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*"The journey of M-Industry is impressive. Moving supply chain planning to the next level across so many different businesses requires strong leadership, a clear purpose-driven vision and strong execution. The open collaboration and deep knowledge of Deloitte and SAP Consulting laid the foundation for the successful transformation enabled by SAP Integrated Business Planning for Supply Chain"*

**Arsim Jahii**

Head of Digital Supply Chain, Switzerland  
SAP Schweiz AG

# Supply Chain Planning across M-Industry

This paper describes the successful implementation of SAP IBP for demand, SAP IBP for response and supply, SAP IBP for sales and operations and the SAP Supply Chain Control Tower at Migros Industry (M-Industry).

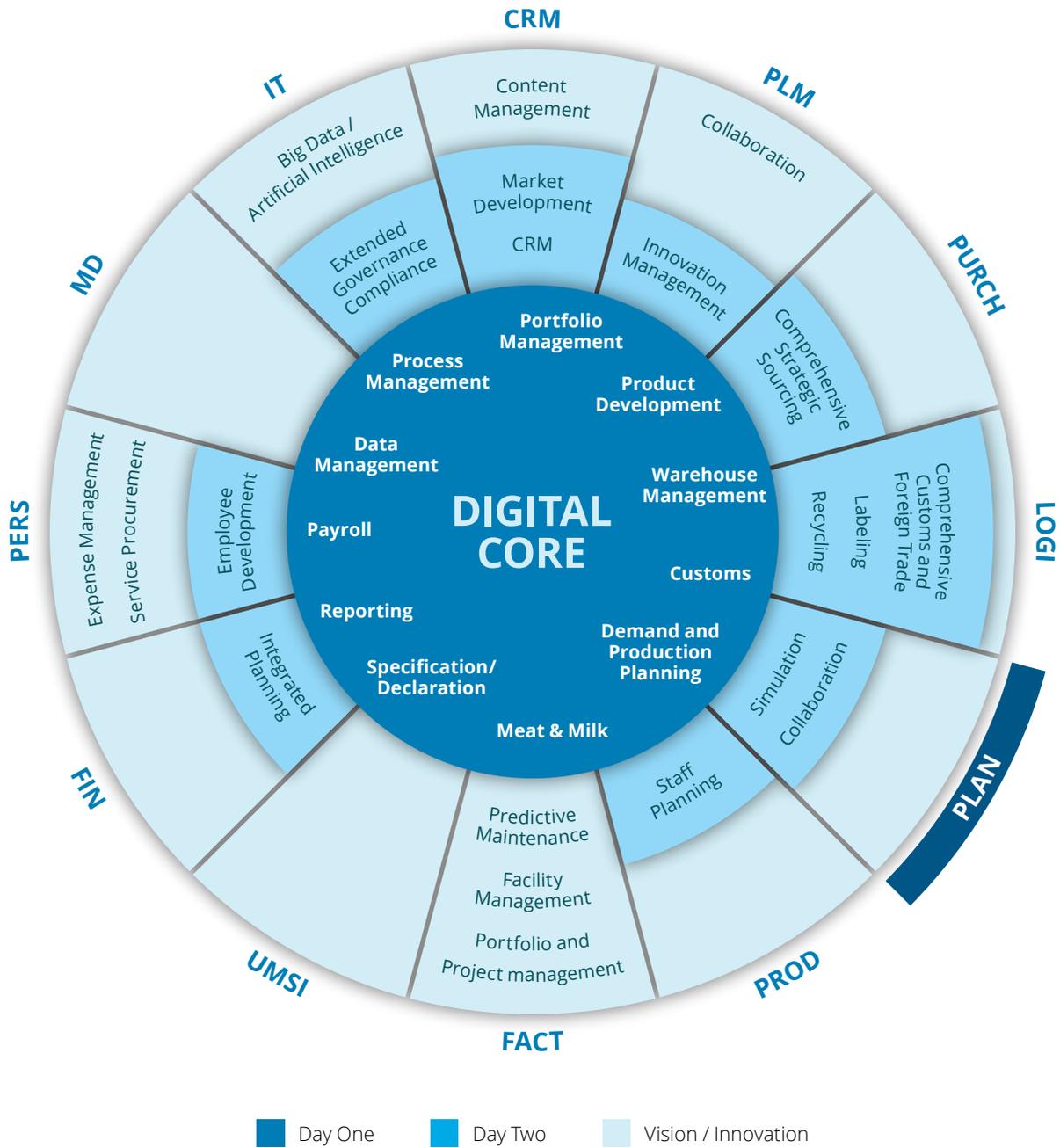
This section begins with an overview of the project scope, followed by insights into the planning processes. The subsequent sections explain how these processes are implemented in SAP IBP and integrated into SAP S/4HANA via SAP Cloud Platform Integration for data services (SAP CPI-DS). The paper concludes with a summary of our lessons learned.

The implementation of SAP IBP is embedded within the larger project 'ONE Smart Solution' which aims at harmonizing processes, systems and data across the entire Migros Industry. M-Industry consists of 30+ companies producing and selling food, beverages and other convenience products. This five-year business transformation program started with initialization and design phases, followed by a common core and pilot implementation, and continues with several roll-in waves integrating more and more M-Industry companies into "ONE Smart Solution".

On the process side, a new operating model was defined, with 12 functional teams designing the business processes and scenarios.

On the system side, a 'Digital Core' is built on SAP S/4HANA, into which additional systems are integrated. In this context, SAP IBP is selected to cover Supply Chain Planning (PLAN) processes.

