Designing new products from reverse flows – empirical survey

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Abstract

Content of reverse flows and the way of dealing with them in companies can serve as one of the sources for inventions and innovations in new product design. This issue can have manifold reasons - from lean thinking or just simply cost and profit focused approach (e.g. how can we use and prevent waste from the reverse flows?), through Extended Producer Responsibility (legal requirements for product design), Corporate Social Responsibility approach (sustainability for stakeholders based on product design that would not harm anybody and promote sustainability of partners in the case of reverse product flows) to Environmentally Conscious Manufacturing and Product Recovery or green or eco product design. This paper introduces results of preliminary empirical survey focused on the investigation of relationships between different dimensions and measures of new product designing and several reverse flows management issues. The aim of the analysis is to discover some patterns of companies' behavior when the possibility to utilize the content of reverse flows for the new product development exists.

1. INTRODUCTION

In 2010 about 250,000 new products launched global markets (Wong, 2010) and despite the the economic crisis this amount in all likelihood does not fall dramatically if at all. Development of new products requires deployment and utilization of more or less resources and does not make do without spending relevant costs. New product development is the value-added and generally the forward thinking process when especially in tangible products and goods raw materials and parts received from suppliers are joint together based on ready product design, manufactured, usually packed in and distributed to customers. Costs and potential margin concern every activity in this value-added process. Nevertheless this is not always the "end of the story". Still more and more products from distributors and customer flow in reverse directions and reverse flows (RF) – despite the effort to manage quality of inputs and purchasing, manufacturing and distribution processes – emerge before the final product are ready to sell. One of the definitions of RF describes them as… "*those flows on the opposite way from the direct chain, where the disposable products after consumption face the adding of different types of values through the reintegration of their components or materials to the productive and business cycles*." (Gonçalves-Dias et al, 2006, p. 2). For the purpose of presented survey, broader view of RF is needed. RF encompasses also products before consumption (e.g. as the result of quality control) and the concepts "product" and "components" must be approached from their classification of tangibility, durability and the phase of value creation, comprising both industrial and consumer products on the continuum "tangible products to the intangible services" (Shostack, 1977).

For many companies RF stand for problems (Trebilcock, 2001). But RF can be understood not only negatively. As still many managers discover, RF can be apprehended as the source of value (Mollenkopf et Closs, 2005). RF have very meaningful information value (Ketzenberg et al, 2006).

This paper deals with the results of exploratory empirical survey dealing with the following research questions: **Do companies use RF for the new product design (NPD) and development? If yes, which types of RF do companies utilize for the NPD? Are there any differences and associations when analyzing the linkage between sources of information for NPD and the perception of product innovation importance, planning RF, reasons for RF management involvement and the drivers of RF management?** Existing body of empirical knowledge that would offer sufficient view and understanding of current practice is scarce and fragmented. This explored issue has strong complex and multifaceted character and insight and understanding of every small piece enables to capture many linkages of management of the new product design and development and backward processes.

2. BACKGROUND AND LITERATURE REVIEW

There are many reasons why RF emerge a lot of common points are grounded in the process of new product development and design. Among all for instance quality, product functions, character and functionality, customers demand patterns, competitors innovation effort, product life cycle, product design itself, technological innovations, legislation or governments' policies can be mentioned. Reverse flows´ value lies in their both tangible and intangible forms. They can serve as the source of manifold information (intangible reverse

flows) not only for product design but for companies´ and supply chain members' processes design and processes innovation as well (Jayramanet Luo, 2007).

With RF in the case of NPD and development environmental sustainability theme dominates, this is why concepts like Extended product or producer responsibility, green product or design, ecoproduct design (Pujari et al, 2003) or Environmentally Conscious Manufacturing and Product Recovery (Gungor et Gupta, 1999), closed-looped product life management (Jun et al, 2004) or lean manufacturing (Yang et al, 2011), life cycle assessment (Stock, 1998) enrich the vocabularies of academics and managers. Here the interest concentrates around waste minimisation and/or prevention, recycling, and remanufacturing following the objectives of complying with legislation (Gehin et al, 2008), meeting the requirements of customers or other stakeholders, improvement of image with being socially responsible and to reduce resources consumption and costs and so to gain potential profit (Jayraman et Luo, 2007). But RF serve as carrier of information for the improvements of the properties and performance of products (Bergfors et Larsson, 2009), i.e. major or minor product changes or as the idea generation or invention stimuli for partially or totally new product (Tibben-Lembke, 2002).

