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Chain-computerisation, quality and risk

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Abstract: The theoretical framework of Chain-computerisation provides insight into social chains and helps to create chain communication systems by tackling a so–called dominant chain problem (the problem that forces the parties within the chain to work together). If the quality of the chain information system and the quality of the data critical for the chain communication are sub-standard, the dominant chain problem cannot be adequately addressed. In this article, a deepening of the quality dimension of the theory of Chain-computerisation will be mapped out which could help create a reliable chain solution. Moreover, we will discuss how the theoretical framework steers us in the determination of the essential quality of a chain information system and the data that is processed by it.

Keywords: chain-computerisation, quality, risk, risk management

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1 Example

Just imagine the following situation: shock waves go through The Netherlands because a few people have been diagnosed with Creutzveldt-Jacob Disease (CJD). One of them ultimately dies from the disease. Upon examination, it emerges that the infections were caused by eating BSE-contaminated beef originating from a South American country and which had been imported into The Netherlands with falsified export documents. Immediately, The Netherlands halts the import of cattle from the country in question and a large number of cattle are preventively culled. Alongside of the fact that there is a real threat to public health, the economic consequences and the damage to the image of the meat industry are enormous. Moreover, the trade relations between The Netherlands and the South American country come under pressure. Although this is a fictitious scenario, such (social) problems do, unfortunately, occur regularly.

2 The theory of Chain-computerisation

The objective of the theory of Chain-computerisation is to establish, more successfully, communication systems for large-scale co-operation in social chains (Grijpink, 2009, p. 20). Social chains focus on, for example, healthcare, welfare or safety. In previously conducted Master's research (Dijkman, 2010), a study was made of how the reliability of the quality of export shipments in the agricultural chain to countries outside the European Union can be increased and what role data and system quality can play in this. The theory of Chain-computerisation provides a new look at chains because it clarifies the problems and fields of influence that play a role in the realisation of large-scale chain communication systems. To that end, the theory offers instruments for the description of the characteristics of social chains and, in particular, the so-called dominant chain problem. This problem forces chain parties to work together, because no one party can tackle that problem on its own. If they do not work together, it damages the image of the chain as a whole or jeopardizes the functioning of the entire chain. The theory also contains an assessment framework (the chain analysis) that helps to determine the content and necessity of an information system that tackles the dominant chain problem. The chain analysis can, finally, provide a judgment regarding the feasibility of a chain-wide solution with the current degree of organisation (degree of co-operation) within the chain. Thus, it can be assessed beforehand if a chain information system in a chain can be successfully implemented to support the chain parties in the realisation of their common social chain task (in the above example: the safe export of beef).

3 The role of quality

What happens if, with the aid of chain analysis, the data necessary for chain communication have been determined and the necessity and feasibility of a chain information system have been assessed, but the quality of the actual data used is below par or the data has been tampered with? This was the case with the BSE contaminated beef: if, during the export of the cattle, incorrect data on the health of the animals is included, doesn't the risk of contagion still exist? Here we see that the concept of quality is virtually inseparable from (chain-)computerisation. The theoretical framework of Chain-computerisation does not delve explicitly into the subject of quality in the realisation of a chain communication system; the reliability of the data and of a chain information system for processing it are assumed. Nonetheless, the quality and the success of a chain solution are largely dependent upon it. If the quality is sub-standard, there is a great chance that the dominant chain problem cannot be adequately addressed. This article will, therefore, map out how the quality dimension within the theoretical framework of Chain-computerisation can been given its own identity thus bridging the gap to quality thinking and risk management.

4 From chain-computerisation to quality and risk management

The essential quality of a chain information system and its data must be seen in relation to the objective: the tackling of the dominant chain problem. In the above example: providing guarantees on the quality of the cattle to be exported. By differentiating between two levels, the theory of Chain-computerisation helps us understand that the concept of quality actually has bearing on two levels (see Figure 1):

1. First of all, the concept of quality has bearing on the base level of the chain. This is the level at which the chain object (the cow) 'goes through the chain.' The data that are exchanged chain-wide must provide guarantees about the health of the cow. This data must therefore be, for example, reliable and traceable.
2. Secondly, the concept of quality has bearing on the chain level. This is the level of the chain information system at which the data exchange takes place. Here, quality has bearing on such quality characteristics as the security, accuracy and fault tolerance of the chain information system.