For Supply Chain Planning, the main challenges relate to the diversity of the industries. Statistical forecasting, planning inputs, promotions integration, daily planning, shelf life considerations, capacity constraint types, master data hierarchies and integration logics have substantially differing requirements between industries. As most of the industries have been using SAP Advanced Planning and Optimization (Demand Planning & Production Planning and Detailed Scheduling) or other highly customized planning solutions, expectations about automation and advanced functionalities were high.



# Planning processes

## SCOPE OF PLANNING PROCESSES

Migros Industry's integrated supply chain planning processes consist of an operational Demand Planning (DP) and an operational Supply Planning (SP) module, and both are integrated into a tactical Sales and Operations Planning (S&OP) process. The planning horizons vary widely between the M-Industry companies but typically are up to 3 months for operational planning and 3 to 24 months for tactical planning.

### Sales and Operations Planning

Sales and Operations Planning (S&OP) is a tactical supply chain planning process that concludes with a monthly management meeting. The S&OP management group also meets ad hoc if events occur that require urgent management attention. During the regular monthly meeting cycle, the following questions are addressed: What should be sold? What should be supplied, and to whom? How profitable is the plan? The answers to these questions align the Supply Chain, commercial and financial functions of the organization in the following five steps: (1) Product Review, (2) Demand Review, (3) Supply Review, (4) Pre-S&OP and (5) S&OP Meeting. Each step is implemented and concluded with a meeting. The outcome is a validated integrated business plan which flows back into operational planning and execution.

The main integration points with other processes are:

- PLM: Product lifecycle data (phase-in, phase-out, replacement)
- CRM: Customer information (business partner and corresponding hierarchies)
- Production: Production information (capacity, availability)
- Logistics: Transport and warehouse information (capacity, lead times)
- Procurement: Supplier information (capacity, lead times)
- Finance: Prices, revenues and cost integration.

### Demand Planning

Demand Planning is usually a weekly operational process, but for some product categories like fresh products, it is a daily task. It aims at producing an unconstrained demand plan by combining different inputs such as product lifecycle data, statistical forecast, and inputs from demand planners, sales and marketing executives, customer orders, promotions as well as external forecasts, e.g., from customers directly. The demand planning process consists of five main steps: (1) Cleanse historical data, (2) generate a statistical forecast, (3) incorporate manual inputs, (4) release the demand plan and (5) measure planning quality.

The main integration points with other processes are:

- Seasonal planning: For products that are only sold during certain time periods or seasons such as Christmas, Easter, Summer BBQ, etc.
- Promotion planning
- Customers: External forecasts
- Sales and Distribution: Sales orders

### Supply Planning

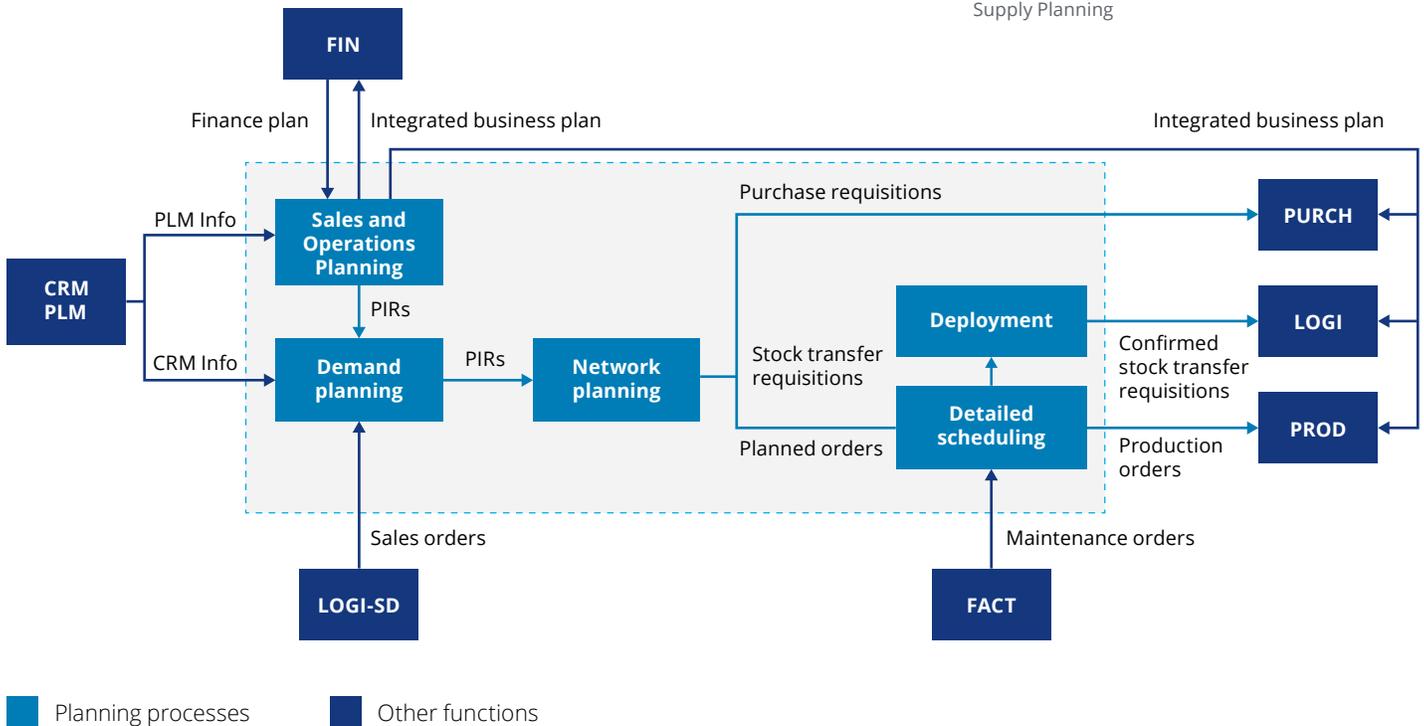
Supply Planning is a weekly or daily operational process. It aims at defining what should be produced, transported and procured throughout the supply network, and where this should happen, in order to satisfy expected demand. It consists of network planning (incl. rough-cut capacity planning), detailed scheduling and deployment planning.

