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## Knowledge Sharing among Supply Chain Members: the Benefits for Circularity

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### Abstract

*In the article, the circular economy is elaborated from the reverse flows perspective, as these flows are the essence of the circular economy. The link between these two areas is straightforward as both focus on transition from linear to circular business environment. To make reverse logistics effective, companies need more than (just) the refinement of reuse/repair/recycle activities, but a more thorough redesign of the production system including product design and the whole business model redefinition is often necessary. In particular, the analysis uncovers managerial characteristics typical for companies that include their first-tier supply chain members in their knowledge ecosystem.*

*The paper utilises the data collected in structured interviews among representatives of companies operating of the Czech market. The interviews covered multiple topics ranging from general management issues to circularity-specific areas such as general business views and motivation, and diverse aspects of management system. For this exploratory research aim, the inferential statistics were employed: besides frequencies, the Mann-Whitney tests and bivariate correlations were calculated for scales and dichotomies variables.*

*The analysis revealed managerial attitudes and practices, which are related to the intensity of knowledge sharing with the business partners; with the first-tier supply chain members. In other words, based on the perceived level of knowledge diffusion across a company, its customers, and suppliers, we identified typical features of management systems in companies that put effort into boosting their knowledge ecosystem.*

*First, these companies are more integrated (internally and externally). The multiple indicators suggest that companies boosting the knowledge diffusion in the supply chain also take slightly different actions in tactical and operational level as expressed by planning activities. The ambitions for circularity (as expressed by the motivation for reverse logistics) are not so much solely focussed on marketing motives such as customers loyalty, satisfaction, or image, but their aim is more shifted towards value creation (out of reverse flows) and (environmental) legislation compliance. These companies often believe that reverse flows are useful/necessary to deal with, which is not always the case in companies in general.*

*Finally, the statistic calculations identified that knowledge sharing has no apparent link to company size, manufacturing/service affiliation, but it is more intensive in companies that are closer to end customers, i.e. in downstream supply chain members.*

*The findings of exploratory nature provide insight into relationships and mechanisms in companies that share their circular economy related knowledge with their suppliers and*

*direct customers. Based on perceived company performance, it provides support for the economic rationality of knowledge sharing in the area of reverse flows.*

**Keywords** – circular economy, reverse flows, knowledge sharing in the supply chain, empirical research, secondary data

**Paper type** – Academic Research Paper

## 1 Introduction

The transition from linear to circular economy is a complex task requiring a redefinition of business models as well as theoretical concepts and frameworks. The area of logistics belongs to the core of domains that are affected by the transition; however, the theoretical interconnection between the circular economy and (much more elaborated concept of) SCM has not been well developed (Homrich et al., 2017).

The paper put stress on one particular area in circularity - on reverse flows and their logistics and management. As the concept of reverse logistics is older than the circular economy initiative, it is natural that the circular economy is not among factors identified as a driver for reverse logistics in the published research papers. Nevertheless, reverse logistics is accepted as an essential tool, as an environmental initiative, that may close the material loop in supply chains (Govindan and Bouzon, 2018) and in this way it is essential for the circular economy.

In other words, the paper approaches the circular economy by focusing on reverse flows specifically. Obviously, this is a less complex view; still, the coverage of related issues is wide: besides product design issues aiming to maximize value creation over the product's lifecycle and its after use (Genovese et al., 2017), the problem of multiple parties involvement and governance in establishing closed loop supply chain (Tseng et al., 2017), are just examples. The papers aim is to identify such company's attributes that are related to external knowledge sharing to answer the question of what is typical in companies sharing knowledge with suppliers and customers.

## 2 Data and methods

The paper utilizes the data, which was collected by the department the author is affiliated and which was aimed at the understanding of managerial approaches of Czech companies to improvement initiatives and processes. In this way, the presented analysis belongs to the secondary data research, as it interprets a subset of variables relating to areas specified below.

The original data were collected through personal, structured interviews with the companies' representatives (top and middle management; operations specialists). As the questions asked for the data that companies usually do not measure, collect, and reprocess, the answers are the statements of informants. That was the only source of

information – no financial or any other quantitative data were used. The quick overview of sample structure containing 166 companies is in Tab 1.

