An approach to reduce complexity in logistics through IT
Forword

Part 1:  
Prerequisites for an IT standard for logistics  
Describable logistical processes by standardization and modularization  
University of Cologne, Seminar for business management and logistics  
Prof. Dr. Dr. h.c. Werner Delfmann (Director)  
Tobias Schmitz (Research Associate)  

Part 2:  
IT solutions for stable and agile processes in supply chain management  
Implementation of “Standardization by modularization” using the example of the logistics platform AX4  
AXIT AG  
Frauke Heistermann (Member of Management)
Dear logistics interested,

Standards are essential for logistics. Containers correspond to normed dimensions. And so do pallets and other loading equipment. But how about the individual links in a logistical process chain? The more dynamics enter cross-company controlling of international supply chains, the more variance is being produced. Sub-steps deviate from the desired comprehensiveness both in planning and realization. Suppliers and forwarders follow different workflows. Cost and risks in the supply chain increase.

Defining standards in controlling the process chain could remedy this. But how flexible or inflexible will logistics handling be with clearly defined performance modules? How can stability and agility in supply chain management be combined in an IT solution?

“Standardization by modularization” is the approach to reduce complexity in the process chain. The importance this topic is gaining in logistics is described by Prof. Dr. Dr. h.c. Werner Delfmann, director of the seminar for business management and logistics at the University of Cologne, and by AXIT AG in this strategy paper.

In the following pages science meets practice: While on one hand the structural challenges in standardizing performance modules in logistics are detailed, offers AXIT with the logistics IT platform AX4 on the other hand practical application examples.

We wish you an informative and inspiring reading!

Frauke Heistermann
AXIT AG

Prof. Dr. Dr. h.c. Werner Delfmann and Tobias Schmitz
University of Cologne
Seminar for business management and logistics
PART 1:

Prerequisites for an IT standard for logistics

Describable logistical processes by standardization and modularization

University of Cologne
Seminar for business management and logistics
Prof. Dr. Dr. h.c. Werner Delfmann (Director)
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STANDARDS AS LINKING ELEMENTS OF INDIVIDUALIZED LOGISTICAL PROCESSES

Logistical processes are individually and diversely tailored as the goods which are transported, stored or processed through them. Thus, in each producing company you can find highly-individual processes, adapted to the requirements of both production and product, while only few processes are fully comparable across companies.

Nevertheless, for these physical processes there are established standards to move any kind of goods flexibly and across various modes of transport. For example, standardized pallets, containers and other loading equipment help in transporting and exchanging diverse goods easily and with least-possible effort.

However, logistics not only describes moving goods from A to B but it includes all structures and processes which are required to move goods and the accompanying services, information flows and also financial flows through time and space.

In this respect the management of information flows has a special relevance. While standardized pallets, boxes or containers as loading equipment flexibly allow for moving all types of goods effectively and to use capacities efficiently, this cannot be performed with the same simplicity for the corresponding information.

LOGISTICAL IT SYSTEMS BETWEEN INDIVIDUAL AND STANDARD SOLUTIONS

IT solutions for logistics are typically either standardized programs which support expected process steps or they are individually configured resp. adapted systems mapping the user’s respective and individual situation.

This results in either implementing a standard solution which can only map partial areas of an individualized logistical overall process or in individual but often costly developments of IT systems tailored to individual partial processes.

Logistics actors are therefore presented with a decision between a compromise solution with monetary attraction (standard system) and degree of suitability or a custom-made solution (individual system), where the latter regularly results in higher expenses.
DEVELOPMENTS OF DELIVERY CHAINS REQUIRE FLEXIBLE YET STANDARDIZED IT SUPPORT

Besides this situation various logistics trends from the last decades have now consequences for companies. As an example, globalization has resulted in expansion of delivery and value added chains across national boundaries and continents. Furthermore, increased outsourcing of logistical and manufacturing activities has led to a larger number of actors involved in a product or delivery process. Finally also the growing variety of products and the end customers’ options to influence the design and varieties of goods leads to a growing complexity in the flows of goods.

To sum it up, companies, along with large numbers of external actors involved, spread out over an expanded geographical space, are facing logistics processes which are becoming more and more complex. In order to allow all involved actors to efficiently coordinate, control and – if necessary – adapt their logistical processes given this initial scenario especially supporting flows of information become a determining factor.

