Integration Management

Case Study: Logistics and Controlling

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Adapted to S/4Hana

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1 Introduction
1.1 The Case

Our company produces communication systems for air traffic control (ATC). Figure 1 shows the product structure. Each system consists of a central unit and a number of workstations. A central unit consists of a certain number of switches depending on the size of the system. These units are responsible for the connection between different communication partners (pilots, other air traffic controller, etc.) using different means of communication (radio, data link, etc.).

The air traffic control workstations are connected to these switches with a switch being able to serve up to 8 workstations. The switches are interconnected to assure a failsafe speech connection with the communication partners.

A workstation consists of a touch screen, where flight objects are marked using a greasy pencil resulting in an immediate connection with the communication partner, a headset, some twisted-pair (TP) cables and a panel.

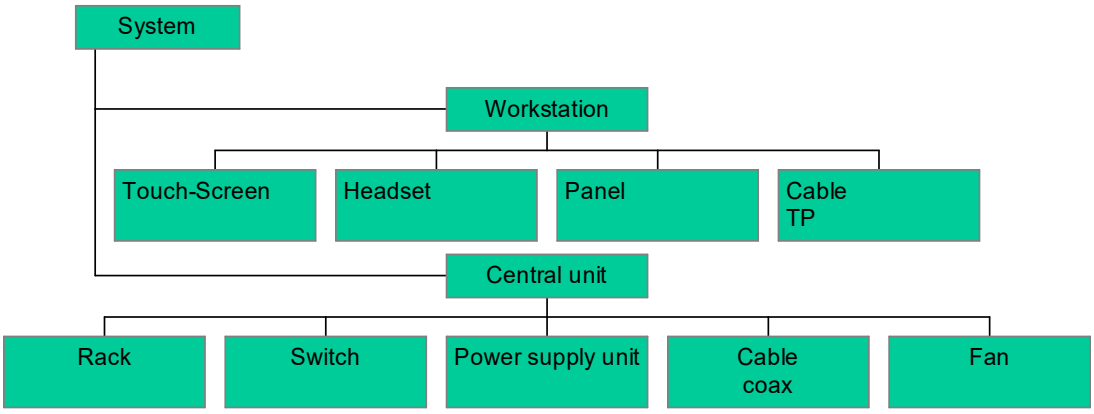

Figure 1: Product structure – overview

Panel and Switch are made to stock (they are also the technological core of the system), the workstations and the central unit are assembled individually for each ATC centre, all other parts in Figure 1 are externally procured. Panel and switch are semi-finished products, only the system itself is a finished product.

1.2 The "Sydney System"

Sydney Airport ordered such an ATC system with 20 workstations, which yields the following parts list derived from Figure 1:

System	Number
Workstations	20
Central unit	1

Workstation	Number
Touch-Screen monitor	1
Headset	1
Panel	1
Cable TP	30m

Central Unit	Number
Rack	1
Switch	3
Power supply unit	2
Fan	2
Cable coax	10m

1.3 Your Task

You have been assigned as a consultant to introduce SAP S/4Hana for production, materials management and cost center accounting. You have to enter the master data and change the customizing according to customer needs. As usual in real-world projects, a prototype is used to test and verify the implementation, production of the Sydney system is used as the test project to verify the SAP S/4Hana system you prepared.

The job will be done by a group of 2 consultants/students. Each group works in a unique plant grxx, which corresponds to a cost centre group. All work centres, materials, etc. start with the prefix grxx-.

Each plant has a purchase organization whose name is identical to the plant.

Continue to use company and sales organisation 3910, distribution channel 10, controlling area A000 and business area 0001. A profit centre for ATC production has been provided.

All prices indicated in EUR.

2 Cost Centre Planning and Work Centres
2.1 Basic Structure

Here the list of the work centres in the plant, each corresponding to one cost centre (cf. Figure 2).