Tab 1. Sample structure

Company size:	small	69%
	middle	25%
	large	6%
Industry: services / manufacturing		32 / 67%
ISO 9001/9004 certification		38 %
ISO 14001/ EMAS certification		18%

The questions in the original survey were adopted from papers of de Brito and Dekker, (2003), Jack, Powers, and Skinner (2010), Mollenkopf and Closs (2005), Rogers and Tibben-Lembke (1998).

Methodologically, the paper explores diverse aspects of the company’s management system using statistical tools: the most variables are measured on ordinal level (seven-point scales). Therefore the analytical part relays on Spearman rank correlations and Chi-square tests in a lesser extent. The calculations were done in SPSS v24 and MS Excel 2016.

The main variable, which measured the cooperation of companies with its business partners, was then related to variables reflecting the motivation, barriers, and internal processes. Its distribution is apparent from Fig 1. This variable has no relationship to companies size or companies industry affiliation (measure on manufacturing/service level only).

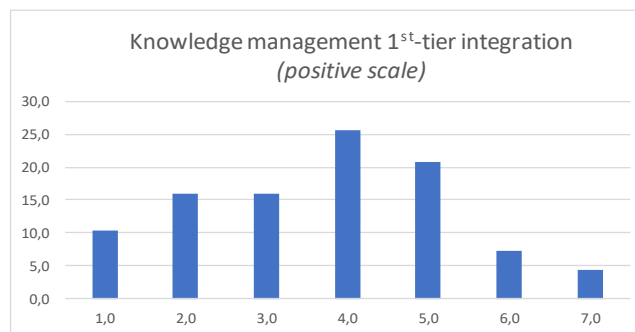


Figure 1: Distribution of Knowledge management 1<sup>st</sup>-tier integration

### 3 Findings

The general view on the strategic role of reverse flows is apparent from Tab 2. The mean values (calculated on positively designed scale 1 - 7) give evidence about a slightly above-average role of reverse flows in terms of usefulness, if we accept 3.5 as cut point. The data about innovativeness in the sphere of reverse flows is more impressive: the mean value of 5.03 and 4.4 suggest that companies are intensively trying to optimize/innovate the reverse flow management.

For companies sharing the knowledge with business partners, the above approaches are even more intensive as suggested by significant correlation with the Role of reverse logistics (first line in Tab 2) and Changes in approach to reverse logistics in the last 5 years (the effectiveness of reverse logistics would fit here too if we accept the 1-sided significance).

Tab 2. The general perception of reverse flows

<b>Variables related to knowledge sharing</b>	<b>Spearman rho</b>	<b>mean</b>
Role of reverse logistics (useless vs. very necessary)	0.227**	3.982
The effectiveness of reverse logistics (causing high losses vs important competitive advantage)	0.131	3.920
Management approach to reverse logistics (conservative vs. innovative)	0.106	5.036
Change in approach to reverse logistics in the last five years (no vs substantial change)	0.237**	4.406

Note: \*\* Correlation is significant at the 0.01 level (2-tailed); \* Correlation is significant at the 0.05 level (2-tailed).

Building on the previous research, we proposed ten business drivers/motives, which might be relevant for companies then thinking about reverse flows. The list of them in Tab 3 is sorted in decreasing way indicating that in general, the main motivation is related to marketing issues and societal aspects such as fulfilling the legislation requirements and conduction of CSR are weaker factors. Speaking about companies sharing the knowledge with the partners, we see some specific relations: in terms of correlation coefficient (and significance), the knowledge sharing is the most closely related to different drivers; it is value retrieval, legislation, and CSR (with some distance). Value retrieval (and CSR to a certain extent, depending on the interpretation of CSR and its real practice), can be interpreted as more circular thinking.

Tab 3. Overview of motivation for reverse flows

<b>Drivers for reverse flows management</b>	<b>Rho</b>	<b>Mean</b>
Customers' satisfaction	0.245**	5.94
Customers' loyalty	0.244**	5.765
Image	0.211**	5.337
Differentiation from competitors	0.186*	4.789
Cost reduction	0.285**	4.735
Productivity increase	0.193*	4.582
Differentiation from competitors	0.276**	4.277
Value retrieval	0.386**	4.021
Legislation	0.365**	3.909
Corporate social responsibility	0.292**	3.581

Note: \*\* Correlation is significant at the 0.01 level (2-tailed); \* Correlation is significant at the 0.05 level (2-tailed).