However, linking logistical actors with these very flows of information is increasingly becoming a time-consuming and cost-intensive challenge for the involved companies considering the background of complex logistical structures. Companies currently use many different IT systems which are not necessarily compatible with those of other supply chain partners. As continuous transparency and an access to the delivery chain’s data in real time are indispensable in the a.m. value added chain, EDI e.g. with the standard EDIFACT is employed. Yet, since this standard has been deployed, it seems that – in view of the previously described developments of logistics chains and the rapid spreading of the internet – this technology is rather outdated.

It is still hardly suitable for connecting partners in a delivery chain in a way that is affordable, quick and flexible at the same time. Besides connecting further partners to the systems (e.g. by outsourcing) it is mainly the mapping of a great variety of logistical processes which is a challenge for IT. Thus an IT standard must be flexible, quickly and easily implementable and scalable and also individually adaptable. So, in order for respective standard systems to be able to be developed and offered at an attractive price it is necessary that as many logistical systems as possible can be described in a standardized way in various company contexts. Consequently tool box type IT systems are required. But how can the idea of standardizing logistics be realized with a background of highly-individual processes?

The management of information becomes the determining success factor in logistics

Companies face a continuously growing number of external actors. This is what makes logistics more and more complex. In order to enable all involved actors to efficiently coordinate, control and – if necessary – adapt their logistical processes especially the supporting flows of information are becoming an essential factor.
STANDARDIZED DESCRIPTION OF LOGISTICAL PROCESS STEPS
AS TOOL BOX MODULES

Obviously a standardized logistics world with identical processes in varieties of companies with diverse goods is an illusion. Therefore it takes intelligent approaches to increase the degree of systems’ flexibility in regard to contents and connectivity and at the same time cover a variety of conditions and still be cost-effective.

The basic idea how to allow for this in a rudimentary way can be compared to an individually configured car: Also here the customer has the option to determine a product which is tuned to his needs within a certain range of choices. This is possible using a modular approach. But how can this approach be transferred to logistical processes?

The basic idea in this is rather trivial: If it can be done to define logistical processes in typified, modular units and to adequately describe them in IT then customers can compile these modules as per their needs and finally receive an individually-tailored IT concept for their logistics.

Each module for itself can then be applied in most logistical procedures. Such an IT concept allows for offering a standardized yet individually adaptable solution for individual customers and thus avoiding having to develop a new IT solution from scratch every time. In the end this means for all parties involved: Flexibility is gained, cost is saved. However, for logistical processes to be able to be mapped in their standardized partial processes they need to be describable in a harmonized way.

For example, one such approach for describing these modular process steps is offered by the so-called „SCOR model” (Supply Chain Operation Reference-Model), developed by the American Supply Chain Council. The panel’s attempt to structure logistical processes into small steps is targeted at obtaining an effective framework for analysis and improvement of said processes.

It requires alignment of logistical activities along this common framework in order to create the cross-company processes interoperably with the supply chain partners and to avoid unnecessary friction and waste of resources at the interfaces. The framework as a basis for a supply chain-wide logistics planning is meant to be a model here.

Standard modules allow for individual realization of IT concepts
If it can be done to define logistical processes in typified, modular units and to adequately describe them in IT then customers can compile these modules as per their needs and finally receive an individually-tailored IT concept for their logistics.
PART 1: PREREQUISITES FOR AN IT STANDARD FOR LOGISTICS

On a first level the SCOR model groups logistical processes across all supply chain partners in the five dimensions “planning”, “procurement”, “production”, “delivery” and, if applicable, “return”. On an underlying second level these five processes are further subdivided into various process categories, e.g. “transport processes” or “warehousing processes”. On a final and most detailed level these processes are then split up into small process elements, e.g. “arranging a transport load” or “goods receipt”.

In the overall picture this modular representation of various logistical part areas results in a detailed overview on the cycle of a full process, which, as an example, is partly summed up for a warehousing process in the following chart:

<table>
<thead>
<tr>
<th>PLANNING</th>
<th>PROCUREMENT</th>
<th>PRODUCTION</th>
<th>DELIVERY</th>
<th>RETURN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock planning</td>
<td>Order</td>
<td>Stocking</td>
<td>Stock removal</td>
<td>Refloows</td>
</tr>
</tbody>
</table>

**PROCESS CATEGORY**
- Inventory audit
- Demand forecast
- Stock planning
- Define order quantities
- Trigger order
- Pass on order internally
- Comparison actual delivery/ order
- Put goods into storage
- Book goods receipt
- Consignment & packaging
- Creation of delivery note
- Tour planning
- Delivery
- Return by customer
- Comparison return delivery and delivery note
- Checking of goods
- Return

The elaboration, alignment and structuring of logistical processes may appear simple at first, but it is complex and its contribution for achievement – if applied continuously in a delivery chain – is effective. Depending on the company context and degree of detail it can be further elaborated or reduced.

From an IT view the SCOR framework represents a modularization of logistical processes for which standard descriptions can now be developed. By individually combining the various modules these add up to an individualized overall process which is able to map the logistics system of a variety of companies.

Thus the goal to have a standardized description of various logistical processes and their related beneficial effects in IT and logistics would be at least in principle achievable.

THE CLOUD AS AN OPTIMAL PLATFORM FOR THE COMBINATION OF LOGISTICAL MODULAR SOLUTIONS IN A STANDARD APPLICATION

The question how such a concept can be effectively realized remains open. The requirements of modern delivery chains due to globalization, outsourcing and variety of products entail the need to connect many actors quickly, inexpensively and flexibly to a common IT system in order to ensure permanent data access, transparency and coordination options across the supply chain.

A cloud solution is especially suitable for this, for it offers:

- “Software as a service” on demand and in any configuration
- Maximum transparency for all logistics activities in the entire delivery chain
- Risk reduction due to shared view of the logistics chain in real time
- Contact with a large number of actors in the supply chain
- Easier organization and coordination of complex services in logistical relations
- Gained flexibility due to increased interoperability and scalability of IT systems
- Minimizes administration efforts and IT know-how requirements for users

Creation of physical logistical processes as close to the developed standard modules of a cloud-based tool box system as possible allows for using the maximum potential in standardizing and modularizing logistics-IT.
PART 2:

IT solutions for stable and agile processes in supply chain management
Implementation of “Standardization by modularization” using the example of the logistics platform AX4

AXIT AG
Frauke Heistermann (Member of Management)
1. DELIVERY CHAIN MANAGEMENT NEEDS STABILITY UND AGILITY

As the provider and operator of the logistics platform AX4, AXIT has been engaged in the topic of standardization of processes in delivery chain management for over 15 years. AX4 integrates all parties involved in a supply chain through one central platform and allows for a common view on their delivery chain. More than 100,000 users are currently connected to the logistics platform. Whether it is about transmitting shipments to a forwarding partner or about managing a global procurement process: At any time the parties involved have access to information, relevant for them, which they can share with other process partners. This way AX4 realizes smooth and efficient cooperation between those involved in the logistics process across companies. Continuous transparency is created, complexity is reduced and stable and reliable supply is ensured.

One of the key factors for successful reduction of complexity and for gaining transparency is the standardization of cross-company processes. At the same time standardization must not lead to a lack of flexibility which in logistics is always required to respond to changed general conditions or new customer requirements. It is for this reason that AXIT favors modularization of standard processes at the same time. By splitting up processes into modular, flexibly combinable elements AXIT creates the required agility in AX4 to react to increasing volatility and dynamization.

How “standardization by modularization” can be realized in practice by using IT solutions and which prerequisites need to be fulfilled will be demonstrated as follows.

PART 2: IT SOLUTIONS FOR STABLE AND AGILE PROCESSES IN SUPPLY CHAIN MANAGEMENT
2. GENERAL CONDITIONS FOR SUCCESSFUL “STANDARDIZATION BY MODULARIZATION”

In order to set up a standardized, IT-based process for all the parties involved in a delivery chain certain prerequisites are required – without these standardization will hardly be successfully realizable.

Prerequisites for standardization by modularization

1. Centrally available IT platform
2. Integration of all parties involved
3. Know-how on best practice processes
4. Product-driven software

2.1 Centrally available IT platform

Cross-company standardization of workflows cannot be achieved if each company only thinks and acts within its own internal IT and process world. All those involved need to look past their current in house systems’ boundaries. From a mere software point of view the need is for an IT solution that is centrally accessed from remote locations. A platform which links the individual system worlds and their acting persons. This way all the parties involved can – independently of locations – enter data or transmit data from their existing systems to the platform for further processing.
From AXIT's point of view the “Community Cloud”, on which the logistics platform AX4 is based, lends itself here. It is centrally available and each participant can get access to the available functionalities via web or interface. “Community” means here that the IT platform maps the “community of interests” of the users working together on a delivery chain or in a network. AX4's authorization and role concepts ensure that every user can see only the data he is authorized for.

