Services for Sustainable Forest Timber Supply Chain Planning and Control: Development, Implementation and Usage

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Abstract

Economic pressure on timber industries, increased European timber imports and exports and growing demand for forest biomass as a renewable energy are compelling forestry operations to optimize value added processes to generate savings. Since the supply chain from the forest to the factory incurs the most costs, efficient organization of logistics is an important secondary aspect. The Fraunhofer IFF and Landesforstbetrieb Sachsen-Anhalt have developed an approach to planning and controlling logistics processes in the forest timber supply chain that integrates small and medium-sized service enterprises. The extended open concept enables service providers to exchange a forestry operation’s logistics information bidirectionally (good practice approach). As service providers endeavor to enhance value added and minimize resource consumption while protecting business interests, approaches and solutions have been applied to optimize forestry operation processes with service providers and clients. An example from the field illustrates the positive effect standardized interfaces and open services and solutions have on internal and external processes by increasing value added and improving resource management. Nonetheless, the supply chain is rife with potential risks, particularly for micro and small enterprises, e.g. new technology use, changing processes and shifting cost types and shares. International research projects have applied alternatives for action to minimize and prevent risk.

Key words: Timber Logistics SCM, Information Exchange, Partner and Process Integration

Introduction

The German forestry and wood processing industries have been experiencing a process of continuous change for some years now, in part because the good global market situation until 2006/2007 induced the timber industry to increase production capacity. More than 1.7 billion Euros have been invested in Saxony-Anhalt alone. Moreover, the overall demand for forest biomass has increased as the volume of European imports and exports has risen and the utilization of renewable energies has intensified [4].

The attendant pressure of demand is particularly placing new demands on the forestry industry. Global competition and sustainable forestry measures are compelling forestry operations to produce more cost effectively and efficiently. If they are to survive internationally, German forestry operations will specifically have to optimize their processes throughout the value added chain from the forest to the factory to cover the mounting demand for timber and realize potential savings. They will also have to make the unused biomass potentials in the private forest sector identified by the Bundeswaldinventur 2 accessible [2]. Private forests predominantly have small and greatly fragmented structures. The overwhelming majority of the over two million forest owners only supply small quantities of timber and frequently have insufficient machinery or none at all. These factors hamper the mobilization of private forest owners’ reserves of raw materials for material and energy recovery.

National and state laws in Germany that require owners to manage their private forests sustainably complicate these challenges even more. The forest is not only regarded as a source of raw material but also as the basis for the protection of species, soil, climate and water as well as a site for public recreation. Hence, forestry industry measures are constantly balancing economic and ecological interests to satisfy the different claims on a forest [1]. The variety of profit-oriented forest management scenarios geared toward nature and nature conservation possible in conjunction with this will directly influence the future availability of the raw material timber and the certainty of supply for future industry demand [4].

In the context of comprehensive structural changes in Germany entailing downsizing of forestry personnel, the aforementioned aspects of mandatory sustainability, mounting demand and international competitive pressure underscore the new challenges forestry operations have to tackle. Thus, cost effective and on schedule timber deliveries are increasing becoming a com-
petitive factor for forest owners, forestry operations, the wood processing industry and even service providers. The technical possibilities in the material flow, e.g. improved harvesting and transport technologies, have largely been exhausted. Therefore, analyses are needed to determine how and above all where productivity can be increased and the supply process organized more efficiently.

1. The Problem

Managing a total of over 3.2 million hectares of forest and 246,000 hectares on average, German and Austrian forest management agencies have downsized personnel considerably in recent years. For the most part, administrative staff has been transferred from business operations to other domains. Various indices from the annual German Federal Government Agriculture Report and the individual forest management agencies’ annual reports reveal that, among other things, the mechanization of harvesting and the outsourcing of work with high labor costs approximately halved the share of labor costs from its original 40% to a good 20%. However, indirect labor costs rose so much in the same period that staff reductions did not result in any savings and labor costs even rose [Sek02].

Trends discernible in the reforms and rationalization in Germany indicate forest management agencies will continue to concentrate on their core competence of organizing and supplying timber and to downsize administrative and forestry staff [7]. This has been recommended by diverse cluster studies conducted in various German states, which identified labor costs as a particular weakness in SWOT analyses and a commensurate need for action [3].

The steadily rising demands on the actors in the supply chain to react rapidly and flexibly to ever more complex external market influences makes efficient and transparent planning and monitoring of the supply chain essential. Therefore, various national and regional projects have been initiated in Germany in recent years to systematically identify existing problem areas and possible solutions. The outcome has been the identification of basic conditions for organizational and operational structuring as factors that actively influence a timber value added chain free of format changes (Landesforstverwaltung NRW, 2003). Moreover, the standards ELDAT [5] and GeoDat ShapeForst [6] have been developed for select aspects of data exchange related to timber logistics.

