



Securing of Food Production and Logistics
with Distributed Ledger Technology

der Bundeswehr
Universität  München

NutriSafe Toolkit
– DLT Application Modules –

Analysis Tools for the Planning of Food Production and Logistics using DLT: Software Concept

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Concept of an Analysis Tool for Food Production and Logistics Planning using DLT

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1 Introduction

This concept describes analysis tools for the planning of food production and logistics using Distributed Ledger Technology (DLT). The concept is primarily intended to illustrate and demonstrate which advantages arise in particular for producing companies from the use of DLT and the associated flow of information along the supply chain.

2 Dashboard

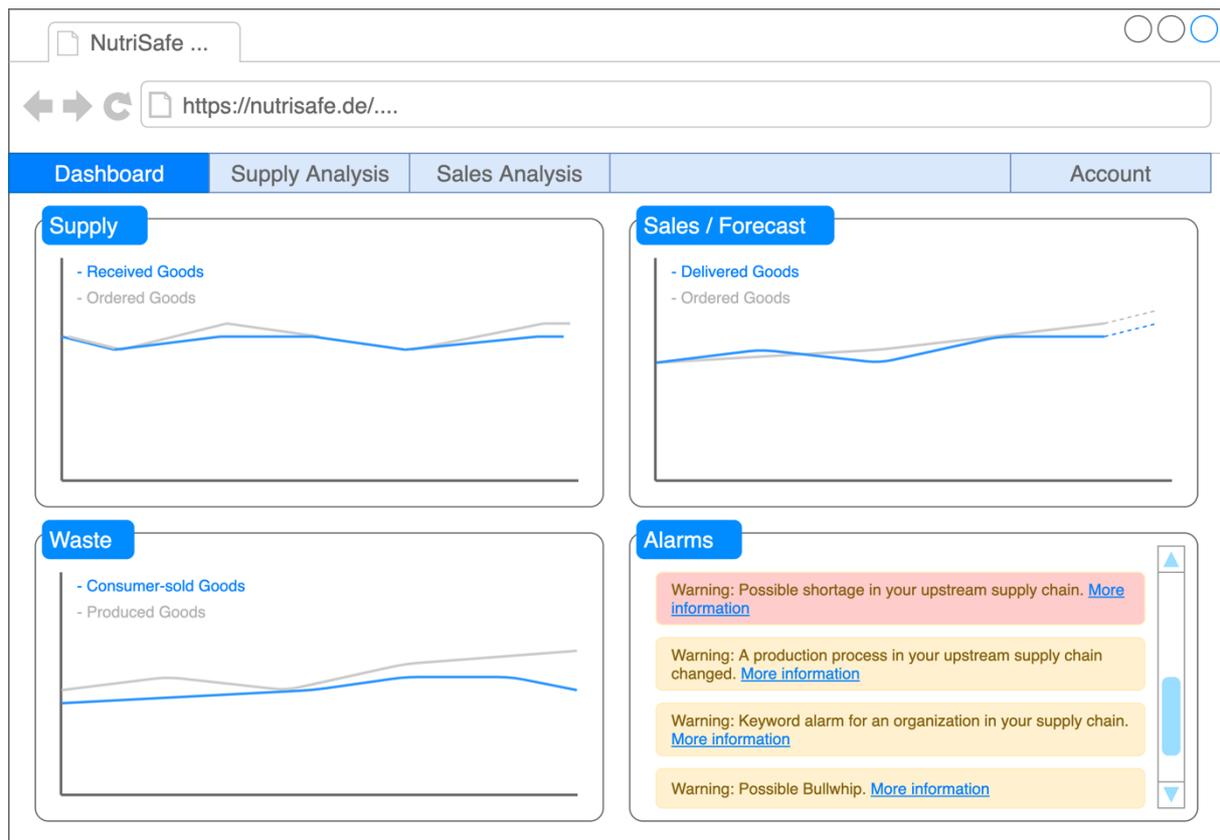


Figure 1 Dashboard view mockup

The dashboard should be designed to provide the user with the most important information in an easily understandable way and at a glance. It contains four areas with brief overviews for the user (Figure 1): supply overview, sales overview, downstream waste overview and the alarm section.

