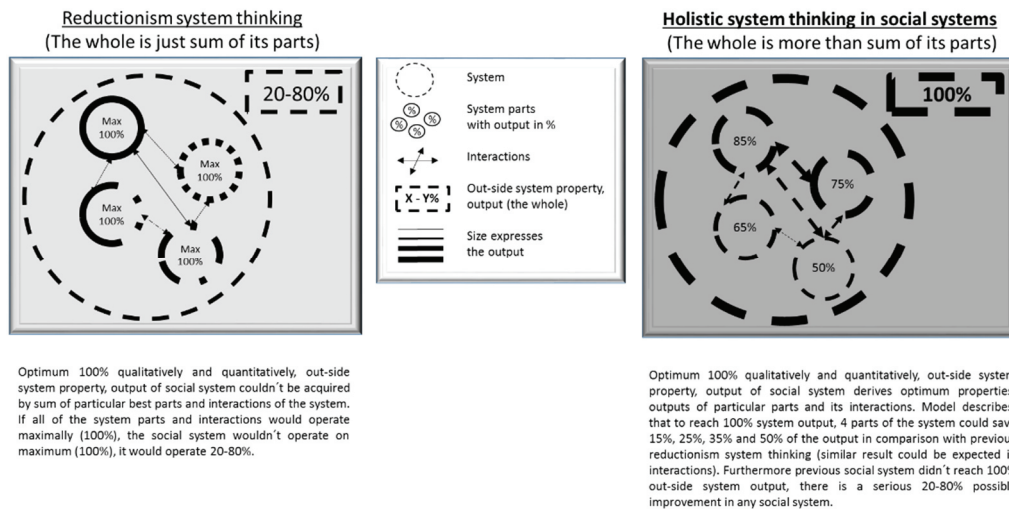
Supply chain management interconnects potential customers, creating the final orders, with producers, suppliers, logistics services providers transforming the orders into deliveries of either semi-finished goods and services between particular chains or final goods and services to the final customers. Reductionistic system thinking and holistic system thinking creates different attitudes into the transformation. Logistics services providers (3PL) assure interconnections - logistics value added processes between production chains - production value added processes (suppliers, producers, etc.). One of the system definitions describes the interactions as a key assumption to reach superior system properties, which makes difference between reductionism and holism. Holistic approach, analysis and synthesis, to the logistics value added process is responsible for developing meaning full solution with half of the resources in the supply chain management. The goal of the paper is to prove the evidence of holistic solution in the logistics value added process on the example of world-wide 3PL logistics services provider.

## 2. LITERATURE REVIEW

Systems thinking is one of the core methodological approaches to SCM research. Activities in organizations are best understood and developed when seen as an interaction of various subsystems and processes constituting a whole [1]. It has been explicitly expressed by Christopher, one of the leading scientists in the branch of SCM in general. After almost 30 years of SCM concept development, he suggests a new direction of the concept, replacing the term supply chain management by demand chain management. Self-centred orientation of businesses and academic research should be replaced by customer-centred orientation, properties derived outside the system. Outside orientation has been seen only in the marketing departments so far and should be rolled out systematically to the whole supply chain [2]. Particularly mentioned by Ackoff's: Systems thinking definition - the essential properties of the system are properties which none of its parts have, the essential properties are derived outside the system and could be seen only in the containing system [3], and Bertalanffy: System thinking is recognized as the general science of wholeness [4]. Interactions between the parts creating the whole systems are the corner stone of the systemic thinking used in social sciences, which understands synthesis as tool to create the whole after taking the system apart by analysis [5]. Ackoff proposed an altered definitions of the system, which are used in methodological part describing system thinking [6]. Such an understanding of the synthesis and ability to understand is critical but has not been applied in the social system yet. The first indication of the environmental full system thinking attitude could be seen in practical use in companies like Toyota or Apple, but has not yet been recognized by academics to create coherent system thinking methodology in social systems. The development of systems thinking or science in general could be summarized by leading system theorist Lazslo "In the history of European science atomistic and holistic thinking have alternated; the early scientific thinking was holistic but speculative the modern scientific temper reacted by being empirical but atomistic. We witness today another shift in ways of thinking, the shift to rigorous yet holistic theories, which means thinking in terms of facts and events in the context of wholes. It is the way of organizing or reorganizing our knowledge in terms of systems, systemic properties and intersystem relationships" [7].