The development of new products is for majority of companies the necessity for sustainable success, competitiveness, survival, engine for growth (Brown et Eisenhardt, 1995*;* Stremersch et Tellis, 2004). This proces is risky, costly and demanding on management (Hernández-Espallardo et Delgado-Ballester, 2009). Thus both RF management and NPD and development should be a part of company policy (or represent special policies) (Carter et Ellram, 1998) and part of company strategy (or special strategies) and plans (Mollenkopf et al, 2007, Lambert et al, 2011).

3. DATA AND METHODS

To obtain answers to the stated research questions primary data gained from the standardised questionnaires were analysed. The size of the sample was 168 companies doing business in the Czech Republic. The questions were answered during the winter months 2012 and 2013 by top, middle and low-level managers through personal interviews. For the purpose of presented paper we selected only several questions from all 27 pieces involved in questionnaire. This analysis is the part of the longitudinal research which purpose is to explore RF management in more complex picture.

Chosen questions were focused on types of RF as the sources of information for NPD (reclamations, complaints, unused materials and unsold products and waste), planning of RF, and perception of product innovation importance for company sustainable existence and on drivers and reasons of RF management. Planning RF was measured and analysed with the help of two new variables after recoding variables used in the questionnaire – the new variables are: a) the quality of planning (scale variable where 1 means planning of RF on corporate strategic level, 2 on functional strategic level, 3 on tactical level, 4 on operational level and 5 stands for ad hoc management without planning) and b) binary variable – planning RF and not planning at all. The perception of product innovation importance was measured wit 5-point scale (1 – product innovation is vital for the existence, 5 – product innovation is of peripheral importance). For discovering driving forces and reasons for interest respondents were asked to indicate drivers from the list introduced in the questionnaire. Respondents were allowed to tick as many drivers and reasons as needed.

Research questions introduced in the Introduction led to the following hypotheses:

H: There are statistically significant differences and associations concerning types of information sources for NPD stemming from RF and

Ha: driving forces and reasons of interest for RF management;
Hb: planning and quality of planning of RF;
Hc: product innovation importance perception of managers.

For the hypothesis verification frequencies and relative frequencies were calculated and contingency tables, χ^2, Spearman Rank Order correlation test and ANOVA were employed. Data were coded and analyzed in SPSS v.18.

4. EMPIRICAL FINDINGS

Services organizations prevailed in the sample of 168 companies (N=110) with the rest 58 represented by manufacturing companies.Tthe size structure of companies was as: small (N=132), middle (N=18) and large (N=18). The prevalence of service organizations influenced the structure of RF types probably. The most often stated type of RF utilized for NPD is complaint (N= 124), the second rank is hold by reclamation (N=107) followed by waste (N=48) and the least mentioned is unused material or unsold product (N=18).

Driving forces and reasons of interest for RF management

Table 1 presents results of chi-square test comparing groups of companies that do and do not use some concrete type of RF as the source of information for NPD from the point of view of stated drivers and reasons of interest to manage RF. The presumption for this analysis is the expectation that there are some differences in the practice of companies. The results are as following:

Those companies that use waste as the information souce for NPD introduced more often as the drivers and reasons for interest to manage RF:

- unsoldable products
- product defects and low quality of product
- possibility to decrease costs
- potential of value retrieval from RF.

Companies, which utilise complaints as the information source for NPD mentioned more often as the drivers and reasons for interest to manage RF:

- goodwill protection
- product defects and low quality of product
- potential of value retrieval from RF
- customer care policy
- environmental protection policy

but much less Corporate Social Responsibility.

Respondents who claimed reclamations as the the information source for NPD assigned more often as a driver or reason of interest to manage RF:

- product defects and low quality of product
- customer interest or pressure
- legislation (not significant)

but as in the case of complaints much less Corporate Social Responsibility.

And finally companies that obtain information from unsold products or unused materials introduce more often:

- product defects and low quality of product

- supplier pressure or interest.