2.1 Supply Overview

The supply overview shows timelines for both ordered and current goods receiving. This allows a quick insight into the development of orders and incoming goods, and especially into deviations between these.

2.2 Sales Overview

The sales overview shows timelines for both ordered and actually delivered goods as well as a forecast for both timelines. This allows a quick look at the trends of incoming orders and

outgoing goods. In addition, a forecast provides direct support for purchasing and production planning.

2.3 Waste Overview

The waste overview contains timelines for produced goods and goods actually sold to the consumer to gain knowledge about the number of discarded or lost goods within the downstream supply chain. Among others, this allows conclusions about possible changes in the quality of the produced goods or packaging issues and a better management of production and delivery from the producers' point of view. This way, such problems within production or packaging can be identified even before being notified by customers.

2.4 Alarm Overview

In the alarms area the user is presented with relevant messages regarding possible supply chain disruption or planning issues. Please refer to section 5 in this document for a more detailed explanation of this functionality.

3 Supply Analysis

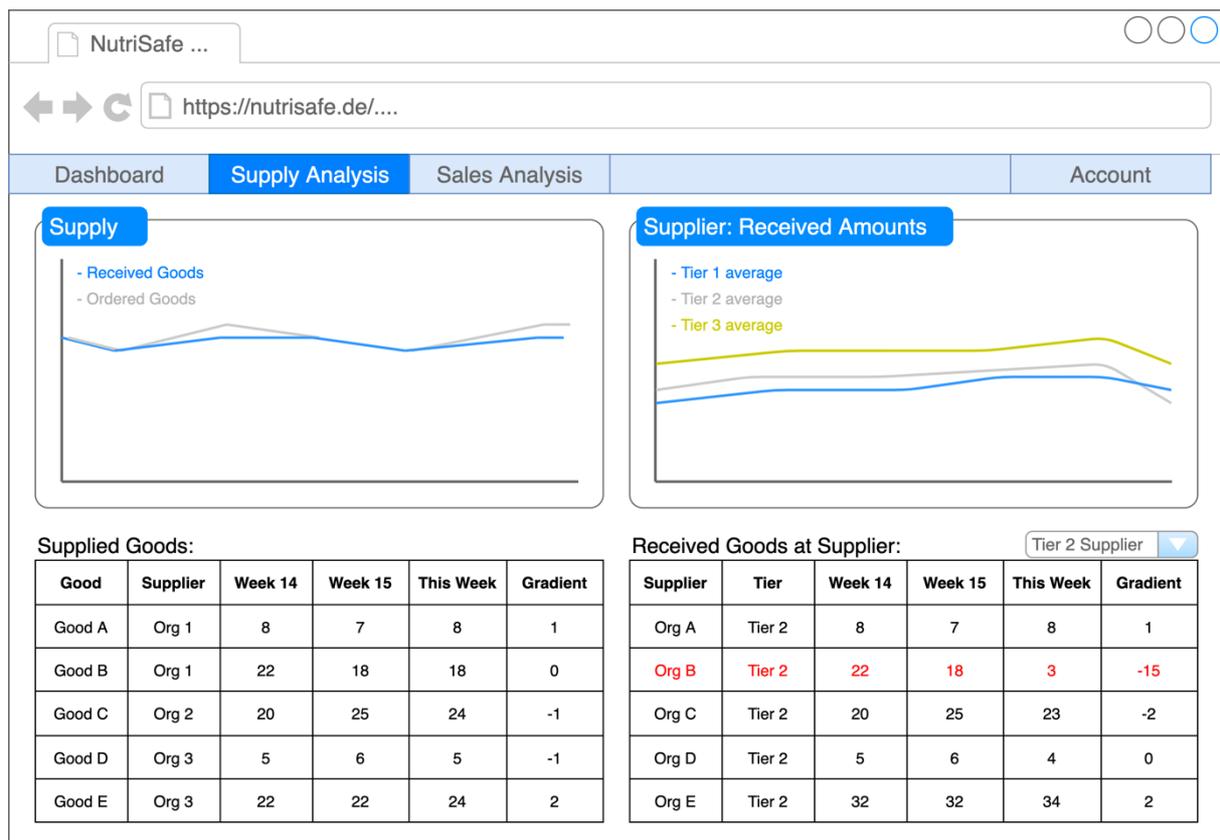


Figure 2 Supply analysis view mockup

The supply analysis view (Figure 2) gives an overview about the ordered and supplied goods. In addition, it provides the possibility to check the upstream supply chain for possible disruptions. On the right side of the view, one can see timelines of the average received goods for each tier. If there is a negative gradient, which can also be inspected in the table below, one can identify possible upstream disruptions in production capacities and thus supply shortages and react

accordingly, for example by looking for additional suppliers or switching to alternatives for the delivered goods.