The main integration points with other processes are:

- Production: Planned orders and process orders
- Logistics: Stock transfer requisitions and orders
- Procurement: Purchase requisitions and orders
- Facility management: Maintenance orders



Figure 2. High-level integration map for Supply Planning



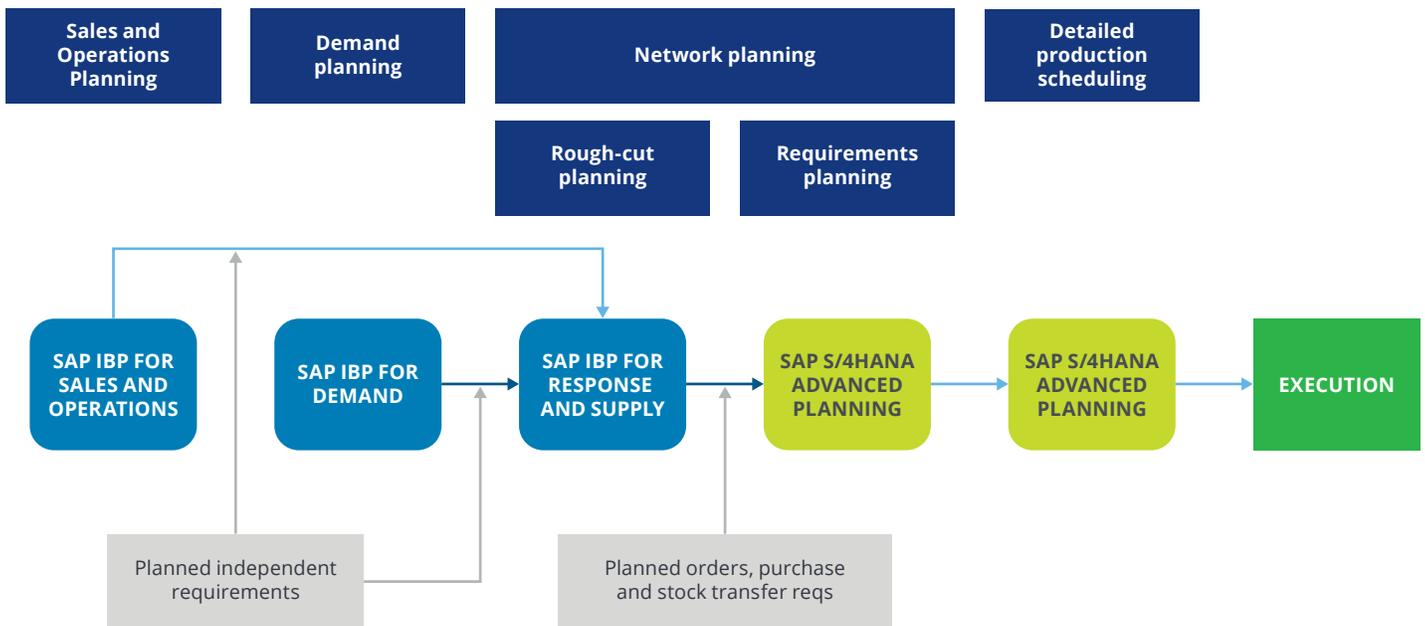


Figure 3. System landscape for supply chain planning processes

## SYSTEM LANDSCAPE FOR SUPPLY CHAIN PLANNING PROCESSES

The figure 3 shows how the planning processes are supported by both SAP IBP and SAP S/4HANA.

To accommodate different planning needs from different M-Industry companies and to allow for maximum flexibility, the supply chain planning model offers two distinct operational network planning options, with either SAP IBP or SAP S/4HANA as the lead system.

### Supply Planning in SAP IBP (rough-cut planning)

In Supply Planning with SAP IBP, SAP IBP for response and supply is used to propagate demand through the supply network, to assess the impact in terms of different constraints (production or storage capacity), to make adjustments to the plan and finally to integrate production, transport and purchase quantities into SAP S/4HANA. During integration, these supply quantities are converted into planned orders, respectively stock transfer and purchase requisitions. This solution allows planners to use time-series-based planning (i.e. in weekly buckets), as well as to benefit from SAP IBP features such as What-if analyses, dashboards analytics, alerts, etc.

After the transfer from SAP IBP to SAP S/4HANA, the supply planning process continues in SAP S/4HANA: this includes Materials Requirements Planning (MRP) for components that are not planned in SAP IBP, as well as detailed scheduling with SAP S/4HANA Advanced Planning.

The integration of orders is designed to work both ways. Planned orders (firmed and date-fixed planned orders), process orders, stock transfer or purchase requisitions (firmed) and purchase orders, all created in SAP S/4HANA, are transferred to SAP IBP. This synchronizes the two supply plans with each other: a precise order-based plan in Production Planning and Detailed Scheduling and a rough-cut time series-based plan in SAP IBP.

**Supply Planning in SAP S/4HANA (without rough-cut planning in SAP IBP)**

In Supply Planning with SAP S/4HANA, SAP S/4HANA is the lead planning system. It uses the Planned Independent Requirements (PIR) transferred from SAP IBP in order to generate supply elements. The entire supply network and production planning is executed in SAP S/4HANA.