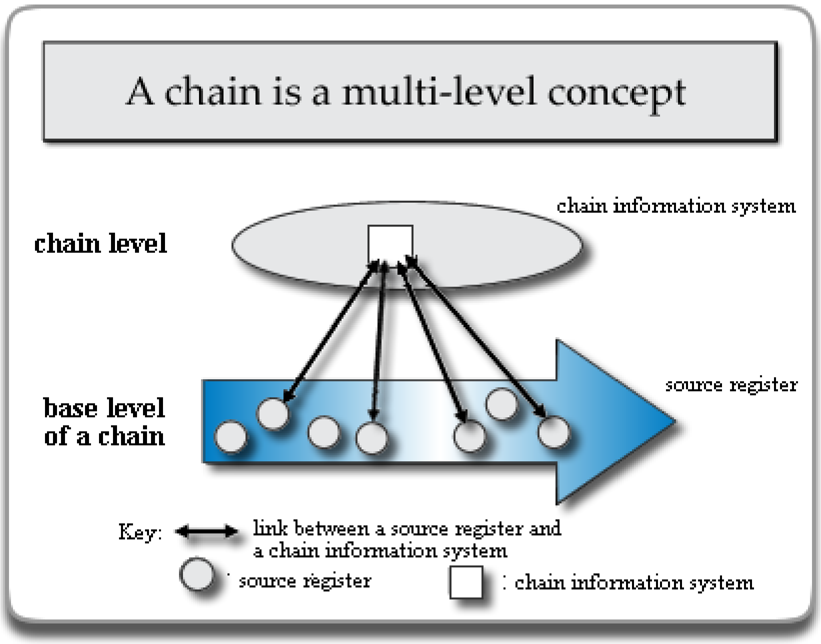

Figure 1: Two analysis levels for chains (Grijpink, 2009, p. 37)

In order to be able to provide guarantees on the quality of the chain object (read: the health of the cow), one must be able to trust the quality of the available data at the base level of the chain and the chain information system at the chain level. DeLone and McLean (1992) clearly describe the importance of data and system quality for ‘Information System Success’ and provide a clear overview of research that has been done in this field. In order to provide guarantees on data and system quality, we differentiate among three ingredients: quality characteristics, quality demands and measures.

4.1 Quality characteristics

In order to be able to measure quality, it must be determined beforehand which quality characteristics are important. By quality characteristic, we mean a characteristic that can be used to measure the quality of a specific object (for example, ‘traceability’ is a quality characteristic of data). In the previously-mentioned Master’s thesis (Dijkman, 2010), a literature study was done on characteristics that help to measure data and system quality. From the articles that were found, only those were selected that help measure quality in relation to a specific goal (Bouman, 2008; Bovee, Srivastava & Mak, 2003; DeLone & McLean, 1992; Sedera & Gable, 2004; Rijsenbrij, 1998; Wand & Wang, 1996; Wang & Strong, 1996; Bemelmans, 1987). The objective here is to determine the correct approach to tackle the dominant chain problem. These articles provided two lists of 39 characteristics each, with the aid of which the total quality of data and information systems can be determined (it seems coincidental that each of the lists contains the same number of characteristics. Further research is necessary to discover if there is an explanation for this).
With the aid of the dominant chain problem, the relevant quality characteristics can be selected from these two long lists. The effectiveness of the chosen approach to tackle the dominant chain problem ultimately depends, namely, upon the quality of the available data and, in particular, of the data that relate to the dominant chain problem. With the dominant chain problem ‘unreliable export of cattle due to fraud with export data,’ for example, it will be clear that a quality characteristic such as 'traceability' is extremely relevant, because with incorrect export data one must be

able to verify where the mistakes originated and whether or not fraud was committed.