4 Sales Analysis

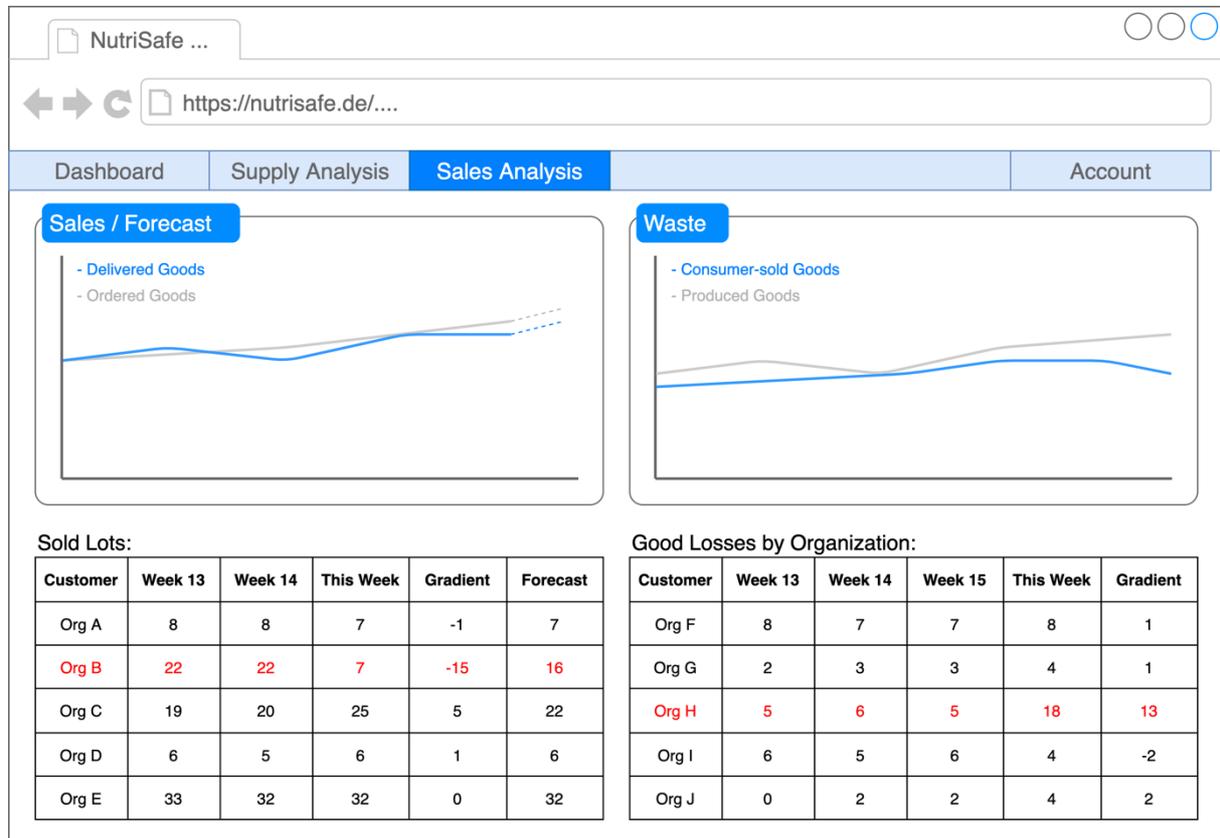


Figure 3 Sales analysis view mockup

The most important factor for production planning is sales analysis – in particular forecast analysis. The sales analysis view (Figure 3) shows the sales statistics on the left side. A graph shows the timeline of ordered and delivered goods including a forecast (indicated by a dashed line). To calculate the forecast, past and present sales data (amount of sold goods) of the user organization and the downstream supply chain are compared. Figure 4 shows a flow chart for forecast generation. The data history reveals not only how many goods the organization has sold but also the amount of goods sold further on the downstream supply chain. This way, a look at current sales data in the downstream supply chain allows an estimation of future sales by the organization. Here, a DLT can improve forecast analysis by making more information available (regarding the downstream flow of goods).

