Requirements of Knowledge Management Systems According To Performance and Risk Related Issues in Global Supply Chains

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Abstract
The development in global network perspectives forces the demand for a proper knowledge management and according configuration of performance and risk issues that occur from the ongoing trend towards the globalized supply chain. The paper shows the requirement shift through globalized procurement. As an effect towards long distance purchasing activities the direct control of production, logistics processes and processing are out of direct control for most of the person in charge in downstream processes. Process transparency and information readiness are essential to reduce risk in (e-)business networks. Output of this requirement is a long-term orientated knowledge management. Support can be delivered by vertical coordination through interorganizational agencies as EurepGap and IFS for the food industry. In this industry a huge gap can be identified in between brand mark products (of international/global brand companies) and local/regional producers – leading to a twin track development (track 1 / track 2).

1. Requirements of a holistic knowledge management approach in global supply chains

Knowledge management is required to deliver a foundation to a continuous development in the process optimization as well as in the quality control and improvement of global supply chains. To show the potential of such an approach the current difficulties in providing food safety and high product quality is shown for the twin track grocery industry. The product quality of specific groceries can at least be differentiated into the three dimensions: *product oriented quality* (physical characteristics of the product), *process oriented quality* (process oriented to two characteristics of the product) and utilization oriented quality (subjective quality aspects of purchasers / consumers). Against the background of this multidimensionality food safety in the European Community is defined within the EU-Community law by the criteria "harmful to health" and "suitability for human consumption"(EC, Art. 14).

Risk occurs from the possibility of insecure products due to insecure processes along the supply chain. Even the existence of insecure processes does not necessarily result in the contamination of products. Likelihood and result of the impact on the product need to be taken into consideration when discussing risk management requirements to specific supply and production chains.

Bitter race can or insecure groceries is related to the likelihood that an agent has a negative effect on the consumer if consuming the specific product. On the other hand the products are considered to be safe when they have an extremely low risk of damage – this does not necessarily mean that this risk must be equal to zero.
Due to the existing information asymmetry in contestable markets a risk reduction needs to be performed by either governmental/multinational institutions (to set minimum requirements on food safety) or BtoB-trust based by an adequate supply chain risk management. Problems may increase whenever products are traded internationally. Depending on different production standards in terms of allowed remaining quantity of ingredients used during production processes no consistent picture of a quality map can be drawn.

Fig 1 shows by a comparison of United States limits and German and Austrian limits (to point out differences even between neighboring countries with matching cultural background and consumer behavior) how allowance-levels for residue of selected pesticides range (see also Henson / Northern, 1997).

(mg/kg) Q-factors	USA	Germany	Austria	Others	
Benomyl	10	3,0	2,0	5,0	Canada
Cymoxanil	0,1	0,2	0,1	0,05	Netherlands
Imidacloprid	1,0	0,05	0,05	1,5	Canada
Glufosinate	0,05	0,1	0,1	K. A.	
Carbofuran	0,4	0,1	0,1	0,01	Belgium
Captan	50,0	3,0	3,0	3,0	France

Fig 1. measurable quality by comparison, own illustration

In the last column additional information from a variety of countries is given. Whereas circles in the first three country columns show maximum allowances the circles in the column "others" highlight minimum allowances from the according country. The differentiation in limiting values doesn't follow logical explanation. This simple example already shows a variation of factor 40 and even more.

There is obviously need for a knowledge database in all involved countries/regions in order to know about allowances differences in importing countries, according optimizations in the production process (that is also related to the right adjustance of the process performance that the market partners obtain), exchange of best practice experiences along the suppliers/producers etc.

Less influence of a single company to secure Food Safety along the whole supply chain lead towards an interface oriented exchange of risk management adequate information in a knowledge management adequate environment. In the long run a data exchange that allows an ongoing usage of the gathered information in preliminary processes are of resemble advantage for process transparency and risk management.

As a first step process quality along all involved partners in the supply chain is required. If non conform behavior is not traceable due to missing information and documentation a disaster may destruct the whole supply chain. For instance illustration 2 shows the effect of additive usage of different pesticides without exceeding tolerance levels in any single residue. The final product itself has on the other hand a contamination level that is far beyond any acceptable point – the result is a so-called „pesticides cocktail". This is a typical example for an output that is related to a missing knowledge exchange.