4.2 Quality requirements

The quality characteristics are, however, still ‘empty shells’ as long as it is not specified what relevant conditions must be met with regard to these characteristics. As stated at the beginning of the article, the quality must be seen in relation to the dominant chain problem. Just as with the selection of the quality characteristics, the dominant chain problem guides us in formulating the quality requirements. It is, after all, only useful to formulate requirements that contribute to the tackling of the dominant chain problem. For example, given the dominant chain problem mentioned in the above paragraph, in order to interpret the quality characteristic ‘traceability’ of data, the following requirement can be set: “one must always be able to verify who has inspected or used the export data.” One technique for formulating quality requirements is the nominal group technique (Van de Ven & Delbecq, 1972). In chains, individual interests of chain parties often play a role and this will, if the parties are asked to formulate quality requirements together, strongly influence the mutual interaction. Because, in a nominal group session, voting rounds alternate with discussions, and the objective is primarily to formulate a specific problem and to discuss it, without regard to persons, this is an appropriate technique from the viewpoint of Chain-computerisation. The focus then lies on discussing the common dominant chain problem and all the parties have, when formulating the requirements, an equal voice.

In the method developed for selection and interpretation of quality characteristics and requirements for tackling the dominant chain problem, the quality dimension within the theoretical framework of Chain-computerisation has been given its own identity. We then go one step further. For, how can it be determined which risks are a threat to achieving or maintaining the quality? For example: the traceability of the available data is hampered if unauthorised persons gain access to that data. Here, we enter the domain of risk management.

4.3 Measures

There are various methods to determine quality risks and these are are grouped together under the common denominator called ‘risk analysis.’ In the Master’s thesis referred to above (Dijkman, 2010), we used the Dependencies and Vulnerabilities Analysis of the CRAMM method (3-Angle, 2003). This is an extremely structured technique for mapping out risks. Based on the quality requirements that have been set (which should, once more, be based on the dominant chain problem) this analysis has helped in determining quality risks. Subsequently, the measures are determined that help keep these risks as small as possible.

5 Conclusions

What does the described approach now mean for the example given at the beginning of this article? If no attention is paid to the quality of the chain information system and the data critical for the chain communication, then, in spite of the implementation of such a system, it will remain possible to tamper with export data. By first determining quality characteristics and then quality requirements, it can be determined what the minimum quality of the chain solution must be. In the third step, the risk analysis has helped to bring unforeseen quality risks into view and to determine measures to reduce these risks. By going through these steps, it becomes possible – on the basis of the export data – to provide, with greater certainty, guarantees on the health of the cattle and the dominant chain problem can be tackled.

What is striking here is that Chain-computerisation, Quality thinking and Risk management prove to complement each other. By elucidating a chain solution from all three sides, a reliable quality can be established:

- The theory of Chain-computerisation helps us 'do the right thing' in a chain environment. It shows that both co-operation and computerisation in social chains can only succeed if the focus remains on the dominant chain problem. This article shows that the dominant chain problem, alongside of determining the content of the chain information system, also helps to determine the direction when identifying key quality characteristics, quality requirements and measures.
- Quality thinking is inseparably linked to Chain-computerisation. If no guarantees are given concerning the quality of a chain information system and the data used in it, the dominant chain problem cannot be adequately addressed. By using quality characteristics and requirements, the quality of a chain-computerisation solution can be made measurable.
- Risk management helps to avoid missing the risks regarding the quality of a chain-computerisation solution. It offers various ways to map out these risks in a structured manner and to select the correct measures for reducing them.

One final comment should be made with respect to the workability of a chain solution. This article shows that the dominant chain problem is the leitmotiv running through the design of a chain solution. This problem also influences the selection of quality characteristics, quality requirements and measures. For that reason, one should realise that a chain solution and the quality of it are always specific for a given dominant chain problem in a given chain and that, therefore, for every dominant chain problem the steps described above must be repeated.

Biography: J.J. (Jesse) Dijkman (1986) earned his BA in Computer Science and MA in Information Science at the University of Utrecht. The subject of his Master's thesis was chain-computerisation in the agriculture-export chain. Alongside of this, he was involved, as a student researcher, in the Chain Landscape research with the chair of Chain-computerisation at the University of Utrecht. He is now employed as a consultant with Vellekoop & Meesters, a Dutch consultancy firm in the field of information, organisation and IT.

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