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ESTABLISHMENT OF RESPONSIBLE SUPPLY CHAIN: PROCESSES STANDARDIZATION

It is established the need to implement activities of concept of sustainable development at Ukrainian industrial enterprises, due to their access to external markets, especially the markets of the European Union. This process involves the use of extended responsibility principles in enterprise management, which is aimed at organic combination of economic objectives with good social environment. The increasing of manufacturing enterprise as the leading element of the supply chain is interested in using of extended principles of accountability by all participants in the supply chain, particularly suppliers. It is established the feasibility of standardization process of selecting the suppliers manufacturing enterprise. The suggested criteria of selection allow to identify suppliers that adhere to the principles of partnership cooperation, European standards of environmental and social responsibility in their work, and create the responsible supply chain.

Keywords: concept of sustainable development, expanded responsibility, responsible supply chain standardization, selection of suppliers, survey, sample survey, group evaluation, importance (weight) criteria, ABC analysis.

Problem statement. Most international companies use [8] the principles of stable development conception in their activity which allows them to be competitive in the market where they conduct business. Good examples of implementing the sustainable development principles, requiring major changes from companies doing business in the economic, social and environmental spheres can be such companies as “Unilever”, “Coca-Cola”, “Nestle” [5; 10]. For instance, group GEFCO as a representative of industrial and car logistics, is providing effective logistics decisions for its customers all over the world and conducting its business according to the modern requirements of stable development, being an active member in the responsible supply chain. The company’s “slogan” is: “constant development: strategic duty” [2].

Extended responsibility in recent years affected also the Ukrainian enterprises, which have influenced mainly the need and empowering the release of Ukrainian goods to the European markets [9]. Participating in the OUN Global agreement initiative [11], the largest international platform on the corporative social and ecological responsibility, companies are paying more and more attention to ten universal implementation principles [10] not only on their companies level, but in relations with the supply chain participants, first of all, with suppliers of materials and parts. So it is actualized the interest of industrial enterprises in the development of criteria cooperation with suppliers, establishing requirements for economic, social and ecological direction in the form of relevant documents, codes and selection criteria. An effective way is to standardize the selection of suppliers, development of criteria in order to identify those whose activities meet the principles of enhanced responsibility, provide training of responsible supply chain, facilitate the introduction of monitoring of their activities in the economic, social and environmental spheres, facilitate the implementation of standards and quality standards, environmental products.

In general, it can be argued about the intensive growth of competitiveness ranking factors

designed to achieve high parameters of responsibility towards society and the environment. This is true especially for highly developed economies, where social and environmental consciousness are respectively higher and this is manifested in everyday behavior of its citizens and business entities. Obviously, the demands of society, consumers of this nature would be standardized, be suitable for formal and informal objective assessment because it affects to the result of adoption both strategic and operational decisions, balanced economically, environmentally and socially. It should be noted that this problem multiplied by a balance significantly in terms of the functioning of supply chains (networks), because the efficiency of their functioning influence (more or less) to all the participants, some of whom, including suppliers of materials, components, services, are operating in other supply chains (networks), updates on the latest correlation “differentiation – standardization”. So if you can not standardize a single process, it is always possible to standardize its components – subprocesses. Thus, extending of the concept of responsible supply chain leads its link on other participants in the chain.