**Remarks**

- The decision about which of the two options to select is defined in the material master at plant level (MRP type).
- Regardless of the chosen option, both systems remain synchronized, due to regular data transfers between them.
- Both supply planning options can be combined, either horizontally or vertically. Horizontally means that SAP IBP is used for long-term planning, while SAP S/4HANA with Advanced Planning is used for short-term, operational planning. Vertically means that the split can be done at material-plant level, e.g., based on material type. Higher material type

levels, like finished products and / or semi-finished products are planned in SAP IBP, while lower level material types are planned in SAP S/4HANA. Currently, only the vertical option is implemented. Which option to choose is based on the process maturity and required flexibility of the planning teams.

The figure/diagram below presents an SAP IBP-centric view, highlighting the integration with the SAP S/4HANA for core use and other systems.

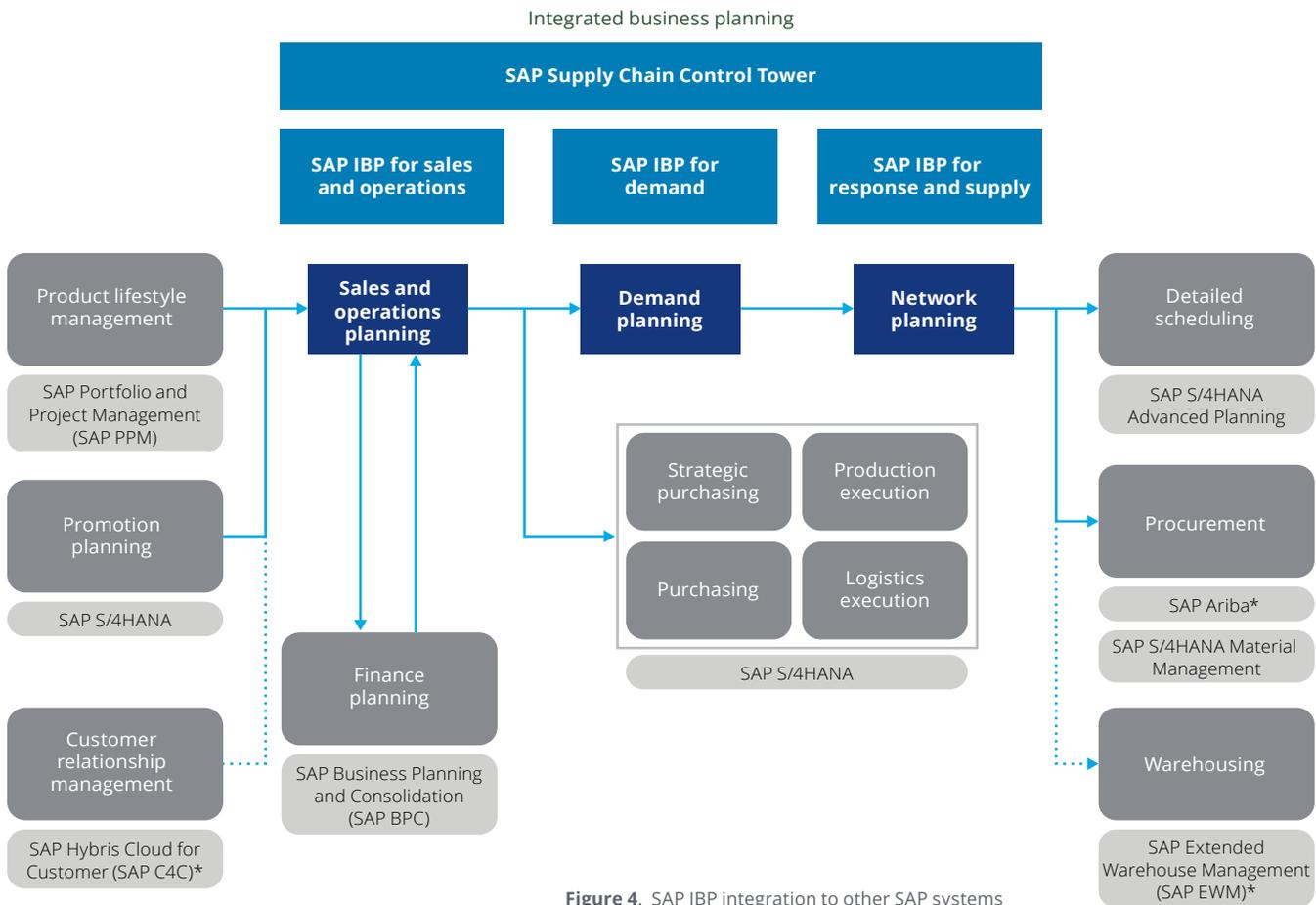


Figure 4. SAP IBP integration to other SAP systems

\* Indirect integration via SAP S/4HANA

# SAP Integrated Business Planning for Supply Chain

## FUNCTIONAL SCOPE AND PLANNING ENVIRONMENT

The figure below shows the SAP IBP modules supporting the M-Industry Project ONE supply chain planning processes.