## 3. DESIGNED METHODOLOGY

**Reductionism system thinking - RST** contains analysis as the main tool to learn how any system works. Analysis has 3 steps. The first is taking system apart. The second is understanding the parts taken separately. And the third is to aggregate understanding of the parts to understand the whole system. Furthermore, RST defines the whole as the sum of its parts (see **Figure 1**). **Holistic system thinking - HST** completed the intellectual level of understanding by synthesis. Synthesis includes 3 steps. The first one is identification of the superior system, where is researched system working. The second is understanding of the superior system, which is the researched system the part of. And the third is identification the role or the function performed in the upper system. Fundamental difference in understanding of reality is holistic definition of the whole. HST define the whole as something more than some of its parts (See **Figure 1**). The more represents the purpose, quality which is the researched system performing in superior system. The car is mechanical system. 3 steps of analysis disassemble the car to the components, understands the how the components work separately and aggregate the understanding of the components to the whole system. Synthesis identify the upper system - the society using the car. Understands the superior system - the society using the car. Identify the role of the car in the society - the purpose of the car, it could take anybody from point A to point B, it contains left-side driving or right-side driving, how many persons usually utilized the car etc. Based on the purpose of any system there could be defined the reasonable performance of its parts and interaction contrary to current situation, which leads very often to overutilization of resources due to maximizing of performance of particular parts. HST contribution is visible on the technical system such as the car. It is understandable that the best possible parts couldn't create the car moving from point A to point B. Despite of, most of the supply chains are managed by RST to maximized performance of its parts rather than the performance of the whole system. Sociological system such as supply chain doesn't have so visible purpose as the technical system, the car.



**Figure 1** RST and HST contribution to the output of the whole system

**Figure 1** explains the significance of the purpose of any system declaring that system is more than sum of its parts. It is absolutely critical to define the purpose of any system first. Afterwards, derived the performance of all parts and interactions of the system from the purpose. This sequence is contrary to the actual status, which prioritize the RST logic, trying to maximize output of parts and interactions first. Furthermore, without understanding how the improved performance of the parts influenced to the purpose, the output of the whole system. The paper case study would apply three steps to understand and verify the advantages of HST attitude.

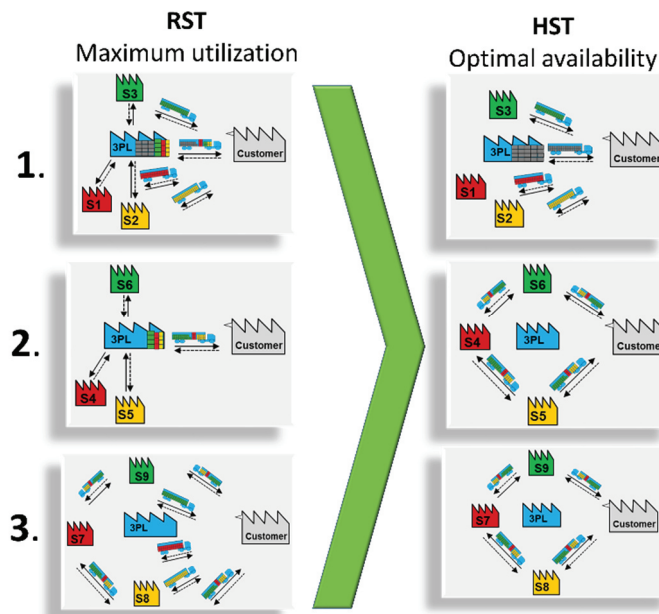
1. Actual status, RST attitude - identification of actual output of particular parts and their interactions and superior, outside system properties of the researched system, if any.
2. Optimal status, HST attitude - identification of superior, outside system properties of the researched system and deriving of optimal output of particular parts and their interactions.
3. Implementation of new superior properties, purposes to the original system with its parts and interactions and comparing the output of its parts in transition from RST > HST.

#### 4. CASE STUDY

3PL provides to its customers logistics value added - time dependent availability of resources. A reductionistic, current, system view RST understood the whole as the sum of its parts, therefore reaching the best possible whole (total costs) requires enhancing the performance of the individual parts. HST states that the whole is more than just the sum of its parts. This higher property, purpose, then derives optimal performance of individual parts and their interactions. If the purpose of the 3PL system is the optimal availability of resources, its achievement cannot be ensured by the maximum utilization of the individual parts as it has been so far. Optimal availability is determined by the 3PL customer. Customer defines its logistic value - time, place, quantity, quality, and 3PL should be able to provide such value at a reasonable price. 3PL logistics services provider, described in case study, is world - wide logistics services provider which organizes the flow of roughly 50 000 pallets/months for customers from different industrial branches. The flow is organized with the network of cross-docking centres (XD) and MilkRun (MR) or Full Truck Load (FTL) deliveries. 3PL is localized in the Czech Republic, serves to about 10 customers from roughly 100 suppliers. To ensure the flow it organises more than 100 transportations a day and uses about 4 000 sqm of cross docking premises. Actual status of 3PL logistics value added activities could be summarized by RST principle. The purpose of 3PL system is delivering the logistics value added with minimum unit cost. It understands the 3PL logistics value delivery

system as the sum of its part. The optimal output of such understood system is obtained by minimum unit costs at transportation (MilkRun - MR, Full Truck Load - FTL) and cross-docking services.