Work Center	Machine	Number	Type
grxx-eprm	EPROM-Loader	1	machine
grxx-smd	SMD-Loader	1	machine
grxx-ass	Assembly Station	2	machine
grxx-qc	Quality Check	1	person

The name of the cost centre and that of the work centre which it is attributed to are identical (save the prefix). All work centres issue activity MANU-H (production hours), they have to be planned accordingly. All work centres are relevant for finite scheduling and may be used by several processes in parallel.

We have three types of cost centers (s. Fig. 3):

- Each of the work centers are linked to a direct cost center.
- Supervisor and Building are indirect cost centers whose costs are allocated to other cost centres in the group (see below).
- Storage and Production Planning (PP) are further indirect cost centers whose costs are attributed to the cost objective by an overhead (OH) surcharge.

Figure 2 shows the performance flow among the cost centers. Building comprises the depreciation for the building, possible maintenance and repairs to it as well as energy costs which cannot be attributed directly to any of the other cost centres, such as lights outside the building or in the corridors.

The supervisor is in charge of the EPROM and SMD loader and the assembly line.

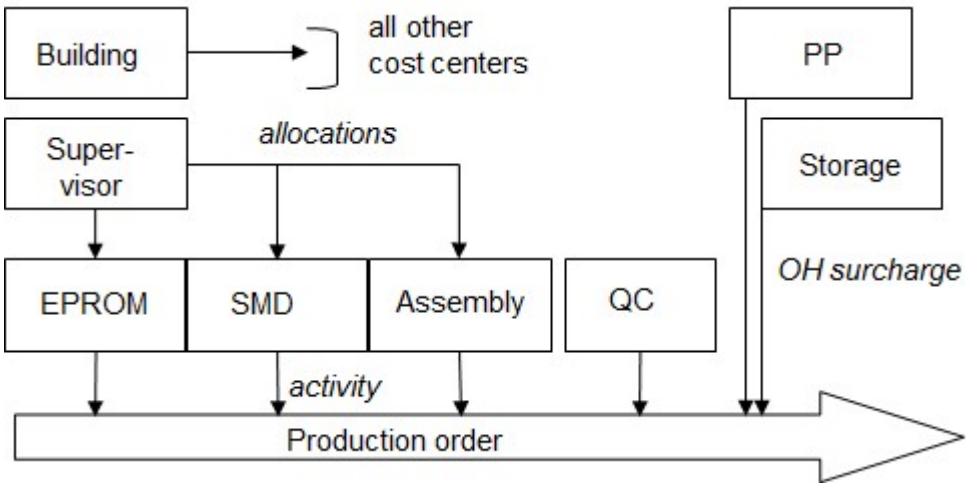

Figure 2: The cost centers involved

2.2 Primary Costs

Let us first consider primary costs (**annual values**):

Wages and salaries:

	No. of people	Total wages EUR	Fixed EUR	Variable EUR
Assembly	2	50.000,00	42.000,00	8.000,00
EPROM Loader	0	0,00	0,00	0,00
SMD	0	0,00	0,00	0,00
Q-Control	1	30.000,00	26.000,00	4.000,00
Storage	2	60.000,00		
PP	1	60.000,00		
Supervisor	1	50.000,00		

Social Security:

	No. of people	Total wages EUR	Fixed EUR	Variable EUR
Assembly	2	15.000,00	12.000,00	3.000,00
EPROM Loader	0	0,00	0,00	0,00
SMD	0	0,00	0,00	0,00
Q-Control	1	9.500,00	8.000,00	1.500,00
Storage	2	15.000,00		
PP	1	23.000,00		
Supervisor	1	18.000,00		

The following table shows the basis for depreciation, whether the asset is depreciated by time or operating hours, and in case of time-dependent depreciation the annual value. The depreciation of the assembly line and the two loaders is considered 80% variable.