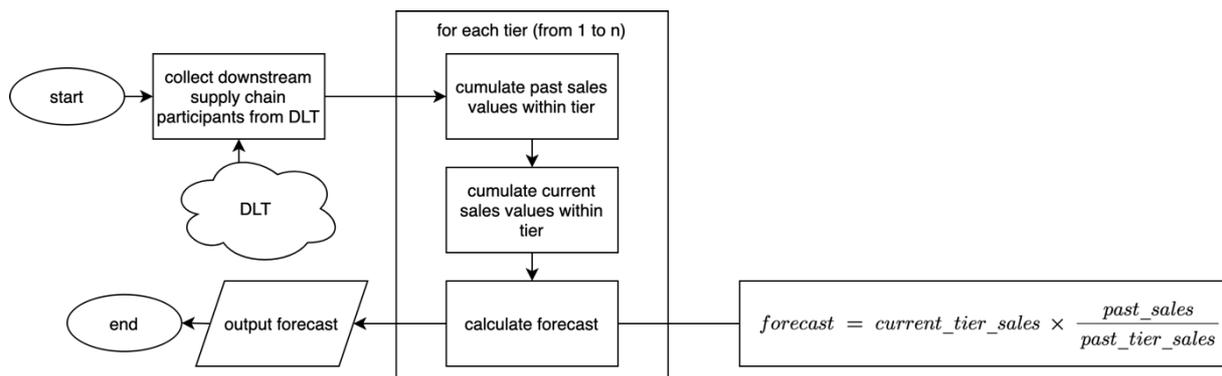


Figure 4 Forecast generation flow chart

In addition to the sales data, waste analysis could be of advantage. A graph shows the timelines of produced goods and goods sold to the end customer. This way one can see how many goods are withdrawn from the supply chain. An accompanying table allows the user to find out, where in the downstream supply chain the goods are withdrawn. This allows insights on how to reduce waste or give hints on quality or packaging problems within own production processes. Especially after changes to the production processes or changes in packaging such numbers can serve as an early warning – even before customer complaints.