Further analysis focused on sources of innovation for companies – both product and process innovations. The internal companies' resources (R and D departments, marketing,

quality departments etc.) are the main innovation sources as expressed using several scale questions. One interpretation of the specifics in companies sharing the knowledge is that slightly more attention is also given for fewer importance sources like unaccepted warranty returns, unsold product quantities, unsystematic complaint collection. In this way the approach of these companies is more diversified – they probably try to learn from any available data, not just relying on internal professionals.

Finally, the internal management system was tested for a relationship to external knowledge sharing. In the case of dichotomous variables, the Mann-Whitney test was applied.

Tab 4. Sources of innovation for companies

Innovations sources	Rho	mean
internal corporate resources	0.062	4.64
customers	0.152	4.22
competitors	0.167*	3.52
suppliers	0.181*	2.87
returned warranty product - accepted	0.147	3.40
returned warranty product - unaccepted/refused	0.202**	2.29
customers complaint collected systematically	0.151	3.69
customer complaints collected by employees unsystematically	0.205**	3.51
other unsystematic resources, (e.g.) customer online reviews	0.098	2.76
quantities of unsold products	0.272**	2.96
waste	0.188*	2.32

Note: \*\* Correlation is significant at the 0.01 level (2-tailed); \* Correlation is significant at the 0.05 level (2-tailed).

One block of question on reverse flow planning is summarized in Tab 5 – each line shows the presence of the topic (reverse flows) in a particular planning level (the column “yes”). The most typical level dealing with reverse flows is the operational, followed by strategic plans. The relationship to knowledge sharing was found in tactical and operational plans.

Tab 5. Reverse flows planning

Level of planning	Mann-Whitney U	P-value	“yes” in %
Corporate strategy plan	2923.5	0.265	54.9
Functional/departmental strategy plans	2667	0.102	41.7
Tactical plans	2388	0.003	50.9
Operational plans	1928	0.001	68.3
No plan – presence of ad hoc decisions	2517	0.063	41.9

There is no relationship to ICT support for reverse flow, ISO 9001/14001 certification and the existence of a specialized department for reverse flows (Tab 6).

Tab 6. Diverse management system aspects

Other management system aspects	Mann-Whitney U	P-value	“yes” in %
ICT support for reverse flow	2753	0,075	47.6
ISO 9001 certification	3018	0,574	62.0
ISO 1004 certification	2045	0,945	81.3
Specialized department for reverse flows	2201	0,841	78.7

The cross-functional integration (relating to the process management approach) was divided into five aspects – internal one, the integration for reverse flows processes, integration for customers/suppliers and end-customers, which is relevant if the company is not final product produced, or/and if there are some intermediaries in the distribution.

As it might be expected, all the above integration areas have significant relationships to knowledge sharing, out of which the internal integration is the strongest (both corporate-wide and reverse flows specific). The last line in table 6 suggests that knowledge sharing is more intensive in companies that are closer to its final customers.

Tab 6. Measures of integration

Management system features	Rho	mean
Corporate-wide integration across functions	0.340**	4.2
Cross-functional integration of reverse flows activities	0.291**	3.93
Integration with customers in the area of reverse flows	0.162*	3.91
Integration with suppliers in the area of reverse flows	0.227**	3.54
Direct (directness) relation to end-customers	0.169*	5.51

Note: \*\* Correlation is significant at the 0.01 level (2-tailed); \* Correlation is significant at the 0.05 level (2-tailed).

## 4 Conclusions

The intensity in knowledge sharing with business partners belongs to those attributes that distinguish the companies in terms of their general strategic orientation (their view on reverse flows in particular) and operational settings. As it was documented by many relationships (identified statistically), the knowledge sharing is linked with circularity – the different view on and the approach to reverse flows is documented by specific motivation and more intense tactical and operational planning. The difference was also found in the innovation sources – compared to whole research sample, the companies with intensive knowledge sharing learn more from diverse sources – in relation to circularity, the reverse flow (refused warranty products) as a source for innovation process is of relevance. The link to integration was confirmed too, even though, this finding was expected. To the contrary, no links were documented in the data in terms of ISO certification.

The study faces several limitations that need to be considered when assessing the validity of the findings. First, the research sample is rather small. There is also a risk of data distortion as a single informant approach was chosen (for a practical reason). As

explained in the beginning, the most questions related to the *non-monitored* facts, so the data were personal perceptions only; the interpersonal view, in this case, would be more relevant here.

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