The latest research analysis. The problems of implementing the concept of “sustainable development” and the introduction of sustainable (balanced) development into the economic systems has been engaged by domestic and foreign scientists, in particular, O.F. Balatskiy, A.A. Veklich, E.V. Hirusov, B.M. Danylyshyn, G. Daly, D. Meadows, L.G. Melnyk, O.V. Prokopenko, O. Shubravskaya and others that allowed to generalize approaches to the coordination of interests of the present generation with a future [1; 5; 7; 9; 11]. E.V. Khlobystov [11, p. 168-180] by analyzing the association agreement between Ukraine and EU, outlining the main provisions of environmental and economic policies for sustainable development of Ukraine at an angle of long-term goals, changes in the legislative and regulatory framework, economic benefits and environmental security. L.G. Melnyk in [14, p. 266-295] justifies resolving environmental conflicts between generations towards sustainable development through economic instruments, differentiating them into three groups: price for resources, economic benefits allocated payments / benefits. Specification of the concept of sustainable development and research of responsibility in the environmental field also engaged by scholars such as T. Vinnikov, M.V. Hayevska, O.A. Grishnova, M.E. Porter, F. Figger and other. In [11, p. 146-155] S.M. Illyashenko identifies priority areas of sustainable economic development of Ukraine that are environmentally focused, motivate producers and consumers to ekoinnovations. The problems of social responsibility of economic systems covered in the scientific works O.P. Hohuli and I.P. Kudinov, O.M. Golovinov, A.M. Kolot, I. Tsaryk and many others. E.V. Krykavsky [23] has been studied the process of greening the transport segment of the logistics system and grounds the ways of increasing efficiency of the supply chain.

The organization of business in the community (BITC) [24] in 2009 published a manual for companies where three main areas of activity were identified: economic, social and environmental, which characterizing the expanded responsibility. If responsibility means to do business in a way to combine economic objectives for the benefit of society and the environment, then a similar approach can be applied to supply chain management.

The concept of responsible chain of supply is rather new in Ukraine, but European markets approach is encouraging not only our manufacturers, but also other participants of supplies chain to introduce principles of stable development into their activity and establish a responsible chain of supply.

Aims of the article. With the aim of forming a responsible supply chain – to identify the main approaches for attracting by industrial enterprise the supply chain participants on the example of the suppliers selection whose activities are based on the principles of economic,

social and environmental responsibility.

Basic material exposition. In an era of increasing market competition, concentrating at the level of customer services in the implementation of orders and supply elasticity, increases the need to improve the efficiency of logistics processes. Supplying processes, being the most important in supply chain, provide the material flow continuity in the whole supply chain. The whole process of building responsible supply chain depends on how well the supplier provides the manufacturer with ecologically clean materials and raw materials and how much cargo transportation is environmentally friendly.

Introduction to the practice of supply chain management principles of socially responsible business and building partnerships with business partners, allows the company to receive a number of benefits:

- to achieve decreasing of resources consumption and their level of production saving (due to innovative technologies reduce the wastes level and dangerous emissions volume);
- to meet certain requirements on security and environmental protection allowing to avoid some extra production costs like fines paying;
- to involve loyal to the companies policy suppliers (ensures continuity of supply, reduce the costs of storage, ensures the production of environmentally friendly products, allows to reach new commodity markets);
- to enhance company's name due to mutual activity with suppliers in order to solve the problems of social and ecological business conducting;
- to involve suppliers into the new products development;
- to implement an exchange with suppliers, distributors and other partners in sphere of innovation.

Leading world companies have developed and applying different tools that tends to create suppliers need of implementing socially responsible business into their activity. Such instruments should include: supplier's survey, development of social and ecological strategies, codes behavior, treaty provisions, ISO standards, SA8000 standard, etc. [9].

The choice of suppliers, subcontractors or business partners base on many criteria. In most cases they are determined by purchasing policy and procedure. The signed agreements include an essential appendix dealing with cooperation conditions, prices, delivery dates and its quality. Requirements concerning suppliers must be adequate to the SBC principles. The questionnaire itself and developed code of suppliers behavior helps not only with choice of criteria determination but also helps to regulate the cooperation with suppliers as well.

The implementation of responsibility principles into the company's activity needs a certain cost; standardization of sourcing will allows to cut the costs due to responsible chain of supply establishment.