5 Alarms

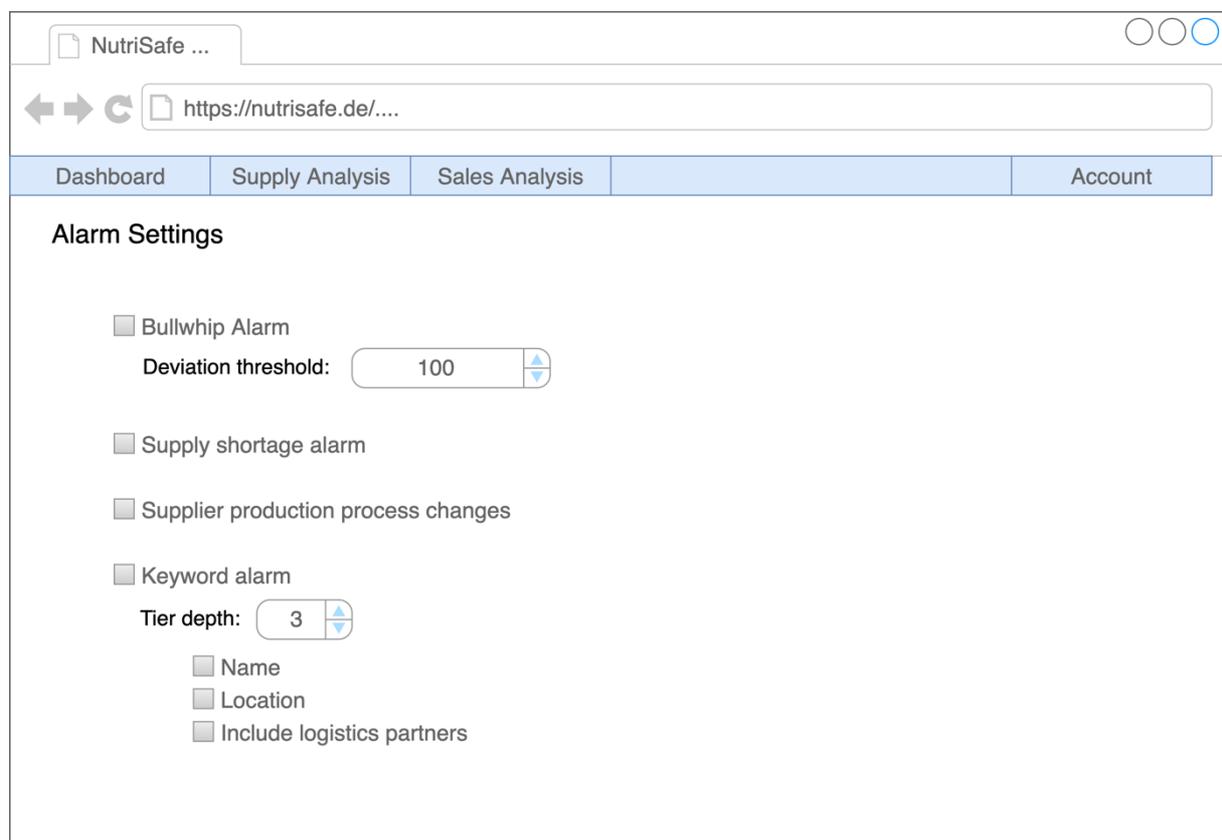


Figure 5 Alarm settings view mockup

According to the concept, the software provides alarms to warn the user in case of possible supply chain disruptions or quality issues. Figure 5 shows the alarms settings view. There are

four alarm types: bullwhip alarm, supply shortage alarm, alarm on change of suppliers' processes and keyword alarm.

5.1 Bullwhip Alarm

The availability of information about flows of goods throughout the whole supply chain can help avoid bullwhip effects. Thus, an alarm can be displayed to the user if such an effect is likely to occur.

5.2 Supply Shortage Alarm

Usually, organizations do not know very much about the production capacities of the supplier network beyond tier 1. The access to information about the flow of goods of the whole supply chain network allows analysis of changes in production capacities of the supplier network and disruptions could be identified much earlier. Therefore, a program could iterate the tiers and cumulate the received goods for each tier (see Figure 6). If there is a negative gradient, there may be possible upstream disruptions in production capacities and thus supply shortages. An alarm allows the user to react accordingly, for example by looking for additional suppliers or switching to alternatives for the delivered goods.

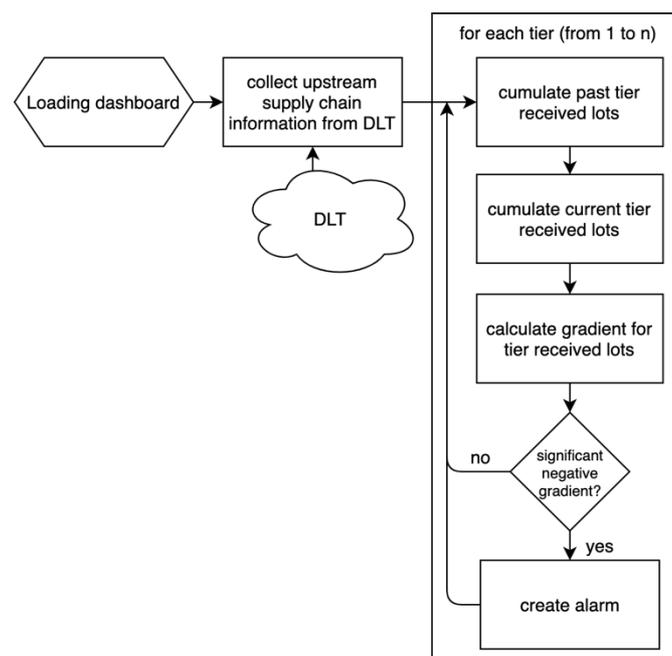


Figure 6 Upstream shortage alarm flow chart

5.3 Supplier Production Process Change Alarm

It is of advantage to know when a supplier's production process changes. Such changes can also lead to a change in product quality. Therefore, it might be useful to perform extra quality checks on incoming goods after such a change by a supplier in order to check for a possible change in quality.