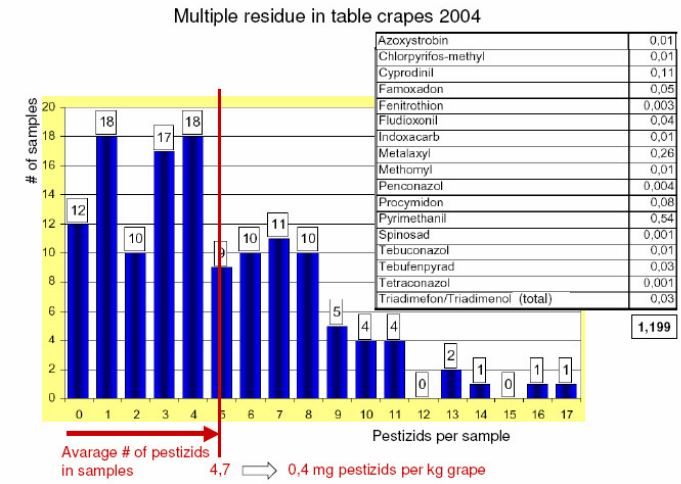

Fig. 2. measurable quality by comparison, own illustration

2. Support to solve this knowledge management problem on international and inter-organizational levels (actual status)

In order to reduce this information asymmetry problem (Stiglitz, 1987) as well as the issue of setting different standards for individual business relations (see chapter 1), a group of 20 leading European grocery retailers established the European Retailer Produce working group Good Agricultural Practice (EurepGap), including production, environmental, social and hygienic standards for fruit and vegetable. EurepGap fruit and vegetable is a normative document for certification and has been developed from a European group of representatives from all stages in the fruit and vegetable sector with the support from producer organizations outside the EU (EuropGap, 2006). It is accredited by ISO 65 (EN 45011) and has worldwide applicability. Likewise, the International Food Standards (IFS) – evolved from the Global Food Safety Initiative (GFSI) to primarily audit private label producers. Since March 2004 some retailers already require an IFS-certification from their suppliers. Both standardization programs allow a better control of performance and risk relevant activities within the supply chain and support network efficiency

through reduced fixed costs in maintaining such a system compared to one-to-one-relations.

As an effect towards long distance purchasing activities the direct control of production, logistics processes and processing are out of direct control for most of the person in charge in downstream processes. As a result the vertical coordination through interorganizational agencies as EurepGAP (European Retailer Produce Group Good Agricultural Practices) and IFS (International Food Standard) emerged. The available information should be included in a knowledge management solution. Additional information, process aspects etc. can be stored and managed.

3. Vertical integration (track 1) vs. adequate risk management through knowledge improvements to secure process and product quality and information readiness (track 2)

As stated before, the internal solution by a vertically integrated supply chain may – if all processes are run properly – achieve the highest level of reliable risk avoidance. It has the second advantage that IT-interfaces can be set up to the required interchange of re-/traceability information. However, for most market players there is no possibility of bringing more value creating activities into the own enterprise. As long as transaction costs by external risk management solutions are competitive against internal solutions, there is no need for vertical integration. Thus, a knowledge management system is required to handle all information that balance risk in a collaborative food network with according statements related to costs issues as well as further benefits, effect on business ties etc. As risk management is always balancing the cost of risk avoidance towards the probability of the event of an non-adequate output and its results in direct damage, evolving costs related to this direct damage as well as loss in goodwill etc. (Schiller, 2005 see also Caswell/Mojduszka, 1996) there must be a comprehensive overview on risk forcing/defending practices of (potential) trading partners on the screen of the decision makers within each enterprise.

Due to the complexity of information requirements there is need of combining risk management information detailed enough to avoid data loss on one side and information overflow that nobody can handle on the other side. Securing and documenting processes within the own production process an mixture processes of raw materials and probable contamination risks through packaging, machinery cleaning etc. is as important as information on the suppliers processes.