Any processes standardization has also some disadvantages, which consist of employees' creativity and innovativeness limitation, lack of non algorithmic but important elements of use in a certain task, weak motivation in a non standard decisions search, their self-control decreasing. In general, it concerns high-level of standardization causing company's low changeability. Thus, to establish a responsible supply chain it's necessary to find such basic standardization attributes which would allow to get a responsible participant of a supply chain and wouldn't be too strict at the same time. Standardized processes raise changes control and regulation autonomy.

There are five levels of processes standardization [2; 11]: 1) no regulation, it means the process mustn't be regulated and executives have high-level freedom of action (discretion); there's a possibility to differentiate ways of processes implementation; 2) regulation of activities is based on certain principles, adjustable range are small, and the range of actions

sufficiently high tailored to the specific rules of activity; a great opportunity to differentiate the modes of work; 3) activity regulation range – average (contractors must follow the general scheme of the process; the level of activity freedom is average (executives must implement the process within defined general scheme); the average level of differentiation methods of action; 4) detailed alternative regulation; the wide range of activity regulation (executives must keep the detailed scheme of the process; low discretion; small freedom choice of alternative ways of the process implementation according to the scheme; small possibility of differentiation methods of action; 5) strict activity regulation; the freedom of process regulation is possible only according to the developed regulation scheme; there's no possibility of differentiation the ways of processes implementation. Average level of processes regulation will be the most efficient due to the process continuity and constant improvement, which is connected with implementation into practical activity the principles of social and environmental responsibility.

Every standard, developed at an enterprise, must be well-balanced, i.e. must be both strict and flexible. The concept of strictness concerns the procedures; which employees must keep while performing certain tasks. As opposed to strictness, flexibility means possibility of employee's creativity, and not strict keeping to the determined standards. R. ikert emphasized the following types of standards [14]:

- management standards deal with inner goals of employee's control. They are used in staff management. These standards are certain instructions for the staff professional activity, description of the fixed types of work, consumables of performance standards etc.;

- operational standards provide the technical-organizational aspects of logistics processes in a supply chain.

It's quite reasonable to apply standards in such logistic supply processes as customer service level determination, delivery time, production time and response speed to the environmental and demand changes. As a result, very important aspect of analysis here is a certain standard that use an effect on operational result. It should be noticed that standards usage allows to make processes more optimized and rationalized which has better efficiency analysis results in the whole supply chain.

It's important for the processes standardization to be focused on the BPR conception (Business Process Reengineering) [3; 15], that underlines the process significance in an enterprise operations and supply chain. The basis of the process approach is establishment of the process responsibility centers, that requires organization matrix structure when every employee that is involved into the production process is a subject of two managers decision making – functional (e.g. purchasing department) and process. At the process approach the organizational structure efficiency criterion is customer's satisfaction due to the enterprise strategic goals transformation on the subprocesses goals, their achievement time reduction, decision making enhancement and quick response to the environmental changes. The use of network model for modeling the process of supply chain helps to increase its efficiency and find logic and time relations between both separate elements of each subprocess and between different enterprise processes and in the whole supply chain, from start to the end of every transaction so that can minimize the time, cost and necessary means of use.

The necessary condition for the proper display of the process in the form of grid model is to determine [7]:

- main flow of work (critical way), basic steps definition (actions, tasks) which are always performed in the process;

- workflow, performed simultaneously with the main workflow (e.g. work performed by a subcontractor);

Розділ 4 Проблеми управління інноваційним розвитком

– alternative ways (different procedures and versions of the process implementation); work time limits and reserves, critical way, optimistic and pessimistic execution of time;

– checkpoints of the process and places in the process where is accepted the decision concerning establishment of the results of operations;

– all process duration, i.e. the total process implementation time curb-to-curb.

To study the structure of the procurement process it should be investigated:

- from what operations the process consists of;
- in what order different operations are performed;
- which operations can't be started till the others aren't finished;
- each operation duration;
- if any downtime takes place (idleness, external delay).