To facilitate this via DLT, the suppliers must store their process IDs (these could be strings or numbers) in the DLT. When changes are made to the process, a supplier changes the ID in the DLT and the customer can then check and react to a change. This not only enables the customer

to perform additional quality checks, but also allows the producer to be informed of problems early after making changes to the production process.

5.4 Keyword Alarm

To identify possible disruptions within the supply chain, one could perform a keyword search in news search engines using the organizations' names or locations. A significant rise in search results may be a sign for disruptions within the supply chain network, for example disasters (location search) or scandals (name search). While this can already be done for direct suppliers and customers, a DLT could enable such searches for more tiers or even the whole supply chain. (However, it is worth to note that this could also be exploited to harm a specific company within the supply chain.)

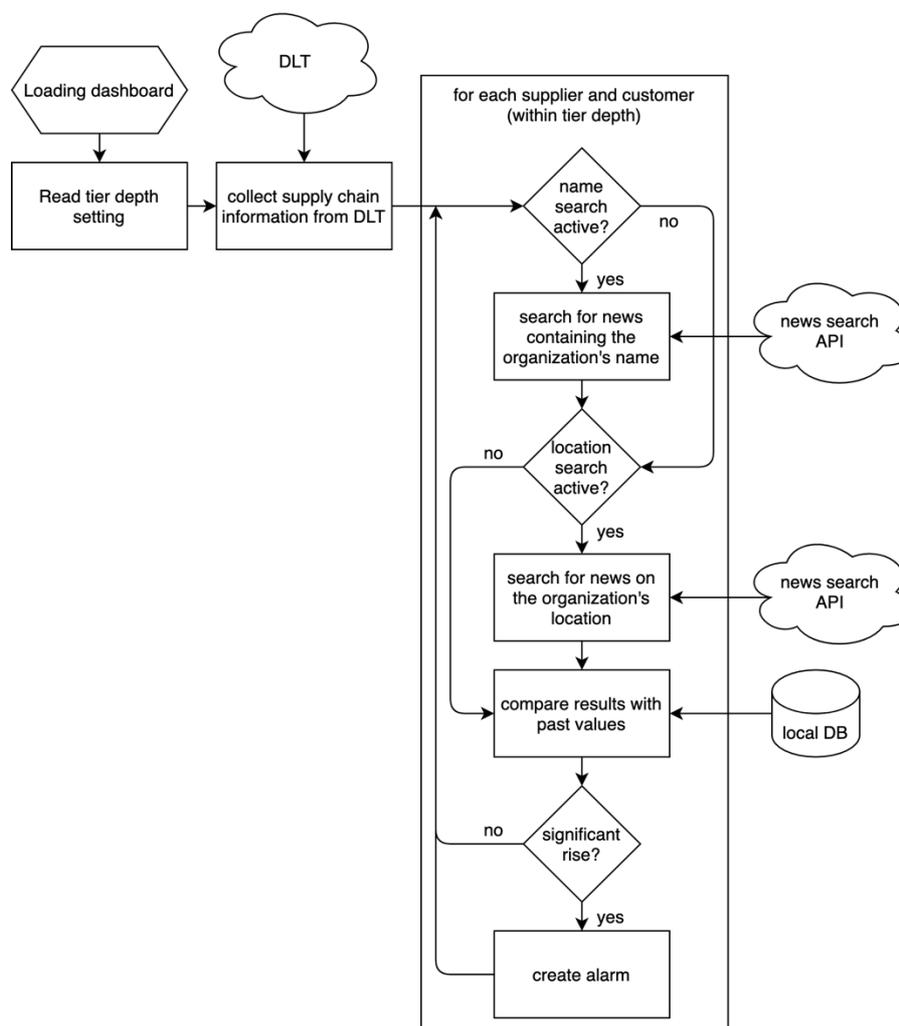


Figure 7 Keyword alarm flow chart

6 DLT Requirements

To enable the analyses described in this document, a DLT must store the following information: Organization assignment and chaining of lots, good amounts within each lot, organization names and locations (for each site), information on orders, timestamps for each transaction.

7 Conclusion

The concept presented in this document demonstrates advantages of a DLT for production and logistics planning. The advantages particularly relate to the possibility of being able to analyze information about the entire supply chain network. This allows to react much earlier on changes in the network or pass information on changes to customers and get near-instant feedback on product quality.