The case study contains 3 examples of RST practical application in 3PL logistics value added services (See **Figure 2**).



**Figure 2** Transition from RST to HST in 3PL System

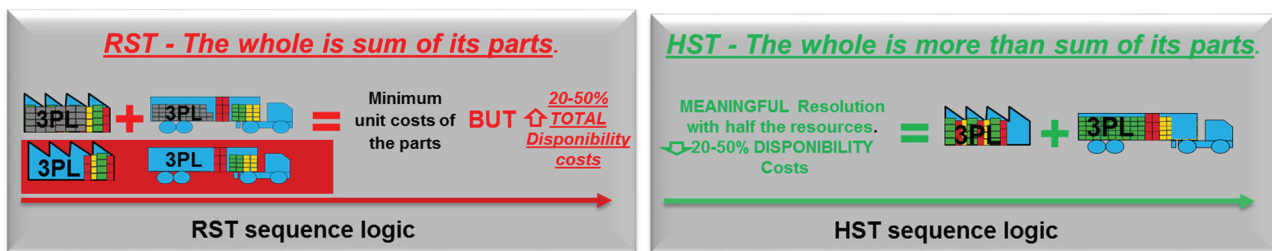
**Example number 1** describes the first kind of overutilization of actual 3PL resources. The purpose of actual 3PL system is the maximal utilization resulting to minimum unit costs. 3PL customers are delivering its products by Full Truck Load Deliveries (FTL) directly from supplier to customer. In case of disturbances, production changes etc. there is possibility to react flexibly due to 3PL Cross-docking centres, followed by distribution to the final customer. The other reason for overutilization of cross-docking centres and its inbound and outbound transportation is 3PL motivation to maximize utilization of its sources. Application of HST principle requires re-design of current attitude. Customer is willing to pay for availability of its deliveries, not the maximal utilization of 3PL sources. HST solution consider the customer needs rather than performance of particular sources. Instead of combination of its deliveries HST applies the meaningful solution such as regular time-table, stable deliveries by FTLs as proposed. Redesign of the 3PL system requires close integration, pull principle, management of processes and logistics value added understanding as well. (See **Figure 2**)

**Example number 2** describes transition from 3PL cross-docking, inbound and outbound deliveries to MilkRun deliveries between suppliers to the final customers. Actual RST status results mainly from particular improvements of 3PL parts. The synthetised holistic approach shows the over utilization of resources. TPS defines over production as the mother of all waste. Over utilization of 3PL resources creates a huge potential for improving of 3PL performance. Especially in reduction of distances, useless manipulation in cross-dock, improved utilization of trucks etc. Cross-docking centres add logistics value in case of small volume deliveries. Optimal availability of resources point of view clearly shows that it is nonsense to over-utilized cross-dock centres with higher volumes. HST solution enhances the performance of the system as the whole, not only particular parts creating total costs less competitive (See **Figure 2**).

**Example number 3** shows the overutilization FTL deliveries. Based on analysis of available 3PL data, there is a serious rate of situations, where possible regular MR deliveries are complemented by FTL deliveries. Furthermore, FTL deliveries created more than 50% of total monthly flow. HST strives for optimal availability

of resources. Resource is not only full container with components but even empty container necessary for production of new components. The reverse flow of empty containers consumes the same cost as the flow of full container. Nevertheless, the flow of empties is underestimated in all parts of supply chains very often, which increases the total costs without direct influence to unit costs. Strong integration of all subjects within the supply chain with the attitude of HST is the key to reach a significant change in effectiveness of the whole supply chain. MilkRun deliveries are more demanding for integration and cooperation between particular subjects in the supply chain. It requires strict, regular timetables, 1:1 full empty exchange rate and regular routes. The serious advantages of MilkRun deliveries in cost, quality, flexibility are demonstrated in Toyota (Toyota Production System) [8], where the evolution of former deliveries of milk in England was developed and extensively applied.