Direct impact on cooperation with other members of the supply chain has the organization of the delivery process. The main goal of standardization as a network model is its formalization, eliminating and improvement so that the products will become cheaper, with better quality and quicker reach the customers.

To identify the standardization processes of supply in respect of the principles of enhanced accountability author conducted online survey of managers at different levels of supply process control of manufacturing companies and logistics operators, contacted local industrial enterprises in Ukraine (excluding occupied territories). The survey of the respondents was conducted on a sample consisting of 45 companies involved in procurement activities (Table 1).

Table 1 – Enterprise basic data (according to the survey results)

Enterprise characteristics	Replies respondents
1. Work only on the Ukrainian market:	
less than 10 employees	7%
from 10 to 49 employees	13%
from 50 to 100 employees	11%
more than 100 employees	7%
Total	38%
2. Work on other countries markets:	
less than 10 employees	3%
from 10 to 49 employees	11%
from 50 to 100 employees	22%
more than 100 employees	26%
Total	62%

The questions to be answered in the survey were: to find the existing level of standards, that has been used in the supply processes, and the necessity of developing extra standards, to extend partners relationships with other enterprises, to study motivation of SBC principles implementation.

To check the sample of representativeness it was used the formula for the case when the population is not known by enterprises [12]

$$n = \frac{t^2 \cdot V_x^2}{V_A^2}, \quad (1)$$

The sample of $n = 45$ enterprises are representative under these conditions, given the probability $P = 0,95$, which corresponds to a table-valued t -test, equal to 2,015, given coefficient of variation of the signs $Vx = 0,33$ (maximum coefficient of variation, ensuring the uniformity of signs) and the level of accuracy of survey results $V = 0,1$.

The study results prove that 60% of all respondents don't have or have partially developed standards of logistic processes implementation in the supply chain. About 55% of respondents, working at foreign markets, prove that managers are becoming more and more aware of supply standardization aimed at an enterprise higher competitiveness in the market.

Those enterprises which have approached or are planning to approach European markets (33% of all respondents) are motivated to introduce into their activity the European standards of ecological and social responsibility, to participate in the responsible supply chain.

Table 2 shows the results of survey concerning the level of supply processes standardization.

Table 2 – Existing level of supply process standardization during the enterprise activity
(own research based on the survey)

Supply process component	Responses percentage*
Sourcing according to the criteria the producers are interested in	27
Materials and parts supply planning	30
Certain merchandise lines stocking	28
Delivery consolidation process	24
Delivery completeness analysis	14

* – respondents might choose more than one response

Table 3 shows the results of the processes study that should be standardized.

Table 3 – The need of supply processes standardization in enterprise economic activity
(own research based on survey)

Components purchasing process	Percentage of responses *
Sourcing according to the criteria the producers are interested in	32
Supply processes network model development	27
Materials supply planning process	11
Delivery consolidation process	28
The introduction of supplier's behavior code	33
Stocking selection method for certain merchandise lines	20

* – respondents might choose more than one response

The obtained results analysis enables us to conclude concerning supply processes standardization level. The following supply processes have the highest standardization level: certain stocking merchandise lines; sourcing according to the criteria the producer is interested in.

The analysis revealed that motivation to standardize the process of implementing the principles of extended liability is around a third of respondents, especially those enterprises

that operate in foreign markets.

Sourcing aimed at the responsible chain of supply establishment, involving three components: economical, ecological and social responsibilities can be presented as a process having the following stages: buying conditions analysis and parts of agreements with suppliers, maintaining partnership relations, conducting business based on social-ecological responsibility.

The process of standardization can be presented by the following components:

- market analysis and market seller’s suggestions selection regarding prices and product environmental friendliness (services);
- prospective candidates analysis according to other economic efficiency criteria;
- suppliers ranging based on the complex index, determined as an average-weighted value on the selected criteria.

Table 4 lists the criteria which obtained the highest marks of respondents and were selected to estimate their importance.

Table 4 – Suppliers estimation criteria (based on the survey)

Supplier estimation criteria
Price level compared with competitors
Terms of payment, its flexibility
Merchandise quality
Product or service environmental friendliness
On time delivery
Social responsibility
Supplies consolidation
Stocking
Own transport
Market stability
Communication degree
Cooperation level with enterprises from other countries

The respondents were leading experts of supply departments or departments of working with clients, who were the experts so obtained the evaluation group had to check the consistency to confirm the reliability of the survey results. Kendall [13] believes that group estimation is valid only under condition that respondents’ responses are in complete agreement. The coefficient of concordance W was used:

$$W = \frac{12S}{m^2(n^3 - n)}, \quad (2)$$

where

$$S = \sum_{i=1}^n \left\{ \sum_{j=1}^m x_{ij} - \bar{x}_{ij} \right\}^2, \quad (3)$$

\bar{x}_{ij} – the mean for the sum of ranks on each criterion.

The coefficient of concordance may vary from 0 to 1, though it’s equal to 1 only in case when all experts completely agreed as for the criteria, but 0 proves no agreement among the

judges. To evaluate the obtained coefficient of concordance significance χ^2 – criterion is used which confirms that coefficient reliability W is proved by the condition: calculating value $m \cdot W \cdot (n-1)$ must have χ^2 – distribution with $\nu = n-1$ degrees of freedom and probability confidence level P and must be more than χ^2 . Confidence probability is, mostly, equal to 0,95 – 0,99. In our case, level of significance is 5% ($P = 95\%$), then at degree of freedom $\nu = 12-1 = 11$ table value $\chi^2 = 19,7$. Calculated actual value $\chi^2 = 46,736$ is much more than the table one, that proves complete judges agreement about all characteristics (Table 5).

Table 5 – Rank estimation of suppliers assessment criteria (own development)

Supplier assessment criteria	№	Average rank estimation of sourcing criteria
Degree of cooperation with other countries enterprises	K1	2,57
Prices level compared to competitors'	K2	2,71
Market stability	K3	4,57
Social responsibility	K4	5,14
Merchandise quality providing	K5	6,00
Stocking	K6	6,14
Product or service environmental friendliness	K7	6,57
On time delivery	K8	7,57
Terms of payment, its flexibility	K9	9,14
Supplies consolidation	K10	9,57
Own transport	K11	10,14
Communication degree	K12	11,00

Before implementing vendor selection process, carried out their preliminary selection by the method ABC analysis, examining the characteristics of the material, components or products, supply quality assurance system and sales activities. This allowed to reduce the number of suppliers under research and reject those who happened to be in group C according to the survey results.

An assessment criterion choice depends on the enterprise specific features and expectations [3]. The next step will be to determine significance for the fixed hierarchy of different assessment criteria (Table 6).

Table 6 – An example of criterion significance determination (own development based on [14])

	K1	K2	K3	K4	K5	K6	K7	K8	K9	K10	K11	K12	The amount of advantages	Significance, %
K1		X	X	X	X	X	X	X	X	X	X	X	11	16,67
K2			X	X	X	X	X	X	X	X	X	X	10	15,15
K3				X	X	X	X	X	X	X	X	X	9	13,64
K4					X	X	X	X	X	X	X	X	8	12,12
K5						X	X	X	X	X	X	X	7	10,61
K6							X	X	X	X	X	X	6	9,09
K7								X	X	X	X	X	5	7,58
K8									X	X	X	X	4	6,06
K9										X	X	X	3	4,55
K10											X	X	2	3,03
K11												X	1	1,52
K12													0	0,00
Sum													36	100

Criterion with the lowest average score is the highest rank the importance (weight). K_1 is a priority criterion (frequency advantages over other criteria – 11). Method of points adding for every supplier also depends on the enterprise requirements, where the materials and spare parts for production are supplied to, and the importance for it of additional services.