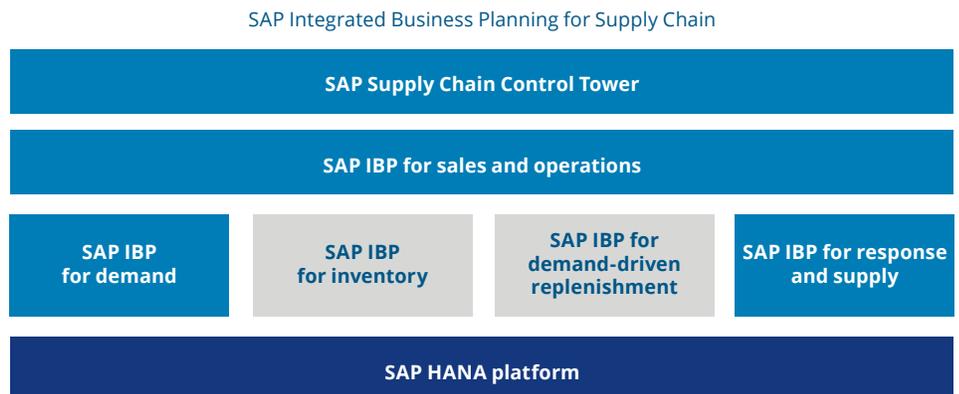


Figure 5. Implemented modules of SAP IBP

### Planning environment

At Migros, for Demand and Supply Planning a single SAP IBP planning area is used for all the industry entities, enforcing harmonization and enabling future synergies. A planning area defines the

structure and forms the backbone of the planning process in SAP IBP. 'Safety fences' are in place through a combination of authorizations and permission filters, as well as scope control for data integration within SAP CPI-DS.

## SAP INTEGRATED BUSINESS PLANNING FOR DEMAND

The final demand plan in SAP IBP is derived from several inputs. At a high level, the demand plan is configured as follows:

- Sales history cleansing
- Point-of-sales (POS) data
- Demand planner forecast with the following defaulting mechanism (refer to the figure 6):
  - » External inputs
  - » Seasonal plan
  - » Final statistical forecast
  - » Manual adjustments
- Promotional input
  - » Consensus demand (demand perspective, released to supply planning)
- Consensus demand (supply perspective)

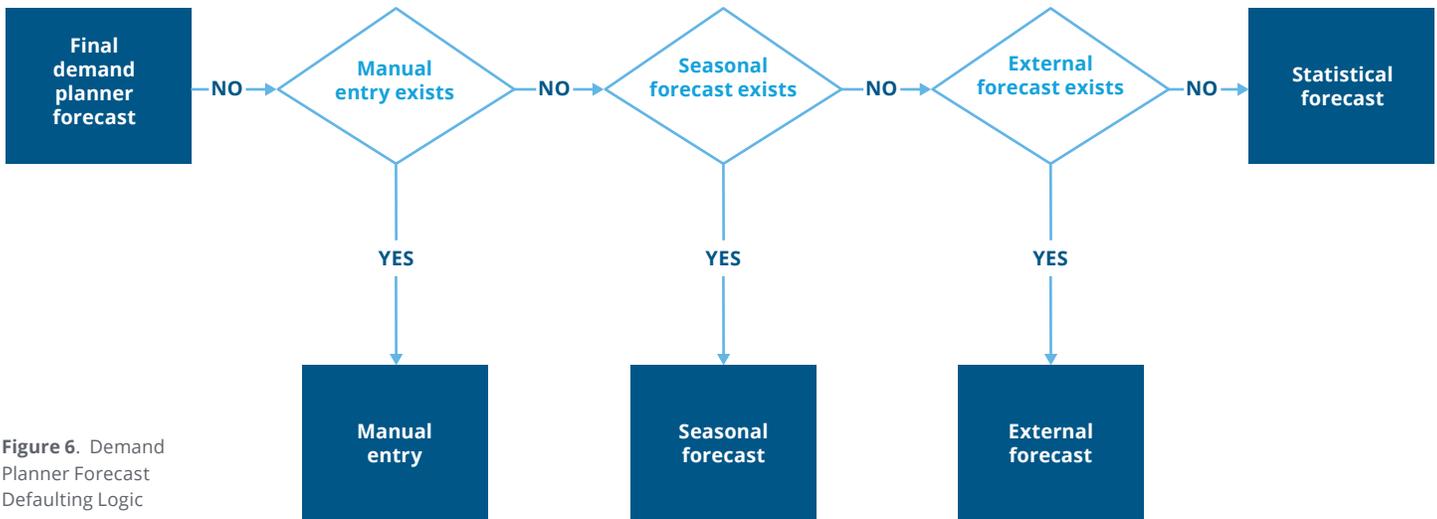


Figure 6. Demand Planner Forecast Defaulting Logic

### Daily demand planning

For some of the M-Industry companies, Demand Planning must be adjusted and released daily, particularly for industries which produce fresh food products. Although the default frequency for Demand Planning is weekly, the daily planning is done in parallel and synchronized with the weekly figures consistently. This consistency is ensured by a sophisticated logic that considers daily levels for the customer calendar, historical sales and open orders, historical and planned promotions.

### Tailored forecasting

To embrace all M-Industry companies within a single planning area, the statistical forecasting process is designed at a product-customer level. In some cases, the forecast calculation needs to be made at aggregated levels. To establish the forecasting level and the most accurate statistical forecast model, an external system is used. The analysis is made possible by having an interface, which regularly feeds the external system with the latest data from SAP IBP and other systems – for example about past sales, promotions, custom outlier cleansing, and recent POS data. The statistical forecast is run inside SAP IBP for different time horizons to capture the short- and long-terms dynamics of demand patterns.

These two combine latest demand signals with the three year cleansed and non-cleansed sales history capturing seasonality, trend or sporadic patterns. The statistical forecast runs on different aggregated levels, followed by a compound disaggregation logic time-wise and customer-product wise. The final forecast is then calculated.