Depreciation

	Original investm. EUR	Useful life years/hours	Annual depr. EUR
EPROM			
Loader	60.000,00	5000 hours	
SMD			
Loader	750.000,00	5000 hours	
Assembly			
assembly line	2.000.000,00	10000 hours	
tools	40.000,00	5 years	8.000,00
Q-Control			
Tools	12.000,00	2 years	6.000,00
Building			
Building	300.000,00	25 years	12.000,00
Storage			
storage system	105.000,00	15,00	7.000,00
PC plus control software	30.000,00	5,00	6.000,00
PP			
PC with PP software	50.000,00	5,00	10.000,00
	2.537.000,00		49.000,00

The next table shows cost elements other than payroll and depreciation. The electricity in direct cost centers is considered 80% variable, all training costs are completely fixed. Minor assets in direct cost centres are considered 50% variable.

All cost elements used for primary cost planning and for allocating Supervisor and Building are combined in cost element group ATC-GROUP.

Other costs:

	Total Cost (EUR)	Comment
Assembly		
minor assets	1.000,00	can be depriciated in the first year
electricity	3.200,00	each cost centre has a separate meter
Q-Control		
electricity	500,00	
EPROM Loader		
minor assets	1.600,00	can be depriciated in the first year
electricity	1.900,00	
SMD Loader		
electricity	4.850,00	
Building		
Heating	6.500,00	
Repairs	1.500,00	not activated
electricity	1.200,00	general consumption which cannot be attributec
Supervisor	n/a	
Storage		
electricity	3.450,00	
minor assets	7.200,00	can be depriciated in the first year
PP		
electricity	400,00	
training	2.000,00	
Sum	35.300,00	

2.3 The Service Flow

Figure 2 shows the main service flow between the cost centres. Cost allocation of the two indirect cost centers which are allocated is done by operating hours (Supervisor) and surface in m^2 (Building) per year. The individual values for the cost centers are shown in the following table. The operating hours indicated are also the basis for activity pricing in the direct cost centers. There is only one activity type in the direct cost centres: manufacturing hour (1 MANU-H). Please assume that all direct cost centers are planned to capacity.

Basis for cost allocation and activity planning:

	Operating hours	m2
Assembly	3.000,00	140,00
Q-Control	1.400,00	100,00
Eprom Loader	1.500,00	100,00
SMD Loader	1.600,00	160,00
Building	-	-
Supervisor	-	70,00
Storage	-	380,00
PP	-	50,00
	7.500,00	1.000,00

Storage and PP will be credited by an overhead surcharge on production orders. The surcharges will be materials and production, resp. For further details please refer to Section 4.1 on production order customizing.

3 Materials

3.1 Externally Procured Materials for the Final Assembly

As already mentioned, panel and switch are produced on stock, all other materials used for the final assembly of the system as depicted in Figure 1 are externally procured:

Material	Price Control*	MRP**
Rack	MVA 65,-	VM/5, HB/10
Cable TP	MVA 2,-/m	VM/200, FX/10000
Cable coax	MVA 30,-/m	VM/20, FX/100
Headset	MVA 80,-	VM/25, HB/100
Touch screen	S-Price 3500,-	PD, EX
Fan and power supply unit are also used for switch and panel.		

* moving average or standard price
** MRP parameter standard code

The materials needed for the production of panel and switch are listed in Section 4 on production data.

3.2 MM Customizing

Some additional guidelines for the MRP procedure:

- The following parameters are given to you regarding the scheduling margins (you may redefine existing key 000):

Opening period	15 days
Release period	6 days
Float before production	3 days
Float after production	1 day

- Please define the checking rule „Nx“ (x for the number of your group).

  There are four checking groups prepared in the system depending on the fact whether their quality check is destructive or non-destructive (dQC/ndQC) and whether they are procured via a reliable supply chain (rSC/nrSC):

  Parts with dQC only include stock in transfer (apart from the unrestricted use stock, of course), parts with ndQC also include the quality inspection stock.

  Parts from a reliable supply chain include purchase orders and requisitions (not dependent requirements) as well as reservations, deliveries and shipping notifications (no sales requirements). Parts from an unreliable supply chain only include reservations from the list above.

  All checks include replenishment lead time (RLT), planned orders and production orders are to be included, dependent reservations and released order requirements are not to be included.

  All materials mentioned in Section 3.1 are ndQC, cables and headset come from a reliable supply chain, the others do not. The remaining parts will be assigned as mentioned below.