The serious impact of over utilized 3PL resources to the total cost demonstrates **Figure 3**. Important is basic logic of the figure. RST relies on the faith that particular reduction of unit costs results in minimal total costs. This assumption is wrong, because based on system thinking theory, it is evident that the whole system is more than some of its parts. The HST introduces the new and contrary logic. Management of any system should start from definition of the holistic purpose, which is critical for derivation of output of particular parts. Holistic purpose, for which is customer willing to pay is optimal availability of resources. This concrete purpose could be assured by far less resources actually consumed by 3PL.



**Figure 3** RST > HST transition effect to the 3PL costs

Researched 3PL system verifies this evidence. The over utilization of resources coming out from maximal utilization of resources leads to the minimum unit cost. Nevertheless, it doesn't say anything about total cost and the faith of RST principle is not enough. The total costs contain not only the sum of unit costs but even the overutilization of 3PL resources, which is theoretically estimated from 20-50%.

**Table 1** Estimated savings due to holistic system thinking (HST) in 3PL system

	TOTAL VOLUME pallets				EFFICIENCY (utilization, manipulation and distance)	EFFECTIVENESS (utilization, manipulation and distance)
	TOTAL	CROSS	FTL	MILK RUN		
3PL RST - Reductionistic System Thinking	50166	4 535	25 013	20 618	-1%	X
3PL HST - Holistic System Thinking	50166	3 429	24 086	22 651	X	-27%

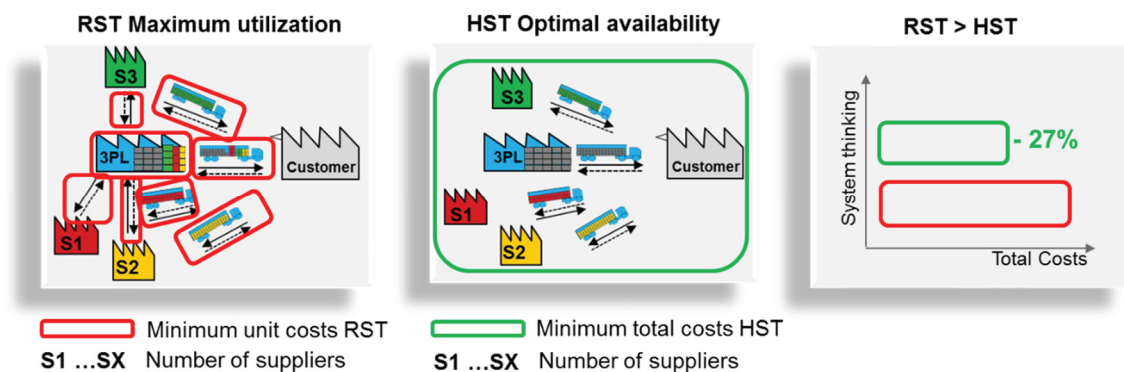
Available data from a few months of deliveries enable to estimate the importance of overutilization of resources. Almost 30% of costs related to 50 000 pallets a month flow in 3PL logistics value added system could be saved due to meaningful solution. Meaningful solution coming out from HST point of view, which could easily show the negative effect of over utilization of available resources to maximize unit costs (very often motivated by short-term KPI of executive management). Important aspect of the performance enhance is distinction between efficiency (RST) and effectiveness (HST). The huge gap between the results (1% vs



27%) declares the importance of distinction stated by Peter Drucker, that there is a big difference between doing things right (efficiency) and doing the right things (effectiveness) [9].

## 5. CONCLUSION

Holistic system thinking (HST) is focused on the effectiveness of any system, currently 3PL logistics services provider connecting suppliers and customers in supply chain management. HST replace reductionistic system thinking (RST) focusing on efficiency of the supply chain management system. HST synthesized the purpose of the SCM system - optimal availability - and uses this purpose to define the optimal output of particular parts and interactions (See **Figure 4**).



**Figure 4** RST > HST (doing things right > doing the right things)

Optimal availability consumes optimal amount of resources of particular parts rather than maximal utilization of the parts consuming 20 - 50% more total resources to obtain minimum unit costs. HST could improve the output of 3PL by 27 %, instead of just partial optimization reached by RST 1%. Meaningful HLS solution enhance competitiveness of 3PL system.

## ACKNOWLEDGEMENTS

***This work was supported by Internal Grant Agency of SKODA AUTO University No. SGS/2015/02 and ERASMUS+ project Green Solutions for Business and Industry No. 2014-1-CZ01-KA203-002096***

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