Table 1 RF management drivers and reasons of interest related to the utilisation of reverse flows as source of information for NPD

Drivers and reasons	Reverse flows type	no	N	yes	N	χ^2	Sign.(2-sided)
Unsoldable products	waste	10%	12	25%	12	*6,300*	*0,012**
Goodwill protection	complaints	45,5%	20	65,9%	81	*5,642*	*0,018**
Product defects/low quality	waste	51,7%	62	68,8%	33	4,072	0,044*
	reclamations	39,3%	24	66,4%	71	11,536	0,001*
	complaints	38,6%	17	62,9%	78	7,783	0,005*
	unused materials/unsold products	53,3%	80	83,3%	15	5,887	0,015*
Costs decrease	waste	61,5%	16	83,7%	77	5,960	0,015*
Value retrieval	waste	72,9%	62	93,9%	31	6,277	0,012*
	complaints						
Legislation	reclamations	14,8%	9	27,1%	29	3,385	0,066
Supplier interest/pressure	unused materials/unsold products	38,1%	40	75,0%	6	4,195	0,041*
Customer interest/pressure	reclamations	63,9%	23	80,9%	72	4,066	0,044*
Customer care policy	complaints	40,9%	18	63,7%	79	6,919	0,009*
Environmental protection policy	complaints	15,9%	7	32,3%	40	4,308	0,038*
Corporate Social Responsibility	reclamations	***60,6%***	***20***	***36,4%***	***24***	***5,236***	***0,022****
	complaints	**64,0%**	**16**	**37,8%**	**28**	**5,180**	**0,023***

Notice: *- statistically significant at the 95% level; degree of freedom for all tests = 1

Planning and quality of planning RF

Waste as the only one information source for NPD shows statistically significant association with both quality level of planning (Spearman´s rho = - 0153, Sig. -2-sided = 0,050, N=164 and ANOVA result: F = 4,236, p = 0,041) where those companies that use this source plan on higher qualitative level (Mean = 2,34) and Mean for those that do not use it is 2,90 and when considering planning as such (χ^2 = 4,945, Sig -2-sided = 0,026). χ^2 squarre analysis revealed that 90,5% companies that use waste as information source for NPD incorporate RF into some level of plans in comparison to those 63,4% that use it as information source but do not plan RF at all.

Product innovation importance perception of managers

Perception of product innovation importance for company survival is significantly associated to two types of RF – reclamations and complaints. ANOVA result for reclamation (F=6,906, p = 0,009) and Spearman´s rho = - 0,201, Sig.-2-sided = 0,006 confirms that there is difference in Means expressing the level of product innovation importance between group of companies that use reclamations as the information source for NPD (Mean = 2,42) and group of those that do not use this source (Mean = 2,90) (F= 6,906, p = 0,009). The same we can conclude with the use of complaints as the informations source where the Means are 2,41 for the group using this type of source and 3,14 for those which do not use it (Spearman´s rho = - 0,257, Sig. – 2-sided = 0,001 and for ANOVA F=12,376, p = 0,001).

5. Conclusions, limitations and disscussion

Empirical survey had exploratory character and the results cannot be generalized at all. Survey had several limitations as well, e.g. size of sample, statement of only one respondent from company that can distort the facts, structure of sample – both from the point of view of various sectors and industries with the prevalence of services organizations and from the point of view of various competences and knowledge of respondents concerning the surveyed issue. Other limitations can be related to the small number of types of RF. In reality the questionnaire enables to choose from more options – for instance in the case of waste 6 answers were available. But the size of sample together with the number of given answers did not allow us to analyse responses in the form of quantitative character of survey and to look after some significant association or differences. This restraint can serve as base for further analyses discovering some other areas of exploration.

Nevertheless the findings revealed several domains that are worth of spare a thought of them. Waste seems to be the flow that is linked the most to the internal environment of companies and to the efficiency-driven tasks, problems and maybe challenges as well (if used for the new product design as the inspiration) probably incorporated into plans. According to assumptions reclamations and complaints are more effectiveness-driven and market oriented. Complaints appear as rather rich source of distinct information and companies applying complaints are conscious of many drivers and reasons of interest for being involved in RF management. Both types are related also to the level of perceived importance of product innovation. These findings can be influenced by the share of services organizations that are usually more dependent on customer relationships and customer needs and to adapt and create products according information gathered through this channel.

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