- All purchased items have a delivery time of 4 days and a goods receipt processing time of 1 day.

- Checking group “individual requirements” is used for all semi-finished materials and the ATC system. All in-process materials as well as switch and panel use MRP-based planning and lot-for-lot order quantities.

- All materials belong to industry “m“.

- Don’t forget to enter the production version with BOM and routing reference for all materials that are produced in-house.

3.3 Purchasing

After streamlining purchasing, all parts are purchased from two sources only, Electronic Supplies, plc and Techno, plc. with the latter delivering the frame, both types of cables, the headset, the circuit board, the keyboard, and the fan. All other parts are bought from Electronic Supplies, plc.

Please create the necessary master data for purchasing, allow for the prices entered at the materials master. Please also note the data indicated below, which are relevant to purchasing.

4 Production

4.1 General Issues

The following requirements are given to you regarding the PP customizing:

Production orders are processed via an own order type grxx, with xx being the group number, which is basically identical to PP01, except for the following points:

- A materials overhead of 25% (crediting the Storage cost centre) and a production overhead of 30% (crediting the PP cost centre) are to be used both in planned and actual costs (please insert your own costing sheet with the surcharge parameters gmxx and gpxx and the calculation variant plxx (planned cost) and acxx (actual cost)),
- The valuation of internal activities according to the planned standard rate of the period, valuation of materials according to the price control in the materials master. Please define your own costing sheet gr00xx.
- Forward scheduling, no adjustment of basic dates in scheduling,
- Use confirmation parameters from order type PP01.
- Continue to use routing key PP01.

Hint:

Since there is no sales plan for switch and panel, independent requirements have to be entered manually via the following menu path: Logistics/Production/MRP => Planned order/create. Order type LA, stock order. Please indicate the material (ATC system), the desired quantity (=1), and the basic dates of the planned order. They will serve as input for the MRP run.

4.2 Boards/Circuit Boards

All boards used in panel and switch basically consist of the same parts which are listed below; all parts are purchased items:

Part	MRP	MVA/Piece
Circuit board incl. pins	VM/25St., FX/500St.	10,-
EPROM	VM/30St., FX/500St.	20,-
Diode type A	VM/250St., FX/3000St.	1,50
Diode type B	VM/250St., FX/3000St.	1,20
DSP	PD/EX	199,-
Resistance type A	VM/250St., FX/3000St.	9,-
Resistance type B	VM/250St., FX/3000St.	6,-
32 GB storage module	VM/250St., FX/2000St.	290,-

All parts stem from a reliable supply chain and are ndQC.

Hint for purchasing procedures: diodes, resistances, and storage modules can only be ordered in portions of 1000 pieces, circuit boards and EPROM's only in 100 piece lots. DSPs can be ordered by the piece.

In addition, EPROM's are loaded with software developed by the company; this is done before the components are mounted on the circuit boards. The standard software modules are represented by a materials master with a standard price.

Software Module	Price of License
Software for central switch	1200,-
Software for workstation hub	500,-
Panel control software	430,-
Panel – switch communication software	300,-

The standard price indicated can be derived from the following considerations:

After finishing the development of a new standard software module, the business case indicates how many times such a module (software license) may be sold to a customer (1000 for each module). The costs accrued in the R&D project are then attributed to the software licenses.

The BOM of the boards are as follows:

Workstation hub

Part	**No.**
Circuit board	1
EPROM	1
Software for workstation hub	1
Diode type A	9
Diode type B	1
DSP	0
Resistance type A	0
Resistance type B	6
32 GB storage module	2

Central switch

Part	**No.**
Circuit board	1
EPROM	1
Software for central switch	1
Diode type A	4
Diode type B	2
DSP	11
Resistance type A	14
Resistance type B	16
32 GB storage module	2

Panel control board

Part	**No.**
Circuit board	1
EPROM	1
Panel control software	1
Diode type A	10
Diode type B	0
DSP	0
Resistance type A	1
Resistance type B	3
32 GB storage module	1

Panel-switch communications board

Part	No.
Circuit board	1
EPROM	1
Panel – switch communication software	1
Diode type A	11
Diode type B	2
DSP	1
Resistance type A	7
Resistance type B	0
32 GB storage module	1

The routings of all boards are basically identical comprising of the same steps (provided, components of a certain type are mounted). All production steps are done on the SMD loader, except for the loading of the EPROM.

EPROM-loader:

- Loading EPROM's with software (set-up time 30 min, processing time 1 min. per piece).

SMD loader:

- Mounting of the components and burn-in of conductor paths (set-up 15 min, processing 5 seconds plus 1 second per piece to be mounted).

A quality check (using the quality assurance work centre) concludes the processing:

- Quality check (no set-up time, 3 min. processing per piece).

There is a minimum waiting time between the application of the conductor paths and the quality check of 30 min. According to past experience an average scrap of 5% in production can be expected in those steps.

Please consider where flow production or partial overlap may be sensibly used.

4.3 Switch

The BOM of the switch is:

Part	No.	Purchased Item/In-process	Price Control	MRP
Power supply unit	1	purchased	MVA 19,-	VM/100St., FX/500 St.
Fan	3	purchased	MVA 26,-	VM/100St., FX/200 St.
Frame	1	purchased	MVA 65,-	VM/30 St., FX/500 St.
Workstation hub	1	in-process	MVA ?	PD, EX
Central switch	1	in-process	MVA ?	PD, EX

Please initialize the moving average prices in a meaningful way. The frame stems from a reliable supply chain and is ndQC, power supply unit and fan are defined as above.

The routing for the switch is:

Work centre	Step	Duration
grxx-ass	locking the frame	Set-up 45 min Processing 5 min
grxx-ass	mounting the workstation hub	Set-up – min Processing 15 min
grxx-ass	mounting the central switch	Set-up – min Processing 10 min
grxx-ass	mounting power supply unit	Set-up – min Processing 5 min
grxx-ass	mounting fans	Set-up – min Processing 3 min
grxx-qa	quality check	Set-up – min Processing 30 min

4.4 Panel

The BOM of the panel is:

Part	No.	Purchased Item/In-process	Price Control	MRP
Frame	1	as above		
Panel keyboard	1	purchased	MVA 230,-	VM/10St., FX/200 St.
Panel control board	1	in-process	MVA ?	PD, EX
Panel-switch communication board	1	in-process	MVA ?	PD, EX
Power supply unit	2	as above		
Fan	3	as above		

The keyboard is from a non-reliable supply chain and ndQC.

The routing is given as:

Work centre	Step	duration
grxx-ass	lock frame	Set-up 45 min Processing 5 min
grxx-ass	mounting power supply units	Set-up – min Processing 5 min
grxx-ass	mounting fans	Set-up – min Processing 3 min
grxx-ass	mounting the panel control board	Set-up – min Processing 10 min
grxx-ass	mounting the panel-switch communication board	Set-up – min Processing 10 min
grxx-ass	add keyboard	Set-up – min Processing 5 min
grxx-qa	quality check	Set-up – min Processing 20 min

4.5 Workstation, Central Unit, ATC System

The BOM for the remaining elements of the ATC system can be found in Section 1.2.

The routing of the workstation is given as:

Work centre	Step	duration
grxx-ass	assemble panel and touch screen	Set-up - min Processing 60 min
grxx-ass	add headset and TP cables	Set-up – min Processing 10 min
grxx-qa	quality check	Set-up – min Processing 20 min

The routing of the central unit is given as:

Work centre	Step	duration
grxx-ass	lock rack	Set-up 45 min Processing 5 min
grxx-ass	mount switches, power supply units and fans	Set-up – min Processing 5 min
grxx-ass	add coax cables	Set-up – min Processing 3 min
grxx-qa	quality check	Set-up – min Processing 20 min

The routing of the ATC system's final assembly is given as:

Work centre	Step	duration
grxx-ass	final assembly	Set-up – min Processing 20 min
grxx-qa	final quality check	Set-up – min Processing 60 min