Managing complexity and bringing order processing to excellence
Supply Chain Planning Challenges in the ETO Business

Engineer to Order (ETO) manufacturers produce customer-specific products that require unique engineering or design work, or significant customization activities. Typically, small production quantities including different versions and a huge variety of parts must be managed.

The ETO project order lifecycle begins with the acquisition phase, which itself requires reliable information from engineering, procurement, and production. Acquisition is followed by the project realization phase, in which engineering activities develop the final basis for production and procurement.

As a significant proportion of the total cost and lead time is incurred in the early phases, competitive planning processes must set in at the very beginning of the lifecycle and manage the complete lifecycle on an ongoing basis.

The challenges faced by ETO manufacturing companies are a result of this specific background of individual customer requirements and product specifications. The following major challenges can be identified in the operations planning of ETO contractors:

- The composition of today’s ERP data structures does not support planning requirements throughout the project lifecycle
- Function-oriented planning processes and organizational structures prevent efficient operational management of project orders
- Synchronization of the project planning initiated in the acquisition phase with the production scheduling in the advanced phases of the project order lifecycle is virtually non-existent
- Innovative technical applications to support planners in managing the complexity of the project are often not found
A major challenge of ETO operations is the uncertainty in product and process design during the early engineering and design phases (low level of specification). Classical MRP planning tools are designed for manufacturers using well-tested product and process design, as they require a bill of materials for materials planning and a specified process design for capacity requirements planning.

Consequences

- Data structures for conventional production planning tools are usually not available at an early stage of the ETO project order lifecycle
- Rough-cut operations planning at an early stage thus takes the form of a black box approach in most ETO manufacturing companies

Camelot ITLab solution approach

- Data structures that can master the uncertainty must be applied. Camelot suggests using project schedules or project networks for ETO projects that consist of several linked operations
- Project schedules tackle the uncertainty as they can be applied to plan operations at an aggregate level only
- Project schedules have the necessary flexibility to cope with constantly changing product and process specifications

By using project schedules, all relevant operations within the ETO project lifecycle, in particular development, engineering, and manufacturing processes, can be integrated into one data structure. This enables aggregate, rough-cut planning right from the beginning of the project lifecycle.
Most ETO manufacturers have in the past had to follow a two-stage planning approach that separated engineering from production planning. Like most other manufacturing companies, ETO companies generally face the problem of separate planning approaches for different functional divisions, leading to a lack of transparency. In organizational terms, this often manifests itself as planning, monitoring, and action taking that focuses only on one’s own individual functional area, without considering cross-divisional and cross-project impacts.

Consequences

- **Efficient and adequate decision-making** throughout the project lifecycle is not possible
- Planning changes are not propagated along the supply chain, resulting in **higher stocks** of valuable materials, a **lower service level**, and **costly fire-fighting**

Camelot ITLab solution approach

- Set-up of an integrated supply planning process based on a harmonized, single planning philosophy across all departments and functions
- Customer orders are centrally planned and feasible delivery dates can be determined throughout the entire customer order lifecycle
- Clearly defined escalation processes enable rapid business decisions
- A dedicated role for managing the integrated supply chain planning process is essential

The designed planning and execution processes guarantee an efficient information flow as well as enabling fast and proactive supply actions and a valid project status evaluation. The cross-divisional positioning of the ETO supply chain planning role ensures organizational acceptance and process reliability.
Having applied the integrated rough-cut planning approach based on project schedules as described above, ETO manufacturers still face a difficult challenge: At a certain stage in the project lifecycle, planning data such as bills of material and process plans will reach a specification level that is good enough for detailed planning (MRP, CRP).

**Consequences**

- **Production planning processes at a rough-cut and detailed level must be integrated** (vertical process integration) in order to avoid the coexistence of two autonomous and unconnected planning approaches.

**Camelot ITLab solution approach**

- The rough-cut planning process sets the operational framework for detailed production planning and scheduling (time buckets and rough capacity requirements at qualification pool level)
- Within that framework, advanced heuristics developed by Camelot ITLab automatically sequence the weekly shop floor workload at a detailed level
- Feedback of the actual product and process data from a detailed to a rough-cut level allows refinement of the project schedule for rough planning based on the detailed data finally specified

This solution approach enables the ETO supply chain planner to focus predominantly on the rough-cut planning process. He is able to manage projects throughout the entire project order lifecycle, from the first quotation to delivery to the customer.
The immense complexity inherent in ETO operations can scarcely be mastered by traditional production planning systems. The ETO supply chain planner’s role as a central information hub adds to this complexity.

Consequences

- ETO supply chain planners need time-efficient planning, monitoring, and exception-handling features.

Camelot ITLab solution approach

- Intelligent exception-based management supported by modern advanced planning systems (APS) enables a focus on the real planning issues, as alerts about planning and execution deviations from rough and detailed planning are displayed.
- The APS concept also fosters the supply chain transparency that is required for pro-active supply chain management.

Based on the latest technology seen in advanced planning systems (APS), Camelot ITLab has developed several progressive planning features that are tailored specifically to the needs of ETO supply chain planners:

- **Advanced alerting**: The actual planning problem is clearly highlighted in the graphical planning board for easy navigation, as is the critical path from the planning problem to the customer due date. An invaluable feature for propagating the exception to the person in charge and for efficient evaluation of different planning alternatives.
- **Advanced planning functionalities** such as the simple, direct adjustment of duration or capacity requirement of network operations within the graphical planning board facilitate effective ETO supply chain planning.
Benefits at a Glance

- Managing uncertainty in product and process design and different levels of detail throughout the project order lifecycle
- Integrating relevant supply planning activities to actively steer projects across departments at every stage of the project lifecycle: ensures delivery dates are adhered to and backlogs minimized
- The vertical integration of rough-cut planning and detailed scheduling makes it possible to manage projects throughout the entire project lifecycle, from the first quotation to delivery to the customer
- Transparency in complex order networks of different projects
- Reduced complexity through implementation of an exception-based management approach and advanced planning features designed for ETO manufacturers

Considerable improvements in the relevant KPIs have been realized in initial implementation projects:
- Lead time reductions of 30-40%
- Increase in service level of 20-30%
- Inventory reduction of 20-25%
Camelot ITLab GmbH
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