As we can see, according to the respondents' responses the first 4 criteria are really the most important ones at sourcing and responsible of supply chain establishment. As for the rest 3 criteria, they are usually necessary at cargo carrier selection, but as there were only 5 transportation companies under research, the significance of these criteria is quite low.

Conclusions. The expediency of use for participants in the supply chain, including suppliers, the average level of regulation of which corresponds with the level of standardization and affects the relationship between the components of rigidity and flexibility of their activities. An effective tool for their useful value proposed the structuring process to the subprocesses, operations and so on. The analysis of random survey of managers of 45 companies involved in procurement activities, revealed the main criteria for selecting the supplier, and set the steps of the process. Group evaluation criteria for selecting suppliers confirmed χ^2 – criterion with probability 95% probability sample representative at $P = 95\%$, given variations signs $V_x = 0,33$ (the critical level of variation coefficient that ensures uniformity of signs), and the error research $V = 0,1$. As a result of the ABC analysis determined the need for unconditional consideration (standardization) of the following four criteria for selecting a supplier: the degree of cooperation with companies in other countries price level relative to competitors, market stability, social responsibility. However, the criterion of ecological products (services) received a below average rating of importance, indicating a lack of environmental awareness in the business environment. According to the author, this criterion must be present in the sub standardization choice of suppliers.

At the **further studies** should be included into the base study transport companies that carry out delivery, since their activities as members of the supply chain in the field of supply must also be based on the principles of environmental and social responsibility.

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Формування відповідального ланцюга поставок: стандартизація процесів

У статті встановлена необхідність упровадження в діяльність українських промислових підприємств концепції сталого розвитку, що пов'язано з їх виходом на зовнішні ринки, насамперед, ринки Європейського Союзу. Цей процес передбачає використання в управлінні підприємствами принципів розширеної відповідальності бізнесу, що спрямовані на органічне поєднання економічних цілей підприємства з благом суспільства та навколишнього середовища. З причини підвищення конкурентоспроможності виробниче підприємство зацікавлене у використанні принципів розширеної відповідальності всіма учасниками ланцюга поставок, особливо постачальниками. Встановлена доцільність стандартизації процесу відбору постачальників виробничим підприємством. Обґрунтовані критерії відбору дають можливість ідентифікувати постачальників, які дотримуються партнерських засад співпраці, європейських стандартів екологічної та соціальної відповідальності у своїй діяльності, і сформуувати відповідальний ланцюг поставок.

Ключові слова: концепція сталого розвитку, розширена відповідальність бізнесу, відповідальний ланцюг поставок, стандартизація, відбір постачальників, опитування, вибіркове дослідження, групова оцінка, важливість (вага) критеріїв, АВС-аналіз.

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Формирование ответственной цепи поставок: стандартизация процессов

В статье определена необходимость внедрения в деятельность украинских промышленных предприятий концепции устойчивого развития, что связано с их выходом на внешние рынки, прежде всего, рынки Европейского Союза. Этот процесс предусматривает использование в управлении предприятиями принципов расширенной ответственности бизнеса, направленных на органичное сочетание экономических целей предприятия с благосостоянием общества и окружающей среды. По причине повышения конкурентоспособности производственное предприятие заинтересовано в использовании принципов расширенной ответственности всеми участниками цепи поставок, особенно поставщиками. Установлена целесообразность стандартизации процесса отбора поставщиков производственным предприятием. Обоснованные критерии отбора позволяют идентифицировать поставщиков, придерживающихся партнерских основ сотрудничества, европейских стандартов экологической и социальной ответственности в своей деятельности, и сформировать ответственную цепь поставок.

Ключевые слова: концепция устойчивого развития, расширенная ответственность бизнеса, ответственная цепь поставок, стандартизация, отбор поставщиков, опрос, выборочное исследование, групповая оценка, важность критериев, АВС-анализ.

Отримано 20.04.2016 р.