An essential prerequisite is the consideration of important security requirements and conforming to data protection rules. The German Federal Data Protection Act (Bundesdatenschutzgesetz) represents the world's strictest rules on this.
2.2 Integration of all parties involved

All the process parties and also their IT systems need to be flexibly integrated with the centrally available IT platform – without any exception. Standardized processes can only be set up successfully if all participants deliver the required information and data and in turn can access the data which is relevant for them. A standard which includes only a part of the participants will not lead to the desired reduction of complexity since "old ways" will still exist on the side.

According to AXIT’s definition integration includes, besides the different companies also:

- different carriers (e.g. in multimodal transports) and
- different data levels (e.g. order, delivery note, shipment, loading list)
Flexible and modern tools must ensure that integration is done as easily and fast as possible to really integrate all involved parties. AX4 offers a broad spectrum of options:

- Access via web account
- Interfaces via EDI, XML, CSV, Web Service, etc.
- Support of various data formats ranging from industry-specific standards to individual formats
- Offers various ways of data transmission

With integration an important milestone on the way to standardization is reached:

- All relevant data is available.
- All involved parties have access.
- Transparency is continuous.
- Automation within the scope of interface connections reduces the options for manual special processes.
- Data quality improves as every participant transmits data to the platform and validates resp. completes data of the previous user.
  Thus data becomes “richer in content” with growing process progress.
2.3 Know-how on best practice processes

Another essential prerequisite for standardization is knowledge about processes, as the model for the standard process should not be just a random one, but rather the most efficient and best one. Experience and know-how on the required business handling is necessary for correct configuration.

In approx. 2,000 customer projects which AXIT has realized in delivery chain management it has turned out that per industry or even across sectors the same kind of problems arise. AXIT has turned this into patterns and modelled IT reference processes based on these. The knowledge and experience of AXIT's staff is thus systematically saved in these best practice processes.

2.4 Product-driven software

In order to be able to structure a software solution into individual, freely combinable modules the IT solution must follow a product idea. Flexibly combinable modules cannot be derived from a multitude of project-specific individual programs.

Only when software consequently follows the product idea it can be systematically split up into modules and be reassembled for other scopes of work.

Among others, a product software is characterized by:

• The software is subject to planned, systematic further development (Product Roadmap)
• Reusability
• Suitability of being multiplied
• Flexibility with regards to realizing changes
3. SOFTWARE MODULES FOR STANDARDIZED DELIVERY CHAIN MANAGEMENT

3.1 The combination of standardization and modularization to achieve agility and stability

Standardization by modularization is about combining stability (standardization) and agility (modularization) in an IT solution. Standardization must not mean that flexibility is lost or that solutions are “set in stone”.

At the same time flexibility must not lead to each and every new requirement being realized by individual programming, since a multitude of such individual solutions creates additional complexity and may be unmanageable at a later stage.

**Stability and agility must thus complement each other:**

- Complexity and increasing cost are responded to by standardization of processes, this results in stability.

- Increasing volatility and dynamization is responded to by flexibility which must also be ensured by IT.
The solution for both lies in standardization by modularization which consists of two essential segments.

1. Based on experience best practice processes are defined for certain application scenarios in delivery chain management (Standardization): e.g.
   - Order management with suppliers or
   - Shipment management with forwarders

2. These reference processes are split up into single components (modules). These can be:
   - Processes (e.g. shipment management / tracking)
   - Partial processes (e.g. shipment advice, shipment release)
   - Partial process variants (e.g. advice by e-mail or EDI)

The approach to modularization includes flexible combination of individual process parts and design of user interfaces via drag and drop with regards to content.

AXIT goes one step further in modularization: The customer himself gets the tool box to configure and maintain his solutions by on his own (AX4 Open).

### 3.2 Standardization of cross-company processes, using the example of the logistics platform AX4

From AXIT’s point of view there are three different areas which are essential for successful realization of a standardized IT solution for cross-company delivery processes:

1. Definition of roles and rules
2. Mapping of Best Practice Workflows
3. Consistent design of documents
3.2.1 Definition of roles and rules

One delivery process includes a large number of various actors with different areas of interest and views on the process. Each participant develops his individual work style, even though he is often facing the same tasks as his other colleagues along the delivery chain. When similar tasks are approached in different ways this may cause coordination problems, frictional loss and complexity is increased.

Therefore an important point is clustering the different participants of a delivery process into certain roles. Here each role has clearly defined tasks, rights and duties. Hereby AX4 ensures that not everyone works in his individual style but that participants sharing a role also work in the same way. Clear awareness of all involved parties about their rights and duties also facilitates fulfilling expectations set by upstream and downstream parties.

Example for role creation
An example for this is the procurement process. Here AX4 defines e.g. the following roles: suppliers, forwarders, orderers, control tower

- The suppliers receive orders through the central platform AX4. All orders are displayed for the suppliers in a consistent structure. The role of the supplier defines clear tasks, e.g. to confirm the orders and to submit changes as well as the creation of delivery notes and shipments. Stored rules monitor automatically if the suppliers are working within the agreed processes. For example, if an order is not confirmed back within a certain amount of time the supplier will automatically receive an e-mail reminder.
- The forwarders are tasked with confirming the pick-up, reporting back differences and confirming predetermined milestones via tracking status. They are also reminded automatically by e-mail if a milestone has not been confirmed at a certain time.
- The orderer’s function is to transmit initial order data to AX4, to inform on incoming volumes in the overviews and to take controlling action in response to discrepancies reported by AX4.

3.2.2 Mapping of Best Practice Workflows

The word “flow” already indicates an essential component of best practices, i.e. the goal to keep the process “flowing” or “moving”. This is achieved by mapping the best-possible process (Best Practice) via IT.

AXIT has used the know-how from over 2,000 realized projects on supply chain management to define reference processes for certain requirements. These can be sector-specific or general. During the process analysis AXIT assessed that across sectors similar “pain points” causing high efforts and increasing cost can be found along the delivery chain. The pre-defined best practices help in making these processes more efficient, faster and smoother, in reducing administrative efforts and in ensuring accurate and reliable supply.

Once it has been defined and mapped the workflow runs fluently and by itself. In part, it monitors and controls itself, i.e. certain events trigger defined actions. This leads to a degree of standardization where it is not necessary to manually intervene with the process.
Here is an example on a best practice workflow from the view of an industrial company.

In distribution the company works with 15 different forwarders and prior to the standardization it supplied them with shipment data through various channels. Also tracking data was received by the company in an unstructured way and through individual channels from the forwarders. With AX4 standardization was carried out.

- The industrial company transmits all shipment data through a central interface to the logistics platform AX4. From there three different ways of receiving shipment data are available for the forwarders: via interface, via web account or by e-mail. This way it is ensured that all forwarders receive their shipment data without having to support numerous individual channels.
- Also the feedback of tracking data is clearly defined: According to their assigned role forwarders are supposed to report status information. If they fail to do so they will receive reminder e-mails through the AX4 supply chain event management. The tracking data which is supposed to be reported back is defined in advance by the industrial company. Again, the forwarders have three channels to choose from: via interface, web account or mobile phone.

3.2.3 Consistent design of documents

Also a standardization of used documents is important. Often the involved parties do not create necessary documents at all, use totally different layouts or manually create documents with faulty or incomplete information. AX4 remedies this: previously defined document types (e.g. a barcode label or a loading list) are created as drafts once and stored centrally in AX4. Now all involved parties can access this central document, fill it with data and print it. There is no longer a risk that users create individual documents or adapt them as they wish – i.e. documents becoming “independent”.

Example for documents:

- The barcode label draft for the transport of a shipment is stored in AX4 once. This maps all information which the forwarder needs for handling the shipment: addresses, the routing barcode, the service type, etc.
- The forwarder accepts and confirms the label.
- Afterwards the barcode label is automatically created in AX4 based on the shipment data which have been entered and is available for printing by the user. No matter which user enters the shipment data, the label type which is used is always the same. For the forwarder this results in much easier identification of labels attached to a shipment as they are all standardized. Efforts for re-labelling – due to outdated labels being used – is drastically reduced as labels in AX4 are always up to date.
3.3 Modularization of IT solutions – using the example of the logistics platform AX4

The core element of modularization in AX4 is the option to split an entire process into freely combinable modules.

From AXIT’s point of view these are:

- **PRODUCT MODULES**  
  Best practice basic solution

- **PROCESSES WITH SUB-PROCESSES**  
  or sub-process variants

- **FREELY CONFIGURABLE SCREENS AND OVERVIEWS**

- **AX4 Open**  
  as an option for customers to configure solutions on their own

- **AX4me**  
  AX4’s user satisfaction program with individual customization options for users
PART 2: IT SOLUTIONS FOR STABLE AND AGILE PROCESSES IN SUPPLY CHAIN MANAGEMENT

PRODUCT MODULES

The best practice basic solution can easily be enhanced by different additional modules which can be activated for the customer.

**An example:** The best practice “Integration of forwarders for a shipper” can be enhanced by additional modules like a report module, freight cost calculation or time slot management.

SUB-PROCESSES

An essential component of modularization is to break down the overall process into individual sub-processes which, in turn, can branch into further process variants. These can be flexibly combined with each other.

**An example:** The process “supplier integration” includes the sub-processes receive order, confirm order, advise delivery note, release delivery note. The sub-process “confirm order” can then include variants like “discrepancies allowed”, “discrepancies only allowed within certain tolerances” or “create change request for ERP system”.

SCREENS AND OVERVIEWS

Each process finally ends in an entry mask (user interface) which serves to enter or retrieve data in a structured way. Modularization also concerns these user interfaces for entry and retrieval of data. From AXIT’s point of view modularization here means that screens can be freely defined in their fields and layout. Fields can be added or removed at the push of a button. This kind of flexible design allows for easier adaptation of the user interface to the customer’s needs and the process.

**An example:** The shipment overview – as output page for information – can be flexibly designed. It can be easily extended by the customer himself by adding another search category (e.g. tracking status) or another search criterion (e.g. delayed) to the selection. Special and recurring search requests can be saved on a separate result page and thus are directly retrievable at any time.
AX4 OPEN

Flexibility alone is not enough to respond to volatility and dynamization in logistics. It has to be enhanced by speed. For this reason AXIT provides its customers with AX4 Open, a tool box with which the customer can configure his SCM IT solutions on his own: “Do IT Yourself”. Process changes can thus be realized faster and more directly. AX4 Open is divided into the following core areas:

- Creation and administration of workflows
- Creation of documents
- Creation and editing of entry or overview screens
- User Management
- Definition of notifications
- Storing and maintenance of profiles

An example: A logistics provider using AX4 Open can create further users who are authorized to enter shipment data into AX4 via web by himself. He edits the shipment entry screen, i.e. by adding new fields which are required for complete shipment entry. He copies a solution that has once been stored for a customer in order to adapt it then for another customer.

AX4me

With AX4me the individual user has the option to independently activate certain functions which facilitate his work with AX4 and which correspond to his individual work style. AX4me is aimed at the logistics platform AX4’s usability and individualization and thus increases each user’s productivity and the efficiency of processes. Additional functions increase user-friendly working and allow every user to make individual settings which optimally correspond to his own needs.

Examples for modularization on user level are activation of an excel download for overview data, the individual creation of overviews, adding of comments to a shipment.
4. DEPICTION OF BENEFITS IN SUMMARY

By realizing “standardization by modularization” comprehensive advantages can be achieved in delivery chain management:

**Efficient processes**
- by using best practices

**Stable and reliable delivery chains**
- by integrating all parties involved and by smooth cooperation

**Reduced complexity**
- by standardization, coordinated work and sharing of information

**Reduced controlling efforts**
- by cross-company transparency

**Flexibility in quick reaction in case of changes**
- by modular conception, information transparency and foresighted working

**Easily scalable and multipliable solutions**
- due to centrally available IT solution

**High acceptance with all involved parties**
- due to various process and integration variants being available, and due to adapted user interfaces
Editors

AXIT AG
connecting logistics
Nachtweideweg 1-7
67227 Frankenthal
Phone: +49 6233 / 45943-0
Fax: +49 6233 / 45943-900
www.axit.de

University of Cologne
Seminar for business management and logistics
Albertus-Magnus-Platz
50923 Köln
Phone: +49 221 / 470-3951
Mail: bpl@wiso.uni-koeln.de
www.bpl.uni-koeln.de

Further information about the use of the logistics platform AX4
as well as examples of best practices you can order at: info@axit.de