**Quality measurement**

In order to assess demand planning performance, Key Performance Indicators (KPI) such as forecast error, bias and Forecast Value Add (FVA) have been set up. This enables continuous monitoring and improvements in the planning process.

Forecast error measurements MAPE (Mean Absolute Percentage Error) and MASE

(Mean Absolute Scaled Error) are available at a product-customer level and with different time lags. These KPIs measure the discrepancy between demand history (customer requested dates and quantities) and forecasts.

Planning bias is measured to assess systematic errors, i.e., the tendencies to over- or under-forecast in planning.

To understand the extent to which the various demand planning activities contribute to improving the final plan, FVA is calculated by comparing the different MAPE values with a low complexity reference forecast. These performance assessments, in combination with ABC/XYZ portfolio segmentation, allow planners to work more efficiently, by focusing on the areas where their input is most effective.

**SAP INTEGRATED BUSINESS PLANNING FOR RESPONSE AND SUPPLY**

**Early distribution of promotional goods**

For some business scenarios, M-Industry companies are required to ship promotional goods in advance of the actual demand date. This requirement is a safety time parameter in SAP S/4HANA and is integrated into SAP IBP. It offsets promotional demand prior to the supply algorithm run. After this run, the promotional demand is re-offset in the opposite direction. This is required for the S&OP process and specifically for monetization of plans that creates a basis for the future financial plan and budget.

**Personnel shifts and capacity planning**

For a production plant where labor is the main capacity constraint, the standard supply model was extended with a tailored set-up to allow:

- Monitoring labor and machine capacity
- Visualizing, levelling and allocating shifts
- Taking into account direct and indirect labor as well as planned downtime.

This custom configuration allows planners to anticipate bottlenecks and derive a finite feasible weekly production plan directly in SAP IBP, before handing over the plan to SAP S/4HANA Advanced Planning for detailed scheduling.

**SAP INTEGRATED BUSINESS PLANNING FOR SALES AND OPERATIONS**

**Integration of Sales and Operations Planning with operational planning**

Sales and Operations Planning (S&OP) is a tactical forecasting and planning tool that delivers a cross-departmental sales and operations plan for inventory, service levels and profitability. The model is designed in a way that the final S&OP Plan is automatically fed to the operational plan

via a flexible horizon-based defaulting logic. This also means that planned independent requirements are updated inside operational demand plan in weeks 1 to n (blue squares in the figure 7), and in the S&OP plan in the following weeks (green squares in the figure 7). The data model allows a flexible parametrization (n) of operational (i.e. weeks 1 to n) and S&OP horizons (i.e. week n+1 to

end of planning horizon). This ensures that the plan for the entire organization is aligned around a single set of numbers, thus making strategic planning actionable.

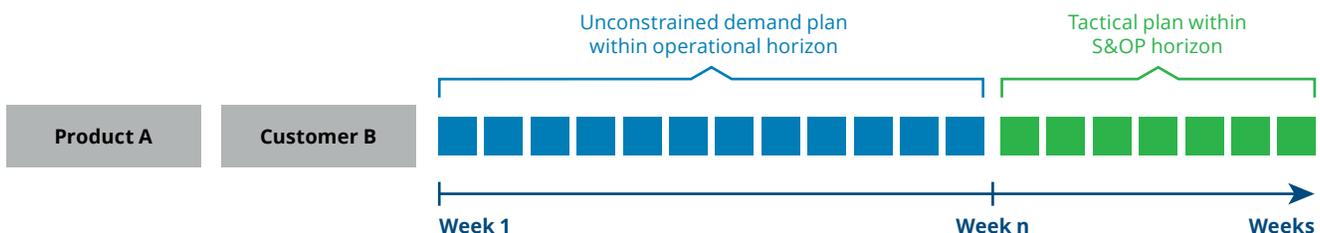


Figure 7. Two horizons of demand plan: operational (in blue) and S&OP (in green)

# SAP S/4HANA Advanced Planning

## SCOPE OF SAP S/4HANA ADVANCED PLANNING

Detailed material planning and production scheduling is performed using SAP S/4HANA Advanced Planning also known as the embedded PP/DS.

As outlined in the system landscape section, there are two approaches to the main integration scenarios between SAP IBP and SAP S/4HANA planning processes. Advanced planning is based either on planned independent requirements coming from the unconstrained demand and S&OP plan, or on a master production schedule established in SAP S/4HANA Advanced Planning.

Materials planning covers cross-plant stocks transfers, multi-level production, and external procurement including subcontracting for all direct materials.

## PLANNING STRATEGIES

The planning strategy 'Planning with final assembly' is used for Migros' Make-to-Stock business while 'Planning w/o final assembly' is used for the Make-to-Order business. A combination of both demand streams is needed to ensure efficient materials supply and to provide visibility for mid-term capacity.

## KEY FEATURES

### Planning with shelf life

Shelf life constraints are a key consideration in the food industry. Parameters such as total shelf life, minimum required shelf life and maturation time are incorporated in planning algorithms to ensure sufficient supply in the event of projected shortages due to items becoming out-of-date. Advanced alerts provide support for decisions to use up batches or reduce supply, in order to avoid scrapping items when batches expire. Some enhancements further improve visibility regarding shelf life expirations and stock projection in standard planning views.

### Contract assignments

Flexible enhancement options provide specific features for advanced planning. For example an enhanced logic assigns cross-plant purchasing contracts for purchase requisitions. This enables strategic purchasing to obtain visibility on projected consumption of contracts, avoiding the time and effort for making unforeseen short-term adjustments.