Numerous studies and projects have demonstrated that cross-actor and sustainable information and data processing, i.e. electronic information exchange, facilitate more efficient organization of logistics. Specifically, solutions that eliminate format changes, fundamentally improved planning and control processes, optimization algorithms for routing and return cargo, spatial data and mobile technologies have been employed to achieve the desired effects. However, general and wide ranging implementation of project results and standards has been thwarted as much by attempts by states and organizations to go it alone as by

- Heterogeneous IT infrastructures,
- Inadequate interface standards for cross-actor and cross-system timber logistics,
- Hardware and software incompatibilities and
- Unacceptable sales and cost concepts from IT service providers.

Such obstacles not only diminish acceptance among the smaller partners being integrated during the development of such projects, i.e. SME, but also increase the reluctance among larger companies to invest in and implement them.

2. Solutions

The intensified use of electronic data exchange to optimize internal company processes also constitutes a great risk. The implementation of or the pressure to implement electronic data exchange may generate costs for service providers and customers, i.e. costs in the supply chain may be shifted from one actor to another.

Various approaches may be considered to identify sustainable solutions for this and the aforementioned problems of acceptance and readiness to invest. They must be compared bearing in mind the constraints on the actors involved who have their own priorities when it comes to electronic data exchange and ensuring service providers are properly equipped with I&C equipment. Three approaches with own advantages and disadvantages are conceivable:

- An industry solution
- An integrated solution or
- An integrative solution.

Unlike in the automotive industry for instance, a complex industry solution would not
function here in light of the number of actors acting as timber providers, service providers or timber buyers. The technical requirements are too complex and could not be implemented for every actor involved. In addition, there are other major challenges, e.g. creating a user and rights concept that meets with acceptance.

Integrated solutions, so-called platforms, have minimal user requirements. An Internet connection usually suffices to be able to utilize such solutions. The challenge of creating an accepted user and rights concept is the drawback here too. Moreover, the time and labor required and thus the costs to operate and update the platform, e.g. by connecting other actors’ systems through new interfaces, and to secure data and transmission are indeterminate.

An integrative infrastructure based on interfaces and services represents an alternative solution all actors can use to employ specific services geared toward their core processes to electronically exchange data on the one hand and to improve their own processes on the other hand.

Fig. 1. Overview of alternative solutions

The implementation of these solutions confronts service providers, with the great challenge of preparing themselves to handle IT, especially if they have never implemented IT. At any rate, a cross-actor solution necessitates a well conceived concept that factors in the integration of such solutions in internal company processes and existing IT structures.

3. Implementation

Landesforstbetrieb Sachsen-Anhalt was one of the first public forestry operations induced by structural changes accompanied by radical downsizing to make new demands pertaining to communication and coordination on its remaining staff and its service providers. Since the reduced staff is supposed to organize even more logging, efficient information exchange free of format changes has become indispensible.

Initial projects aimed at producing solutions and applications to achieve these goals developed and piloted a complete technical system for Saxony-Anhalt’s forestry and wood processing industries. Originally designed purely as a platform, the suggestions and expectations of numerous actors involved in the timber logistics process were incorporated to produce the first ever approach to an integrative platform for the planning, control and monitoring as well as controlling of timber supply chains. It constituted the basis for a concept to coordinate processes between the actors involved in the supply chain from the forest to the factory. The complete solution not only served as the core system for the roll-out of technical equipment and IT applications for different target groups but also the operation of an integrative platform and the provision and further development of individual services.

In many cases, the actors combined the rigorous use of complete integrative systems in their daily routine with the organization or reorganization of their internal workflows or even the upgrading and customization of their IT systems with interfaces and applications for mobile terminals. This especially occurred among individual
actors who intended for their already existing sophisticated internal systems to exchange data with the overall system in the future.

This was the impetus to begin progressively implementing high value added solutions to utilize existing technical options and, above all, provide every partner access. The individual modules of the complete system were prioritized and implemented within the integrative approach, i.e. existing solutions were adapted and equipped with appropriate interfaces for cross-actor information exchange. By quickly taking advantage of the technical options at its disposal, this approach enabled Landesforstbetrieb Sachsen-Anhalt to generate appropriate models that are conducive to its own internal processes (direct benefit) and provide every (direct) partner access (indirect benefit). Ultimately, initial improvements were made in cross-actor communication and the logistics process was modified.

Obstacles included the forestry sector’s lack of any integrated cross-actor and cross-industry infrastructure that might aid in combining services geared toward core processes. Consequently, there is still not any substantial electronic data exchange. The implementation of solutions for electronic data exchange creates an opportunity to convince service providers who have little or no technical equipment at their disposal of the value added of a solution and electronic data exchange and, where necessary, to invest in equipment on the service provider side.