Therefore relationship management and vertical cooperation becomes more and more important. As brands need to make sure that the quality of their products is continuously of high quality there is a direct relation towards controlling the whole value chain for the products – and as a result establishing an in-house knowledge management (track 1). That doesn't necessarily lead to a vertical integration. More important is an appropriate risk management that combines trust through long-term relations with trading partners as well as definitive process and product quality levels and control systems throughout the process chain (Antle, 1999). Considering, that in following steps the relevant safety and quality could not be adopted through intensive control systems anymore. A consistent approach to fulfill the requirements is the required information provided by an industry wide knowledge management (track 2).

4. Extension of a knowledge management for a global/international brand company (track1) for e-market solutions

In e-market solutions the average trade process has to take the multiple influences of risk within the specific supply chain into consideration. Therefore a one-size-fits-all strategy for all industries is not practicable. As mentioned before, the buyers cannot handle a too detailed information exchange approach. The decision maker requires an easy information system, that provides the latest knowledge from latest transactions as well as new information about suppliers performance and potential problems with inputs from specific companies / regional produce.

From the e-procurement perspective the adequate set up of the purchasing action is as well part of the information the knowledge management system must provide. E. g. risks in higher input prices, negative quality details due to non-specified requirements in the order specification process and the wrong setting of internet auctions. Fig 3 gives an example of the result from a reverse auction from a major grocery producer in Europe, where the specifications for the auctioned input factor was missed due to a lack of knowledge exchange – explaining the huge variance in bidders offer. The auction result was a price increase of almost 20 percent

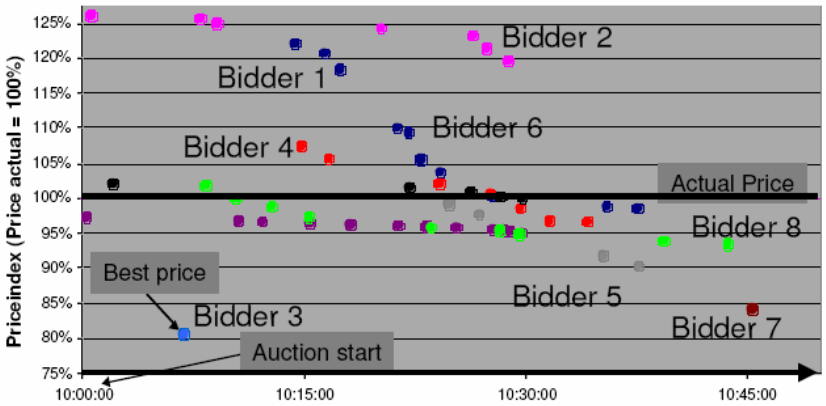

Fig 3. e-markets reverse auction example – wrong parameter setting (missing specification)

However, the trust within a business network is mostly based on logistics performance and general quality aspects the end consumers link with that non-brand product or brand. Essential for the BtoB risk and performance process are up to date information in the knowledge management system about supply readiness, product conditions and the ability to provide detailed information about specific processes.

5. The adequate set up of knowledge management

In order to establish an adequate knowledge management to provide food safety and traceability, restrictions and typical issues of companies need to be taken into consideration. The basic idea is, to deliver a consideration matrix that allows companies to evaluate the required level of food safety and supply chain control according to upstream, in-house, and downstream activities for specific products.

The appropriate level of details in terms of available information and to trust in documented information leads to product and process technical activities in the grocery supply chain. Some sources of information for all participants in the supply chain (track 2) are a must, such as lot numbers (89/396/EWG, including best before date, lot and date of production); product labeling (labeling requirements as in 2000/13/EWG); number of pallet (barcode, transport labels with EAN 128 information); quality-control information; production planning information; audit reports; delivery notes (information accompanying the flow of goods); accounting information (information following the goods flow). However the additional information handled in the knowledge database delivers business advantages in a competitive world. If some companies/industries establish such a system and others don't, there will be a disadvantage in the possibility of selling products in global supply chains in the medium run. Positive examples show the benefit of knowledge management, as managed by the PECCBS in South Africa for instance. ; According to the level of information details that can be gathered by using all potential sources, the remaining gap in information and transparency can be evaluated – assuming that all gathered information is trustful. Additional risk aspects through potential information manipulation need further activities.

The higher the number of suppliers and customers the more technical efficiency in terms of electronic data interchange is required (BLL-Online, 2001). Enterprises participating in the same value chain should negotiate which data source should be used for what kind of information to suit all requirements best and in order to deliver traceability, information readiness and acceptable security of the food supply chain.

As a result a knowledge management system should include information about the relevant processes of the industry, all process and quality impacts as well as state of the art improvements, potential risk through upstream and downstream shift in requirements, internal aspects that involve process improvement components etc. Depending on the major market of the enterprise there might be a big advantage to participate in an industry wide solution (track 2) in order to compete with global competitors (track 1). If the company wants to run an independent solution it's more or less the small version of the big players solution.

First step for a single enterprise is an evaluation of the own potential risk within the three process parts

upstream, intern and downstream (Hammer, 1988). With target orientated questions on the quality control und risk management system itself as well as on relevant aspects regarding input and output factors a significant overview can be reached to support decisions on risk management. In order to make the questions operable for further evaluation of major areas e.g. call for action for short-term activities, a percentage level of possible risk management performance was delivered by transforming qualitative answers into quantitative counts and balance these with performance and risk relevant factors. As a result a differentiated position for all processes-parts can be pointed out. By dividing this approach into process and product aspects for all three areas a profile of the collaborative food network (from the single company point of view is obtained.

Using the results of this evaluation in a condensed approach like this would deliver the accumulated information a buyer would need on suppliers level in order to take all required information from the knowledge management system into account. How this solution might look like is shown in Fig. 4.

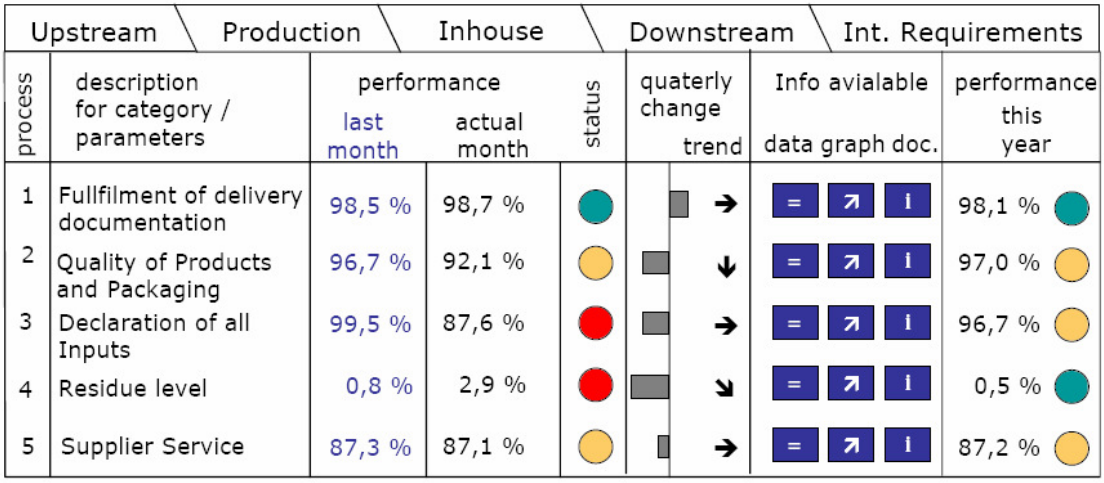

Fig. 4 a performance and risk management tool with integrated knowledge management system

As there are many dimensions of relevant knowledge aspects that need to be covered by an extended knowledge management solution a multilevel-approach to support decision makers is preferable. On the operations level additional information available must be stored in a data warehouse or in classical files in the back office. The positive effects on performance improvement, risk reduction; process transparency and continuous information readiness along the supply chain may overrule the fears that an industry wide solution usually sets of for the single participant. In order to be competitive in the long run there should be an intrinsic motivation to establish it.

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