### Sub-daily planning for fresh produce items

Migros' fresh product segments require a detailed supply plan on a daily or even sub-daily basis. Precise data about demand times, transport durations and production are required to ensure availability of fresh products in retail outlets and for other customers. The flexible set-up of planning includes an option to combine materials planning and resource scheduling activities and establish distribution and multi-level production plans within minutes.

### Finite production scheduling

A key deliverable of production scheduling is the provision of a feasible production plan in a sequence that reduces the need for product line changeovers in its execution. The system supports a bottleneck-oriented approach as well as the possibility to consider all relevant resources with a finite capacity. Labor pools and tools are considered in addition to the production lines.

### Interactive planning

A graphical planning board and other powerful planning tools are used to maintain a short-term finite production schedule. Heuristics support the planners to automate or simplify repetitive activities such as splitting or merging orders, building campaigns, or resolving a production backlog.

### Production sequencing

Depending on the planning horizons and specifics of the several product segments, production schedules are based on a predefined product sequence or calculated using the SAP S/4HANA Advanced Planning optimizer. This makes use of dynamic set-up times, upstream supply constraints and downstream due dates. Set-up transitions are calculated using easy-to-maintain characteristics matrices.

### Alerts

The alert monitor is a key element supporting an exception-based planning process. It is the entry point for identifying critical situations that require the planner's attention, such as capacity overloads, delays, shortages and supply surplus. From the alert monitor, users can navigate to planning screens to resolve issues immediately or initiate further activities. This enables the managing of complex planning processes on an 'exception' basis.

# SAP Cloud Platform Integration for data services

The landscape is composed of two environments: On-premise and Cloud. SAP Cloud Platform Integration for data services is Extract, Transform, and Load (ETL) middleware that connects Migros On-premise to the SAP Cloud applications using batched data transfers, based on a defined schedule or triggered manually.

SAP IBP is linked to the SAP S/4HANA digital core by leveraging the SAP Agent to connect to SAP S/4HANA, BPC and data files. The figure below shows that SAP IBP is not the only tool offered in the Cloud suite: there are plans to integrate SAP Ariba directly in order to benefit from a native connectivity without the need for ETL transfers or complex SAP S/4HANA workarounds.

During the implementation phase there have been several challenges, and design decisions have led to a number of innovative features. There are three major features that enable Migros to integrate data between the two environments, something that is not commonly seen in other projects.

## BI-DIRECTIONAL DATA TRANSFERS

Extracting data from SAP S/4HANA to SAP IBP makes use of the ability of SAP CPI-DS to generate ABAP programs. This creates a pushdown logic for heavy data processing, such as complex joins from the DS-Agent Server to SAP S/4HANA Application Server and as a result transforming data locally before transferring it to SAP IBP. This approach is best practice for most of the SAP CPI-DS projects.

Another differentiating feature of Migros is that it sends data from SAP IBP to SAP S/4HANA using an ODATA web service. The ODATA connection showed performance limitations being unable to send records in batches (many records at a time) but instead records are sent one by one. This is unlike

SOAP, which has a batch parameter and is sometimes used in the write-back scenario. At the time of writing, the current ODATA v2 connection is being replaced with an Remote Function Call (RFC) connection to improve data integration performance between SAP IBP to SAP S/4HANA. RFC became available in SAP CPI-DS with the latest release upgrade in February 2020.

Data (records) are transferred to custom tables in a staging area. This enables a data transformation in post-processing using an ABAP code before storing the data in SAP S/4HANA standard target tables. This approach is exemplified best in the case of integrating planned independent requirements (PIR). Since the PIR source

data for Migros comes from different SAP IBP key figures, it is extracted in parallel using multiple data flows. The data is then consolidated into a custom table which allows a BAPI call from SAP CPI-DS: this triggers a transfer from the custom table into a function module to create the SAP S/4HANA planned independent requirements. The sequence (1) SAP IBP key figures read, (2) SAP S/4HANA custom table write, (3) BAPI call, is orchestrated by the processes functionality in SAP CPI-DS.

One of the benefits of this approach is greater transparency through the ability to see data in a staging table and enabling transformation of data in post-processing.





## SCOPE CONTROL

Migros' integration solution features the implementation of a scope control mechanism for data transfers from SAP IBP to SAP S/4HANA. This extracts data by limiting parameters, for example a specific range of plant IDs or material IDs, in order to reduce the amount of data transferred from SAP IBP to SAP S/4HANA. This in turn reduces the data transfer time substantially in cases where the user would like to trigger an ad hoc transfer for a specific change knowing the Material or Plant ID.

One of the benefits is the reduced time for data transfers when data is not scheduled to run in full overnight.

## CLOUD WITH ON-PREMISE SCHEDULING

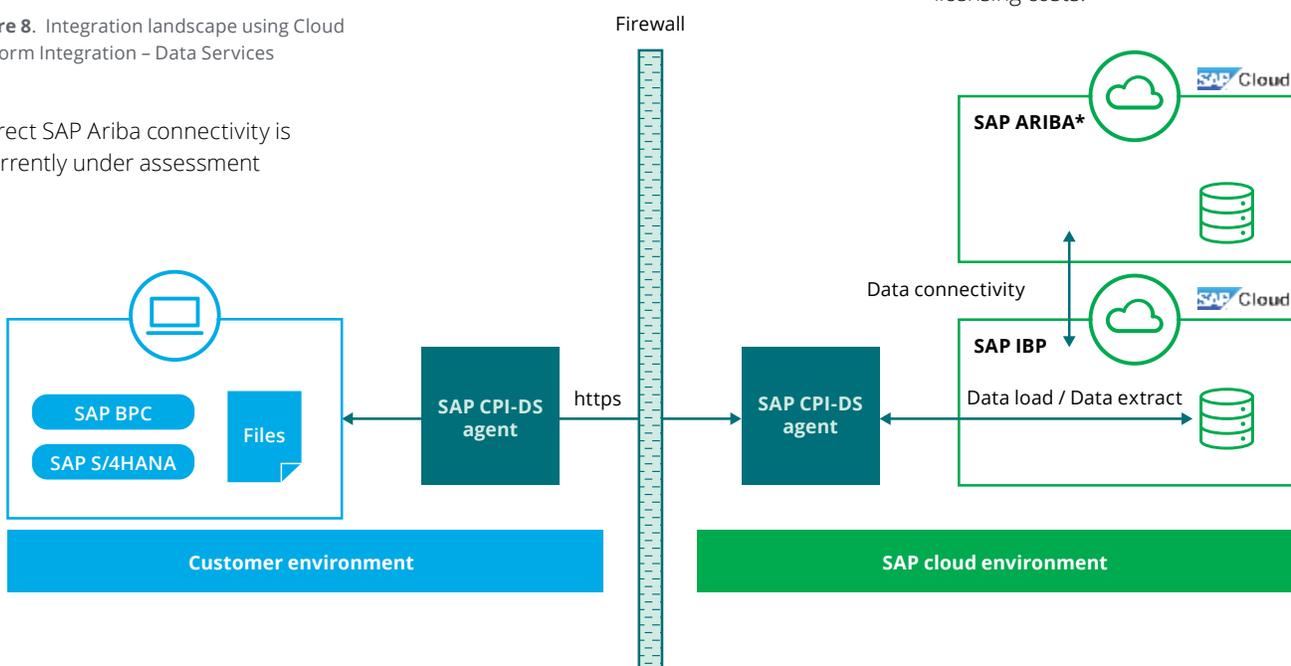
SAP IBP can easily schedule SAP CPI-DS jobs by leveraging the cross-system communication feature in the native Fiori app 'Application jobs'. The challenge is to trigger an ABAP program in SAP S/4HANA in sequence with a SAP CPI-DS task and an SAP IBP internal job (e.g., a copy operator).

This is achieved in SAP CPI-DS using the ODATA functionality, which will also be changed to an RFC connection as soon as it becomes available. An SAP IBP multi-step job orchestrates and triggers the entire set, and can be run ad hoc or as a scheduled job.

An outcome of this approach is that the SAP IBP job scheduling mechanism allows running jobs across both cloud and on-premise environments, grouped into packages. These packages are organized by business processes rather than by their technical limitations. This avoids the use of third party tools that often require extra development work and typically come with licensing costs.

**Figure 8.** Integration landscape using Cloud Platform Integration – Data Services

\* Direct SAP Ariba connectivity is currently under assessment



# Lessons learned

Implementation in pilot companies has shown that careful scoping is required. We highlight the following findings:

- **Build it gradually:** Start slowly, focus on major functionalities and grow gradually - manage the scope carefully. Unless your organization already uses the SAP APO optimizer, start with the modules SAP IBP for sales and operations using heuristics and SAP IBP for demand. After your organization adapts and grows with integrated business planning extend the scope by using SAP IBP for response and supply using the optimizer.
- **Do not underestimate additional efforts in connected systems:** When implementing SAP IBP take into account not only SAP IBP and SAP CPI-DS configuration activities but also efforts on custom developments in connected systems like SAP S/4HANA, SAP BPC and other solutions.
- **Do not focus on content for data integration only but also consider the underlying technology capabilities:** Data integration is a hot topic and vital for an end-to-end integrated business planning process. Evaluate available options that allow to transfer mass data between SAP IBP and SAP S/4HANA and keep your mind open for new functionalities once they emerge on the market. For example, with the latest release in SAP CPI-DS in February 2020 a Remote Function Call (RFC) functionality became available — this is worth to be checked out.
- **Position complex data calculations in SAP S/4HANA instead of in SAP CPI-DS:** Performance intensive data transformation activities are best executed in SAP S/4HANA by using custom programs, targeting staging tables to minimize the calculation load on SAP CPI-DS.
- **Measure performance through large data scale test during build phase:** Once your data integration interfaces are built, as early as possible perform mass tests to measure performance and to assess the configuration.
- **Repeat sizing activity:** A sizing estimation at the beginning of a project remains an important task to get an idea on how many planning points will be generated with your to-be data model. Keep in mind to repeat this activity if your assumptions change during the implementation.
- **Setup support organization at an early stage:** As skilled SAP IBP and SAP CPI-DS personnel are still scarce in the market, setup a support organization well in advance of your go live and include the support team in testing and training activities.
- **Resist the temptation to make it a technical implementation only:** Implementing integrated business planning is more than a technical implementation of SAP IBP but also involves a mind-set and organizational change best facilitated by change management activities in close collaboration with the top management.

# Contacts

If you are interested in finding out more about the solution, or would like to discuss your business challenges, please contact any of the following:



**Fabian Wagner**  
Supply Chain  
Planning project lead  
fdwagner@deloitte.ch



**Vladimir Dorodnitsyn**  
SAP IBP solution and  
implementation expert  
vdorodnitsyn@deloitte.ch



**Ivan Kostakev**  
SAP IBP solution and  
implementation expert  
ikostakev@deloitte.ch



**Cosmin Pop**  
SAP CPI-DS solution  
and implementation expert  
cppop@deloitte.ch



**Alexander Mutterer**  
SAP S/4HANA Advanced Planning  
solution and implementation expert  
alexander.mutterer@sap.com



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