Exchanging electronic data with every client is but one way transport service providers may take advantage of the practicable solutions with value added. Given the current market and economic situation, route planning solutions with efficient scheduling of one’s own drivers’ and routing including driver instructions are extremely interesting economically. The results of planning can also be transmitted through electronic channels. Furthermore, vehicles can be monitored with localization technologies and, where applicable, provided new job orders at short notice. Information on the status of the execution of transport orders can additionally be obtained when the driver utilizes appropriate software solutions, e.g. off-road-navigation systems, or hardware solutions, e.g. telematic boxes with status keys. Status information can in turn be incorporated in carriers’ planning processes and, as an overview of electronic data exchange in an integrative infrastructure illustrates (Fig. 2), are also interesting for the Landesforstbetrieb.

Fig. 2. Value added through extended solutions for carriers

Not only transport service providers but also actors with other jobs and functions in the supply chain are clamoring for such solutions for implementation in their organizations. Nonetheless, they will only invest in such systems and only incorporate them in their operations when they maximize value added and, for example, the job order data from every client can be transmitted electronically. This presupposes data is exchanged through standardized interfaces to keep costs to a minimum.

4. Use in the Field

Electronic data exchange based on the concept of an IT infrastructure integrating various actors’ solutions and applications has been implemented in Saxony-Anhalt. The actors involved, existing interfaces and implemented solutions interact in a variety of ways (Fig. 2).
The Landesforstbetrieb, forest service providers and the timber industry have implemented internal information systems for internal process planning, control and accounting (1 and 2 in Fig. 3). These stationary central systems are supplemented by mobile solutions (3 and 4) used by staff on site to collect and process information, e.g. applications to capture data on harvester harvests, register decks or navigate. Data or machinery captured and being captured by company staff on site is exchanged with the central system through interfaces.

Standardized interfaces are particularly important where the process shifts to the carriers. While the ELDAT standard was already defined earlier for data exchange between forestry enterprises and the wood processing industry (7), universally valid rules for the exchange of logistical information were and still are nonexistent. Therefore, a process has been initiated in Saxony-Anhalt to reach agreement with transport service providers on standardized formats for the purpose of efficient data exchange (5 and 6). This is a significant competitive aspect especially for smaller (transport) service providers since they have neither complex internal systems with professional data import and export functions at their disposal nor the necessary personnel and financial capacities to create and maintain the numerous data interfaces generated by business relations with normally several forestry enterprises and processing companies.

Once they have imported electronic data on the execution of outbound transportation job orders from the Landesforstbetrieb or wood processing industry’s central systems through standardized interfaces case by case, the carriers employ internal solutions (8) to schedule transportation orders and manage the outbound transportation of timber. Technical and human resources’ time and capacity are planned, supported by functions for routing and transport optimization. Prior electronic capture of information on the timber’s geographic location (3 and 4) and its transmission to the carrier makes this possible. Dispatched transport orders are then no longer handed over to the assigned drivers on paper since their mobile systems (normally a PDA or tablet PC) usually furnish them with functions for navigation and transport order status reporting (9). Navigation that also allows off-road driver route guidance to a specified deck coordinate can significantly reduce time spent searching for or being shown the way – a clear gain in efficiency both for the carrier and the client.

The functions for reporting the status of transport orders generates another advantage from drivers’ use of mobile systems. By capturing the information whether a deck is fully outbound, can be driven to again for a complete load or has been reduced to a small load, the dispatcher obtains a prompt and up-to-the-minute overview of the status for internal plan-
ning. Moreover, relevant for control and accounting purposes, the electronic exchange of this information with clients (10) can likewise generate more transparency and efficiency.

Conclusion and Outlook

Work on providing applications and services to improve logistics in timber supply processes from the forest to the factory has reached a point where initial applications such as deck management, route management and off-road navigation have already been implemented among actors in Saxony-Anhalt and other supplementary value added solutions with great potential are being developed further. At the same time, existing solutions are being rolled out further and interfaces refined and adapted. Other German state forestry operations and wood processing industries have initiated projects modeled on the approaches from Saxony-Anhalt and aimed at implementing preparatory measures to utilize these solutions. Among others, this includes processing data for navigation and implementing interfaces for data exchange. These activities are accompanied by a desire to develop interstate cooperation that will ultimately be instrumental in establishing acceptance among small and medium-sized service providers. Current research activities related to the solutions for information exchange and improved logistics are, for instance, focusing on the use of advanced identification technologies (RFID). Among others, the goal is to make essential information pertaining to the timber, e.g. provenience and quality, clearly available at every point in the material flow so that there can be no mix-ups.

The development of a basic infrastructure is a fundamental basis for implementing and rolling out the developed solutions, particularly among the smallest actors in the timber supply chain. The Fraunhofer IFF is also addressing this aspect in its development work and endeavoring to establish appropriate collaborative relations with hardware and software providers and distributors.

An important success factor of the approach thus far has been the well-conceived IT concepts matched to the processes and the collaborating parties (internal staff, service providers, clients, etc.). Actors will only be moved to invest when they are convinced they will benefit directly and indirectly, i.e. through value added.

Another aspect that has led to the success of the approaches from Saxony-Anhalt was the intention to produce not high end solutions in the first stage but practicable implemented solutions with high value added instead.

References: