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**SAP BW ON HANA**

**Implementing SAP BW on HANA for finance module**

**Thesis**

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**ABSTRACT**

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<p>The fourth industrial revolution has been happening now and then all over the world, the main key behind the story is the power of data. In regard to data reporting and analysis, especially big data, there are several tools helping us to deal with decision making. SAP BI, Tableau, Oracle, to name but a few, however, SAP BI stands out as one of the most popular solution for companies.</p> <p>Decision making is the most challenging process nowadays for all businesses. Besides, the ever-changing market, circumstances, and knowledge of the industry, along with the information and facts happen around it, are of paramount importance to the final decision. Thanks to the development of the technology, an organization can take advantage on the big data. SAP BW on HANA, one of the useful business intelligent software solutions on the market, could support a firm to make the better and more accurate strategy based on the analytical data collected.</p> <p>The aim of the thesis was to provide a better understanding on how SAP BW on HANA works, particularly on the field of finance. The thesis was supported by an in-depth illustration of all the details of the system. For better demonstration, data and information of a real company from FPT Information System company, which remains anonymous, were used to portray software's relevant functions and solutions regarding BI finance functions. Visual aids of dashboards were used to further explain about how SAP BW on HANA could benefit the management board and assist the company in setting and achieving its goals.</p>		
<b>Key words</b> BI, ERP, Dashboard, SAP, SAP BW on HANA, SAP FI.		

## CONCEPT DEFINITIONS

DB	Dashboard: the graph uses in BI to illustrate the data visually.
ERP	Enterprise Resource Planning
OLAP	Online Analytical Processing
OLTD	Online Transactional Processing
SAP BI	SAP Business Intelligent
SAP BW	SAP Business Warehouse
SAP CO	SAP Financial Management/Controlling
SAP FI	SAP Financial Accounting
SAP MM	SAP Material Management
SAP HCM	SAP Human Capital Management
SAP PP	SAP Production Planning
SAP SD	SAP Sales and Distribution

**ABSTRACT**  
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## 1 INTRODUCTION

Finance is the most vital functions of the organization's operation. It guarantees that companies have enough liquidity to run other functions smoothly. It can be seen as the heart of human being, for instance, which never stops working to bump blood travel over human body blood stream. Due to these activities, the enormous amount of data is generated. Handle these big, non-analytical data is challenging for the management teams. Fortunately, SAP BW on HANA is the answer for the problem. Having an ability to analyze and evaluate big data from a matrix of numbers and figures, then transform them into a reasonable report and visual dashboard are the key functions of SAP BW on HANA. (Palekar, Patel & Shiralkar 2015, 31-33.). To portrait how it works, using a real business entity is the key objective of the thesis. Besides, the underlying theoretical frameworks covering ERP, SAP SE, and SAP BI on HANA are also considered.

Having an opportunity to work in the most dynamically environmental company who is leading in the tech industrial field in Vietnam, a conductor of the paper learns from ERP consultant experts. A training on job policy from FPT Information System company provides the author not only the knowledge but also experience. Thanks to these working times, a reality picture about the ERP industry in general and SAP BI in particular is conducted.

With that in mind, the aim of the thesis is to afford readers an insight of SAP BI solution, especially in the SAP BI Finance module. The objective of this work is answer to the question: what benefit and How can SAP BW on HANA provide to customers?

The following three questions which are: what is ERP? what is SAP SE? what is SAP BW on HANA? are considered as the sub-objectives of the thesis to support to the main objective, as well as beneficial for those who are new to the field.

For a better structure, the paper is separated into two parts. The first part covers relevant theories, which provide readers an overview about the ERP, SAP fields, its modules, and SAP BW on HANA. The second stage of the thesis is practical case presenting how the SAP BE on HANA analyses and supports the decision-making process by its dashboards. Due to confidential policy, the practical case is hidden in the final public version. Figure 1 below demonstrates the thesis's flow clearly.

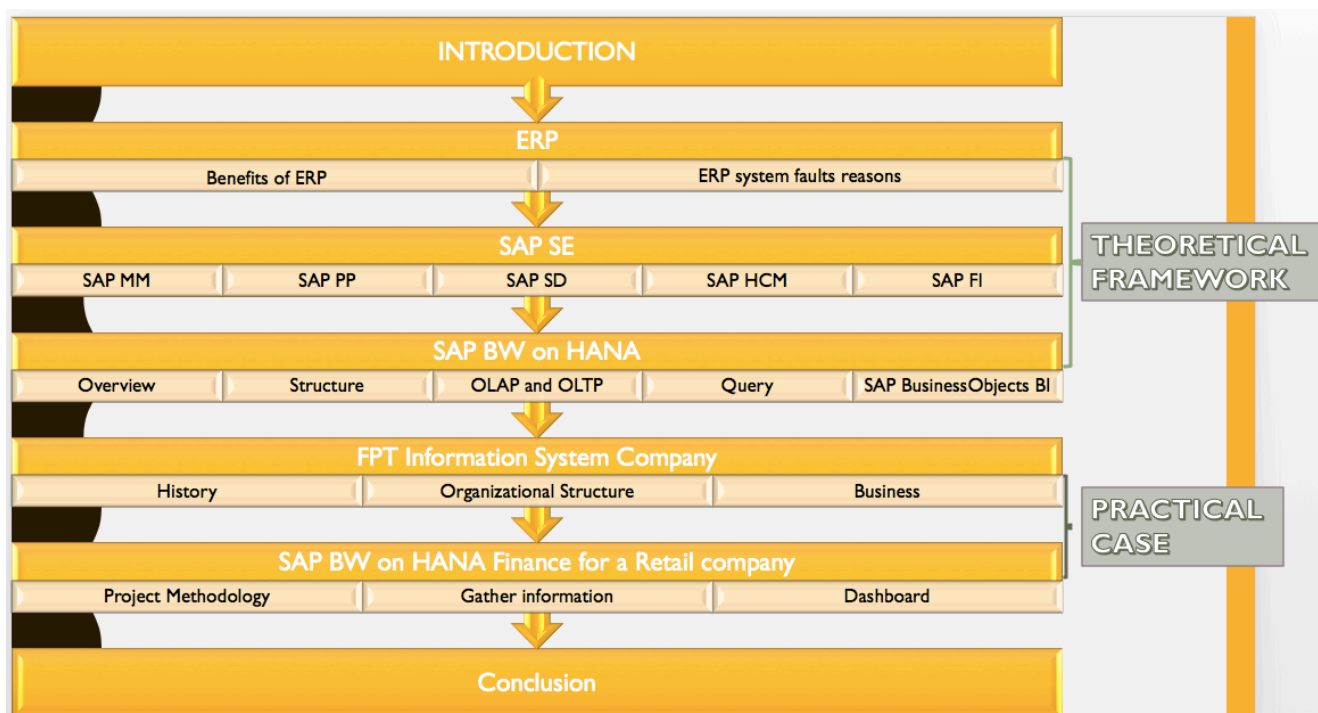


FIGURE 1. Thesis Structure

Information collected is from primary and secondary resources. The first and primary preference is confidential and adapted from FPT information. Data from company is prohibited to public and only presented in the practical case under permission and control of the company.

Additionally, the secondary resource of the paper is first from SAP Press books and course materials. Articles are applied with careful consideration from the trusted and creditable resources following the academic instructions.

Since the second part of the thesis is hidden from those who are not granted viewing permission, it may prevent the fully understanding this report. The theoretical framework, on the other hand, is likely to provide necessary background for those who are interested on this topic.

Another difficulty for the author is that the case used is still on processing. All the solutions and tools introduced may vary due to the company's situation and users' needs. By this reason, those who are allowed to read the full version of the thesis might bear in mind the fact that the final solution of this case may be altered and updated.

Having to use the out-of-date version of SAP BW, in addition, likely to be a disadvantage of this work. The latest version of SAP data warehouse is SAP BW/4HANA launching in August 2016. The SAP BW/4HANA is a pioneer in the real-time data analyzing that is ultimate the power of data and far easier to use. (SAP News 2016.). Because of several internal reasons, the company's customer has chosen the old version instead of the newest release. This fact likely shows a drawback from the writer point of view.



## 2 ENTERPRISE RESOURCE PLANNING (ERP)

According to Gartner (2019), ERP systems integrate all the businesses' processes from logistic, finance, HR, and so on, automatically based on the use of common shared database. By doing so, businesses' administrations and operations are powered to support and share a real-time, common data. An ERP deployment is too costly for both money, time, and resources, that sometimes shrink customers from implementation, nevertheless. Take Nestle case in 2000 as an example, it took years, and up to \$300 million as a total cost for implementing SAP project (Worthen 2002).

### 2.1 Benefits of ERP

Even it costs a massive amount of investments, companies continuously tie to the ERP systems due to significant potential benefits. Figure 2 illustrates the ERP's benefits more in details, outlining the four essential benefits: fostering innovation, reducing IT cost infrastructure, streamlining business process more efficiently and effectively, and forming the process' standardization (Gartner 2019). At the time of an interview in 2002, the Nestle project gained \$325 million in return of investment (Worthen 2002).

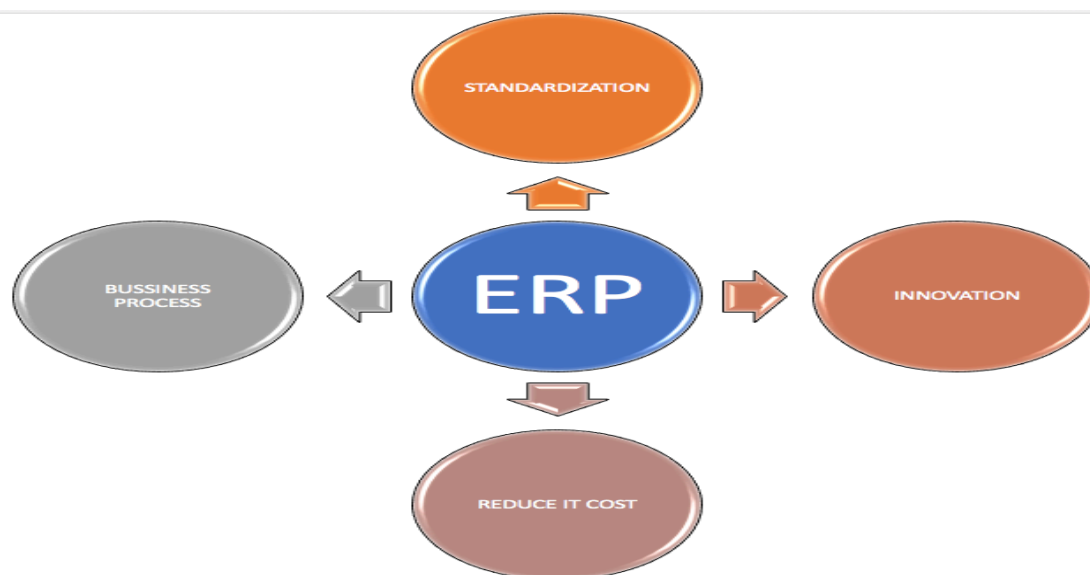


FIGURE 2. ERP business benefit (adapted from Gartner 2019)

The business process terminology, which most of managers nowadays pay attention, is focusing on meeting and satisfying customers' needs and wants. From customers' vision, they are actually concerned

about their satisfaction. As long as a company can deliver their products and services at the most reasonable cost, the best quality, and the smallest lead time, that company is likely favored by most customers. With the integration between firm's functions from production, sales and distribution, delivery, customers' services, ERP system can support organizations to win their market segments. (Monk & Wagner 2013, 1-6.)

Moreover, because of the integration of departments within an organization, the data can be update at the time transactions occur namely real-time data. All of which can now be stored in the same database, it is likely an advantage of ERP to increase a business's performance to compare with the legacy systems(Perkins 2019). Let's imagine that the management members now can make decisions from anywhere and anytime in the world, even they are on a plane, or differently geographical location, thanks to the flexibility, accessibility, and accurate of the real-time data. It is not only boosting performance, but more importantly maintaining company's competitive advantage. Despite its remarkable benefits, one should not ignore the challenges and potential risks when deploying the ERP system, which is discussed in the next section.

## **2.2 The reasons caused the implementing ERP system faults**

ERP projects' characteristics vary from project to project depending on their scopes, customizations, and complexities. The implementing risks are predictable even with experienced consultants. The failures, for instance, of HP project were sunk approximately \$160 million in 2004. None of a ton of small issues was been well-handled created a perfect storm, said by global HP CIO Gilles Bouchard. (Fruhlinger & Wailgum 2019.)

When mentioned people, all from project team members to key and end users are listed. According to Deloitte report "Your guide to the success ERP journey" (2019), the biggest barrier to the successfully implementing ERP project is the change management. The top levels managers to junior staffs of the organization need to understand the importance of deploying new system. Psychologically speaking, it is easier said than done when it comes change of habits topic (Lipkin 2018). For this reason, the project management team should always be aware of the challenge. Explaining the needs of changing to the new software, organizing the meetings with all company departments as well as individuals so that they can listen, learn, and understand are a few suggestions to solve the problem. In addition, the training

courses from experienced experts that provides the knowledge of the new system are vital for the users to help them familiar with the new technology quickly.

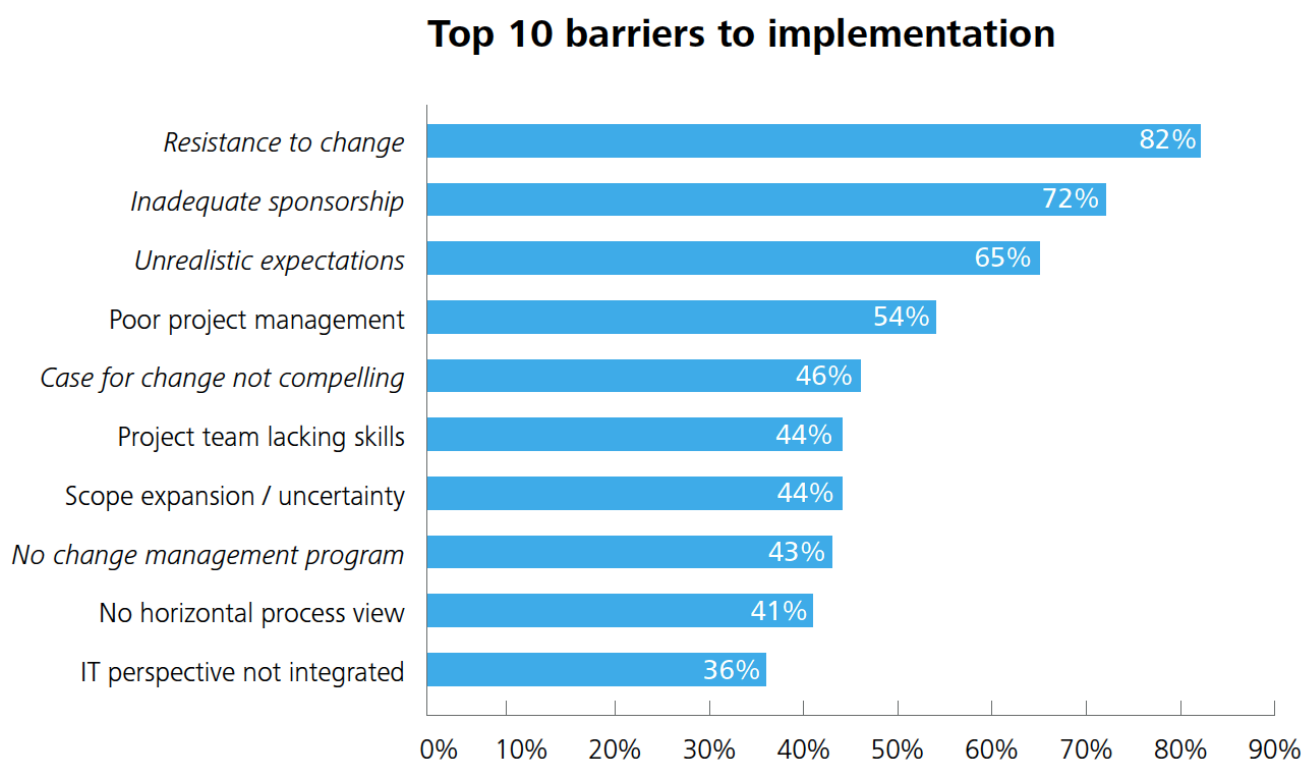


FIGURE 3. Top 10 barriers to implementation ERP project (adapted from Deloitte 2019)

Panorama consulting group also agree that company should set out the top to the people when implementing an ERP project. a common reason causing failure for many projects is the unrealistic project's goal. The clear and precise goal is essential for all project, but it should be workable, based on the company current and future strategies and adapted with technological conditions. The seven years and over half billion US dollars are the cost from the SAP Lidl project (Saran 2018). The customizations, in addition, are needed when companies deploy new system. Over customized the standardized functionalities to meet the expectations might trigger as a burden for the project. (Panorama Consulting Group 2018.)

### 3 SAP SE

In the early 1970s, the first SAP product namely The Realtime Financials (RF) was created by five former IBM employees: Hans-Werner Hektor, Dietmar Hopp, Hasso Plattner, Klaus Tschira, and Claus Wellenreuther under the name of the company Systemanalyse und Programmentwicklung (System Analysis and Program Development), and then renamed Systeme, Anwendungen und Produkte in der Datenverarbeitung (Systems, Applications, and Products in Data Processing). The company were first located in Weinheim, Germany, which relocated in 1977 its headquarters to Walldorf, Germany. Since then, SAP SE that company official named from 2104, has developed several applications that are R/1(1972), R/2, R/3, following by the ERP product in 2004, and the SAP HANA between 2011 to 2014. (Schulz 2017, 21-23.)

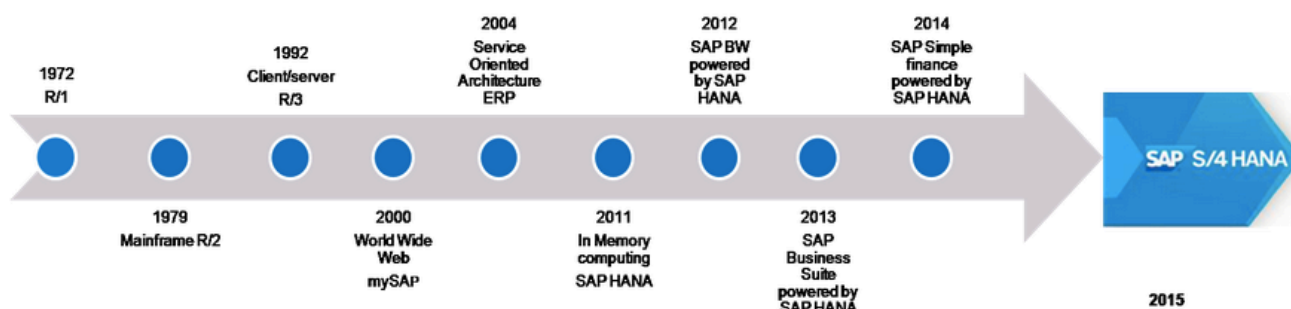


FIGURE 4. SAP history evolution from R/1 to S/4HANA (adapted from Vadrevu 2015)

The newest version SAP S/4HANA (SAP Business Suite 4 SAP HANA) that could be seen as the next generation of the software whose provide more user-friendly and simplify the system was launched on February, 2015. The system that optimizes the capacity to handle with big data, mobility of the system thanks to SAP Fiori UX, and the available of software installation which on premise, hybrid, and on the cloud are the valuable features of the SAP S/4HANA. With these added values, SAP supports customers to adapt quickly with the fast-changing technologies which are the Internet of Things (IoT), AI, and big data. (Schulz 2017, 49-50.)

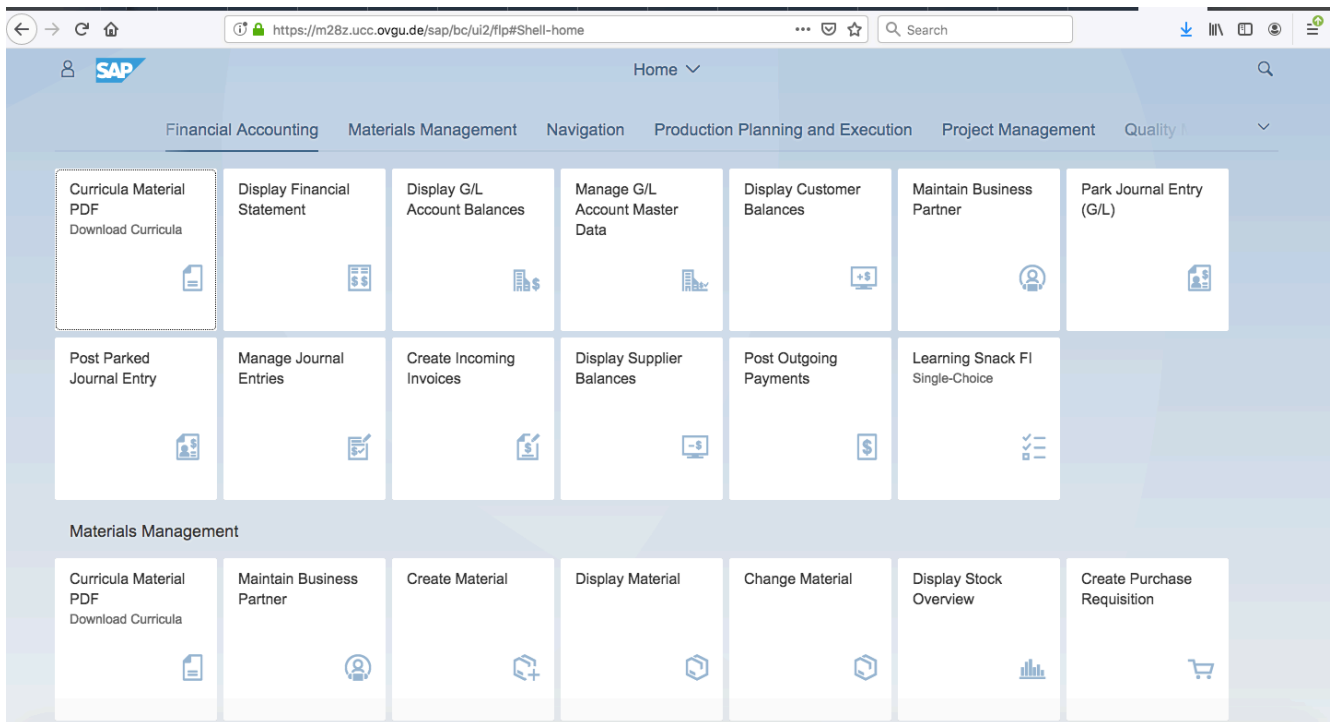


FIGURE 5. SAP Fiori UX (adapted from SAP Fiori 2019).

The “R” letter which means Real-time is one of three key features of the SAP software, namely Real-time processing, Standard System, Integration. Regarding the first feature that is real-time processing, all transactions from the enterprise are updated to the installed system. The shared database as the single source of truth, indeed, is available based on this feature. The standard software is likely standardized the system worldwide for those who implementing the product. To adjust the standard SAP version to companies’ structures, the customizations are needed but the standard system still remains unchanged. Also, the business process is integrated. To complete the sales process, these inventory management, sales and distribution, and financial department are connected to each other, for instance. (Schulz 2017, 22.)

### 3.1 Material management (MM)

Material management function or purchase to pay business process can be seen similarly. Both terms describe equally to the work with the same meaning. The MM is the first stage of supply chain and is discussed in details.

### 3.1.1 Purchase to Pay business process

The Purchase-to-Pay Business process includes eight steps demonstrated as the figure 6 below. The vendor selected based on the supply determination from the demand requirements. The next three steps are handling the purchase or and receiving goods. The last two steps relate to invoice and payment that integrate FI and CO. (TERP10 SAP ERP Integration of Business Process 2013, 144.)

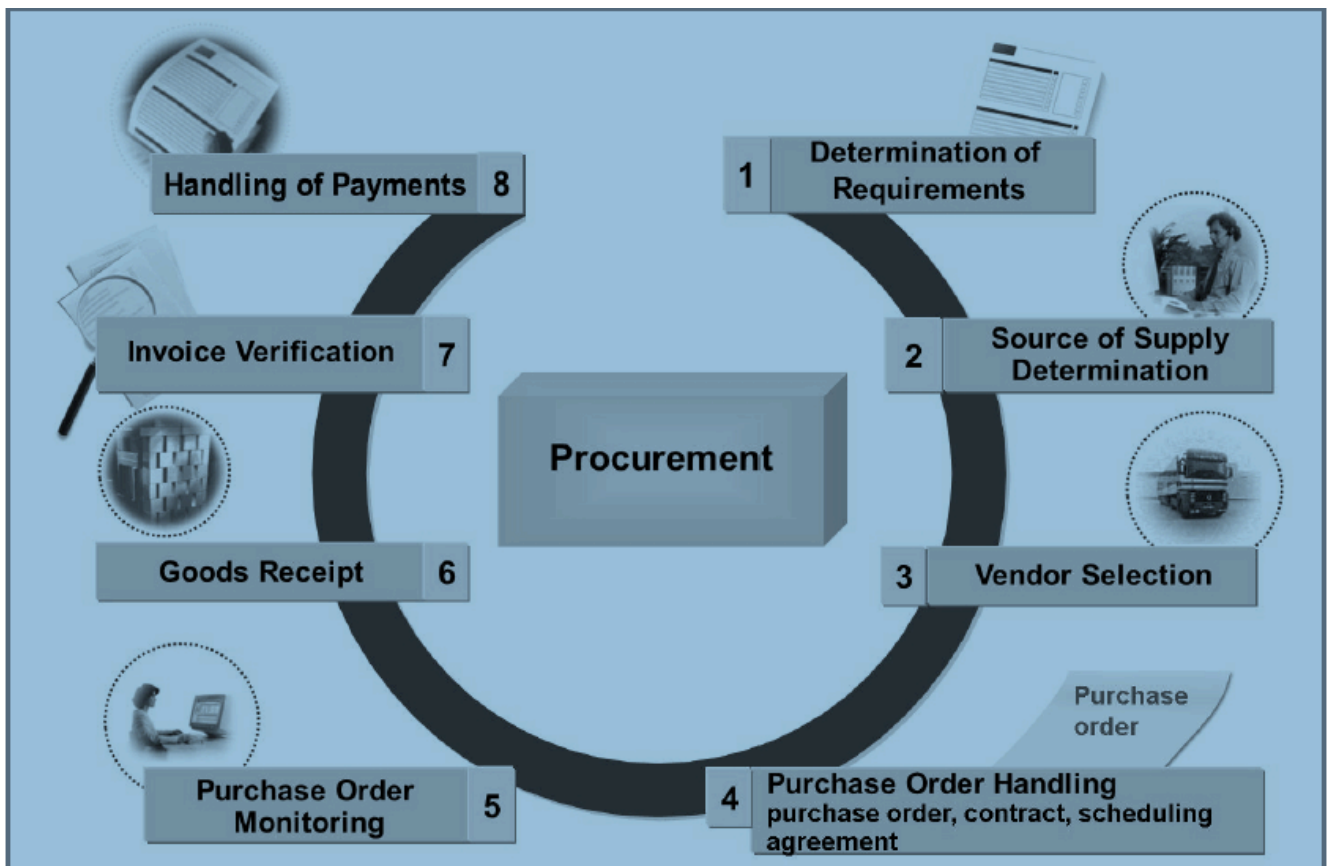


FIGURE 6. Purchase-to-Pay Business Process (adapted from TERP10 SAP ERP Integration of Business Process 2013, 144)

### 3.1.2 Organization structures

Maintaining organizational levels are essential to project deployment. These levels are defined in Customizing, and configured to the vendor master, customer master, material master, general ledger account, and so on. The client and company code are corresponding to the rest SAP components. For the configuration rule, the number of digit numeric key for client and company code is three and four respectively. The highest organizational level is client that represents for a whole corporation or parent company,

following by the company code that is a legal entity for external reporting allows creation of balance sheet, as well as profit and loss. The organizational units of Purchase to Pay Business Process are shown below in the figure 7 which include Client, Company code, Plant, Storage location, Purchasing organization and Purchasing group. (Schulz 2017, 205.)

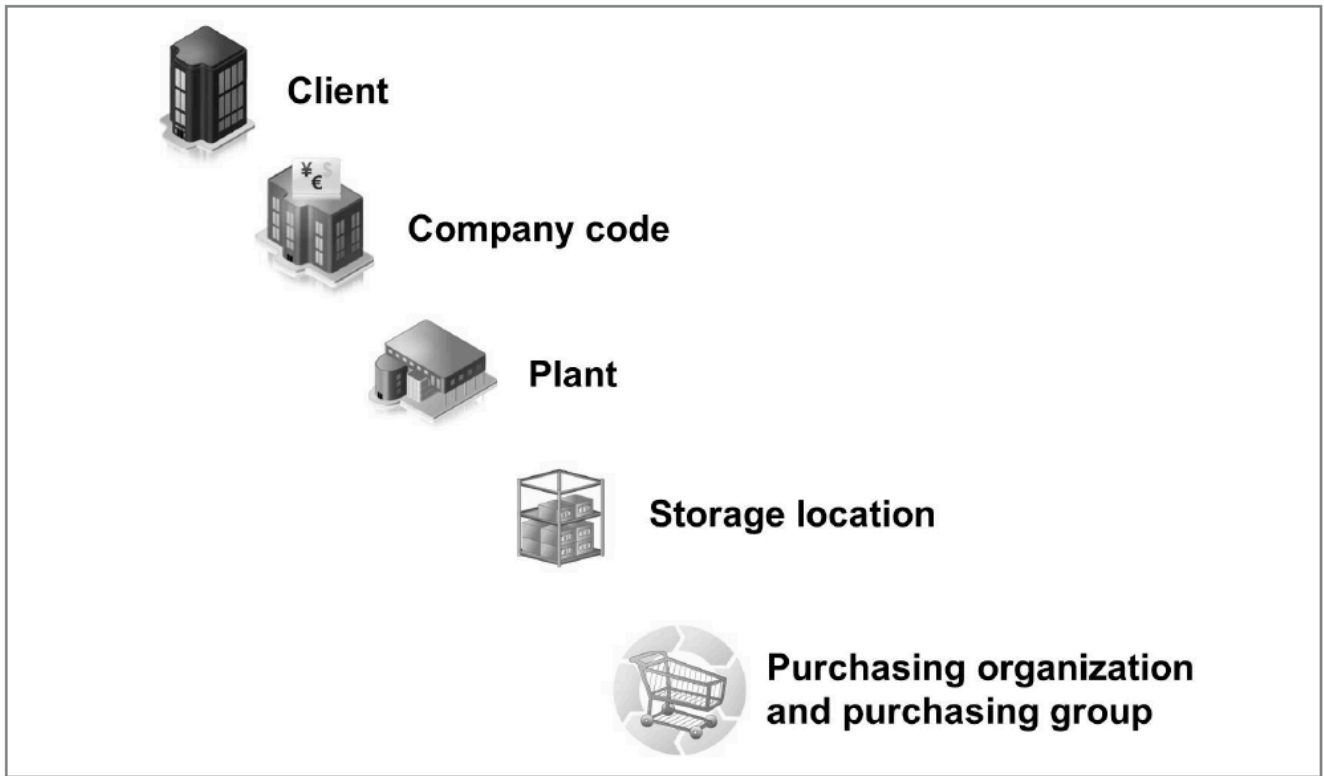


FIGURE 7. Organizational Levels of Purchase to Pay Business Process (adapted from TERP10 SAP ERP Integration of Business Process 2013, 147)

Before figuring out the master data of MM, let's make the comparison between master data and transaction data. The transaction data is based on the master data and changeable. Master data, on the other hand, may create, update, and delete but unchangeable. Table 1 shows the master data and transaction data in more details. (SAP Documentation 2019a; SAP Documentation 2019b.)

TABLE 1. Master data vs Transaction data (SAP Documentation 2019a; SAP Documentation 2019b)

	Master data	Transaction Data
Characteristic	<p>Data remains unchanged for a long period of time.</p> <p>All the relevant functions can apply its data.</p> <p>Data is needed and used at the same content frequently, for the authorized users and applications.</p>	<p>Data is changeable and short-lived.</p> <p>It is assigned to the relevant master data.</p> <p>For every transaction or posting activity, it is transaction data.</p>
Example	<p>Cost center master data, vendor master data, customer master data, material master data, user master data, etc.</p>	<p>Sales order transaction data, purchase order transaction data, etc.</p>

For MM, the most used master data is material master data, vendor master data, and purchasing info record. The purchasing info record is the combination of the vendor master and material master.

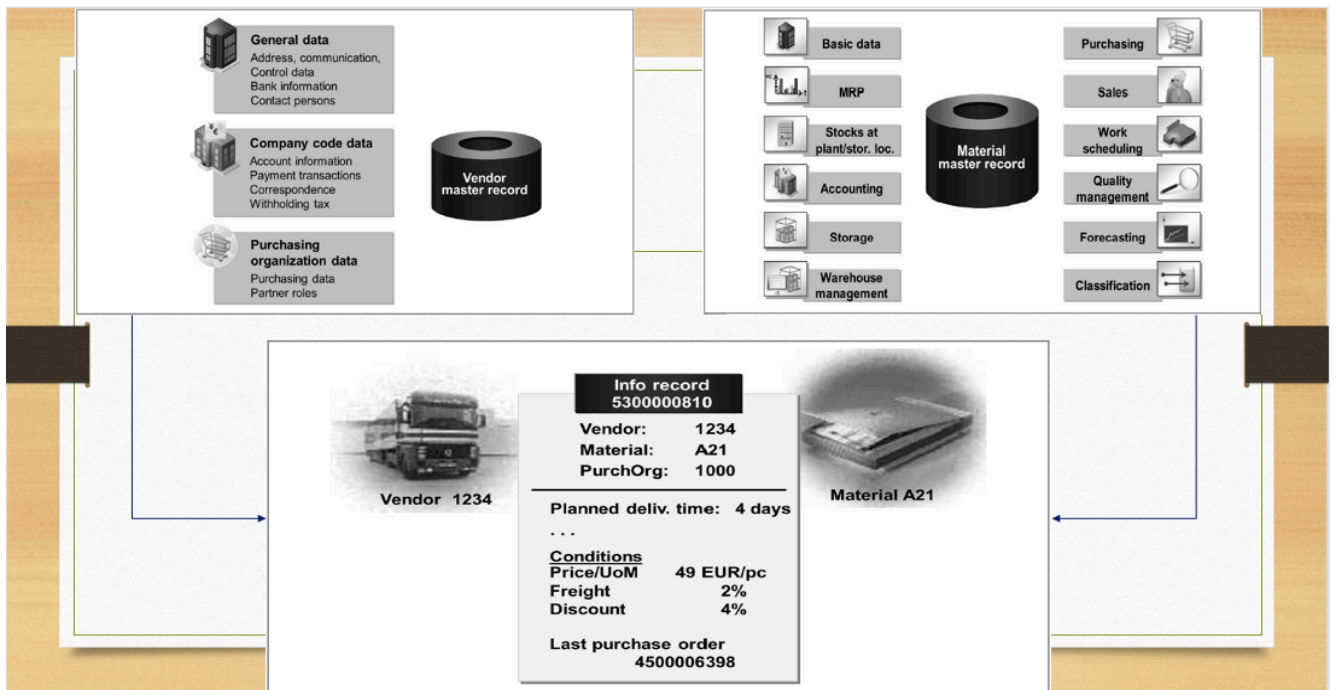


FIGURE 8. Material master data, vendor master data, purchasing record (adapted from TERP10 SAP ERP Integration of Business Process 2013, 158, 171, 180)



The goods are received after the purchase order (PO) is made. All related materials' activities are handled in Inventory management (MM-IM) component. Its organizational structure is shown in figure 9 which includes Client, Company Code, Plant, and Storage location. From management perspective, there are two types of material: stock material and consumable material. The main differences between the two stocks are that while consumable material is settled directly to the cost assignments or assets such as office supplies, posted to consumption account, those related information needs to be filled manually, and may not need the master record or good receipt. On the other hand, stock material has to enter the material number, posted to stock account, and master records needs to be updated. (TERP10 SAP ERP Integration of Business Process 2013, 190.)

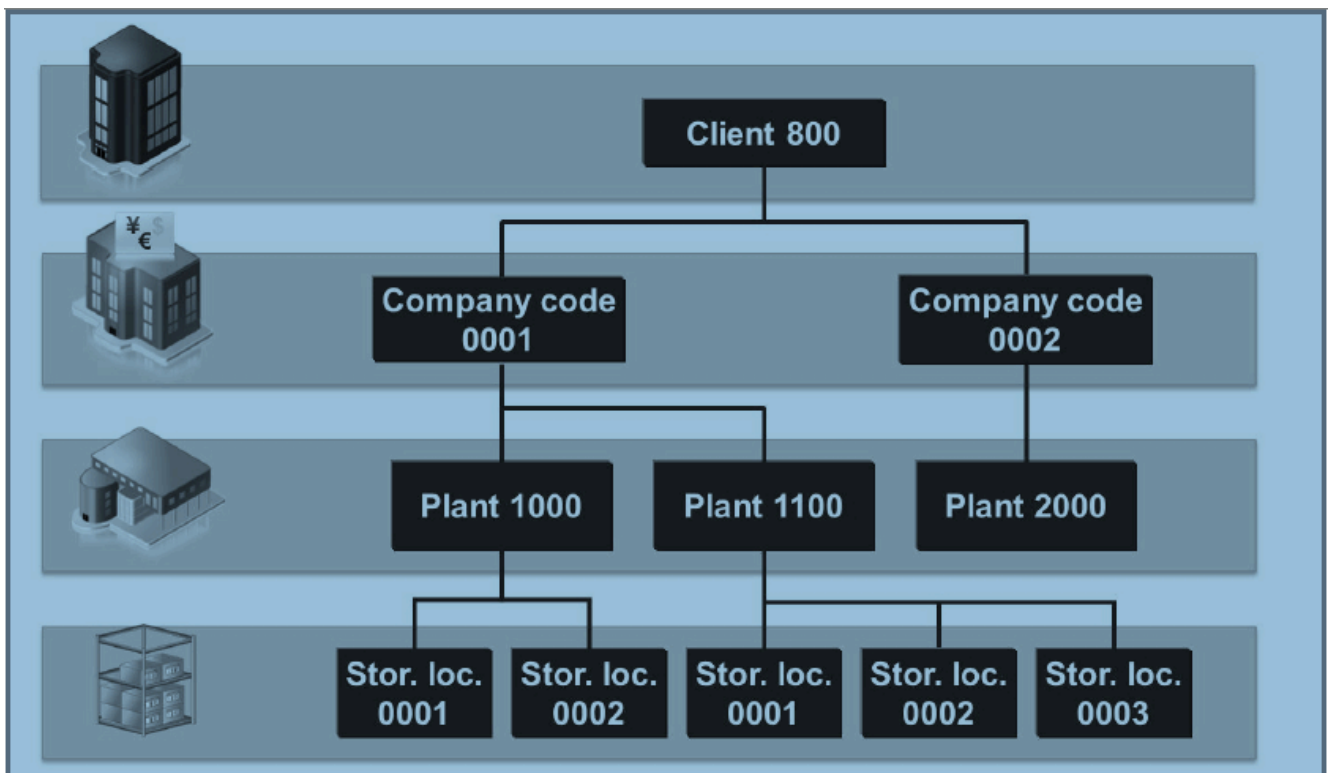


FIGURE 9. Inventory Management Organizational Structure (adapted from TERP10 SAP ERP Integration of Business Process 2013, 149)

For inventory management component, these tasks that manage material stocks, plan and record good movement, and run inventory are included. When materials delivered, they are separated into three types which are unrestricted use stock, quality inspection stock, and blocked stock. Moreover, goods movements happening such as goods receipt, goods issue, stocks transfer, and transfer posting are managed in IM. (Schulz 2017, 223.)

### 3.2 SAP Production Planning (SAP PP)

Plan to produce process is a next business process to be discussed. The business process, and organizational structure are listed. Also, a bill of material (BOM), and integration point are displayed. Let's first discover the PP business process.

#### 3.2.1 Plan to produce business process

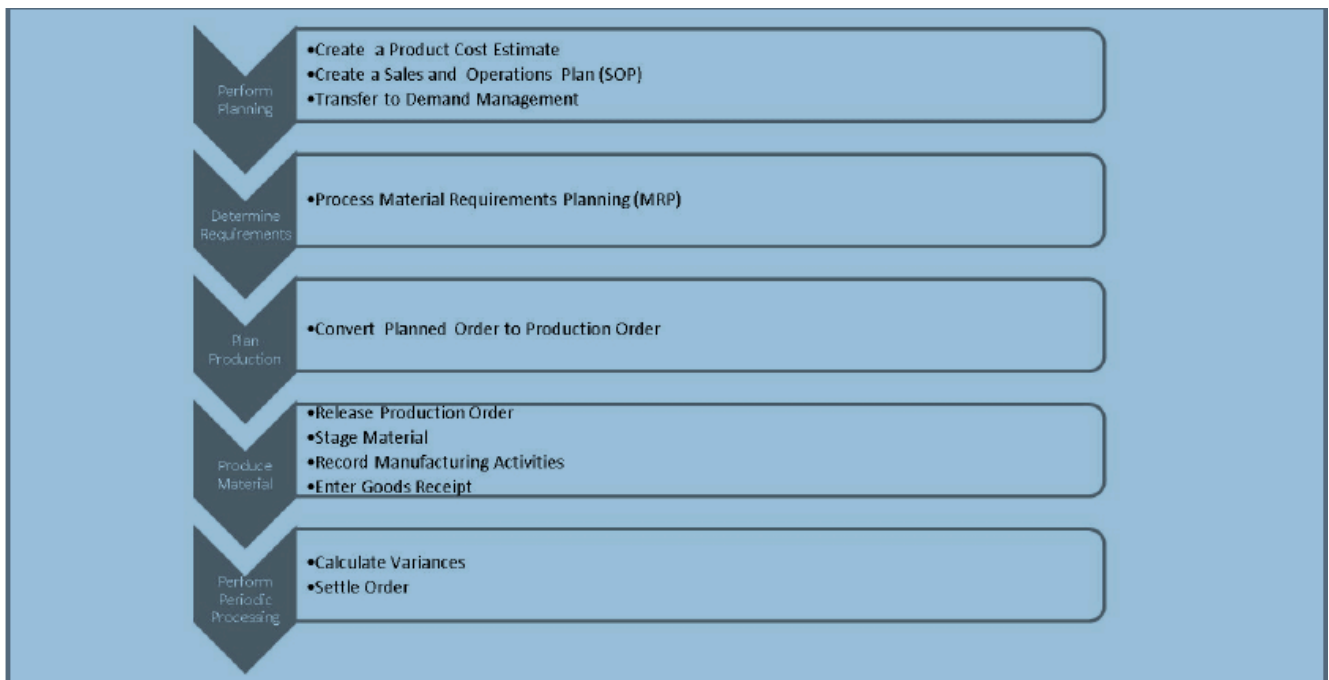


FIGURE 10. Plan to produce business process (adapted from TERP10 SAP ERP Integration of Business Process 2013, 278)

The plan to produce business process has five stages. Firstly, product cost is estimated, sales and operations plan is created based on the previous data and information gathering in the current period, then sent to the demand management. The next step is processing the material requirement planning, following to plan production which transfers planned order to production order. The releasing production order, staging material, recording manufacturing activities, and entering goods receipt are activities in the produce material stage. Last step is performing period processing which calculates variances and settles orders. The step normally is relevant with SAP Controlling as it collects cost controlling through work

in process determination (WIP), variant calculation, and settlements. (TERP10 SAP ERP Integration of Business Process 2013, 367.)

### 3.2.2 Organizational structure

Similar to MM, the organizational structure of PP has Client, Company Code, Plant, and Storage location. A plant can be a place where produce goods, or a distribution channel, or a service providing location in case a company is a service providing company. A storage location, in this case, is an organizational level assigning to a plan. A plant can have several storage locations that stored goods or materials. (TERP10 SAP ERP Integration of Business Process 2013, 280.)

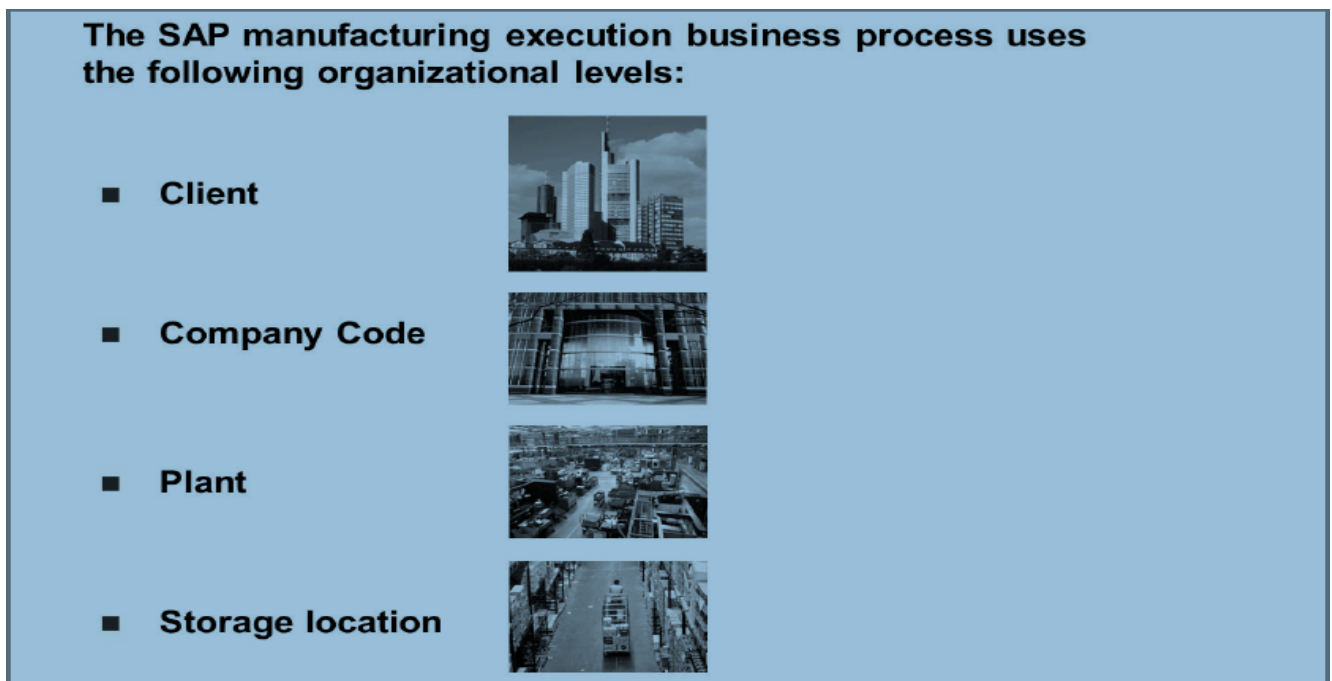


FIGURE 11. Plan to produce organizational structure (adapted from TERP10 SAP ERP Integration of Business Process 2013, 280)

To describe the completed, structured components that builds the object, or material is the BOM. As the instruction for produce material, it contains quantity, description, unit of measure. The BOM contains the header and items that the items are the components. Even the item may include other components as the multi-level, the BOM is the single-level. (TERP10 SAP ERP Integration of Business Process 2013, 289.). Figure 12 can illustrate the single-level BOM of the pump P-100. It contains five items which are

listed from 0010 to 0050. While items 0010, 0020, 0030, 0040 only need 1PC each to produce the pump P-100, the last item 0050 requires 8PC.

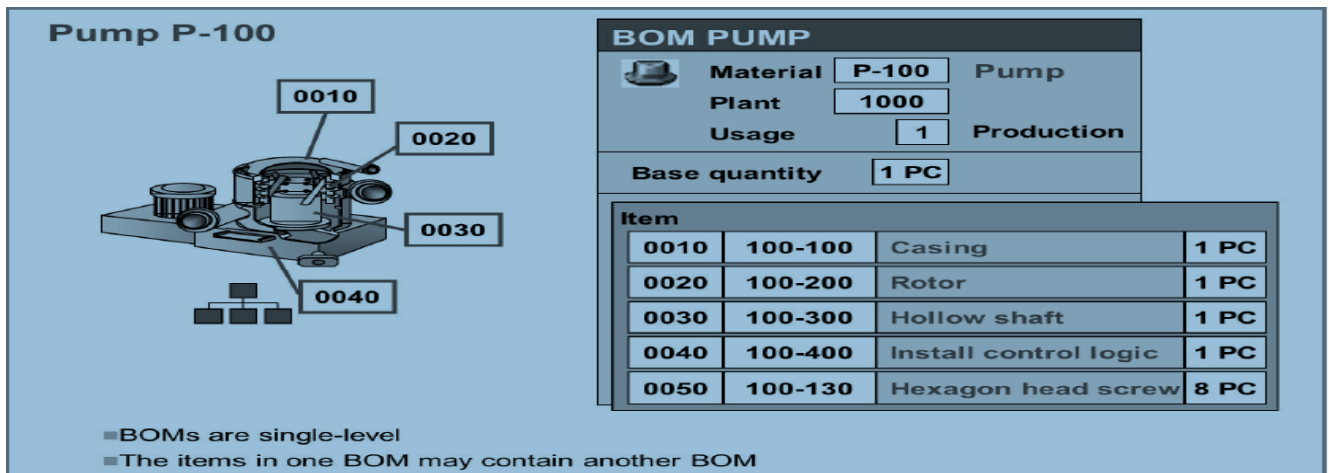


FIGURE 12. Bills of material (adapted from TERP10 SAP ERP Integration of Business Process 2013, 289)

As there are several manufacturing approaches such as make to stock, make to order, or assemble to order (Segal 2019), the integration points of the SAP PP are followed the these integrated in figure 13. The material requirements planning (MRP) is formed from the sales history and the period sales data. Based on the MRP, the production order is created then posted the goods issues after finished. To confirmation, those costs labor, manufacturing, packing, for instance, are collected and allocated later in SAP CO. The material documents that increase the finishing goods, and decrease the inventory quantity, the financial documents, and controlling documents also create automatically. (TERP10 SAP ERP Integration of Business Process 2013, 417-418.)

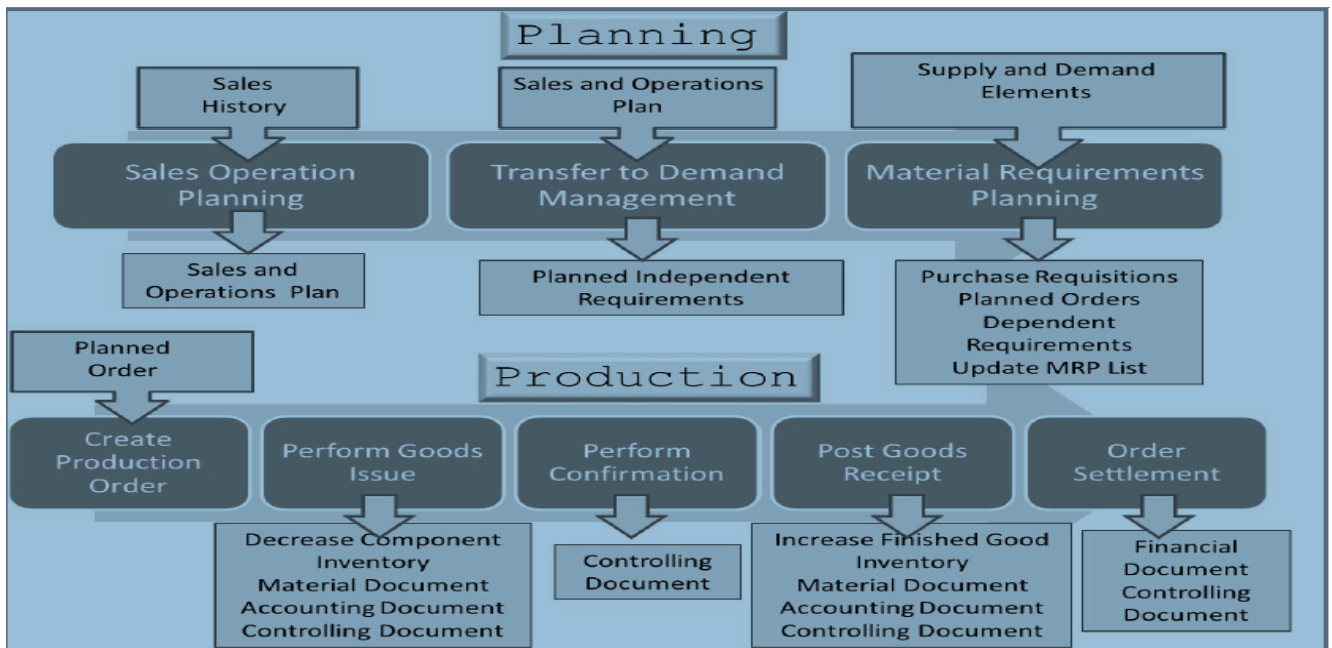


FIGURE 13. Plan to produce business process –Integration Points (adapted from TERP10 SAP ERP Integration of Business Process 2013, 416).

### 3.3 SAP Sales and Distribution (SAP SD)

It is agreed that sales numbers are the primary company's source of revenue. Thus, the sales data is considered as the vital information for the relevant departments from marketing to manufacturing. The production scale and scope, pricing policy, distribute and after sales programs are the top concerns for company strategies that primarily associated with sales history. (Monk & Wagner 2013.). SAP provides order to cash business process that supports the sales and distribution and integrates with the relevant components. Let's discover the business process of SAP order to cash.

#### 3.3.1 Order to cash business process

The presales activities which are unlikely mandatory and include customer inquiries and quotations may happen before the sales order entered. To begin the sales process, the sales orders first need to be formed. The conditions of the orders are defined in the step such as discount, surcharge, delivery terms, and so on. The goods then pick are picked and packed and sent to customers after the availability check and

outbound delivery steps are triggered. When the goods are delivered to customers, the invoices are created and the payment process monitored in the SAP Financial-Account Receivable (FI-AR) component. (Schulz 2017, 235-236)



FIGURE 14. Order to cash business process (adapted from TERP10 SAP ERP Integration of Business Process 2013, 437)

Complaint processing handles those unsatisfied customers that receive the goods or invoices differentiating with their orders. A credit memo, goods return, or substitute is the solutions for the issues. The pricing and conditions policies are studied in the SD function so all specific or unusual pricing condition programs are under controlled. (Schulz 2017, 237.)

### 3.3.2 Organizational structure

The highest organizational level in SD is sales organization, which assigned to the company code. The sales organization, distribution channel, division, and shipping points are only available for SD. The sales area is then formed between the sales organization, distribution channel, and division. The sales area is crucial as all SD documents and master data accessing is belonging to the exact sales area and stay unchanged permanently. For plants and shipping points, a plant can have multiple shipping points and a shipping point can be assigned to multiple plants. To minimize the delivery times, a shipping point

should be near to the delivery plant. (TERP10 SAP ERP Integration of Business Process 2013, 442-444.)

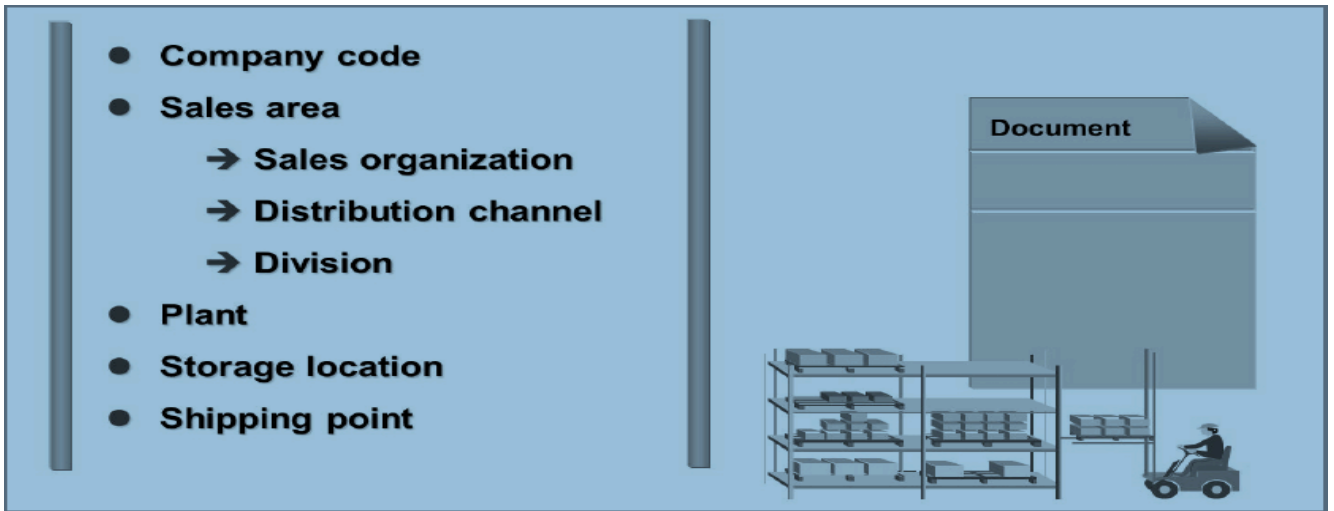


FIGURE 15. SD organizational level (adapted from TERP10 SAP ERP Integration of Business Process 2013, 439)

The customer master data, material master data, and conditional master records play a vital role in the SD. These master data are described below to provide further understanding about the SD processes.

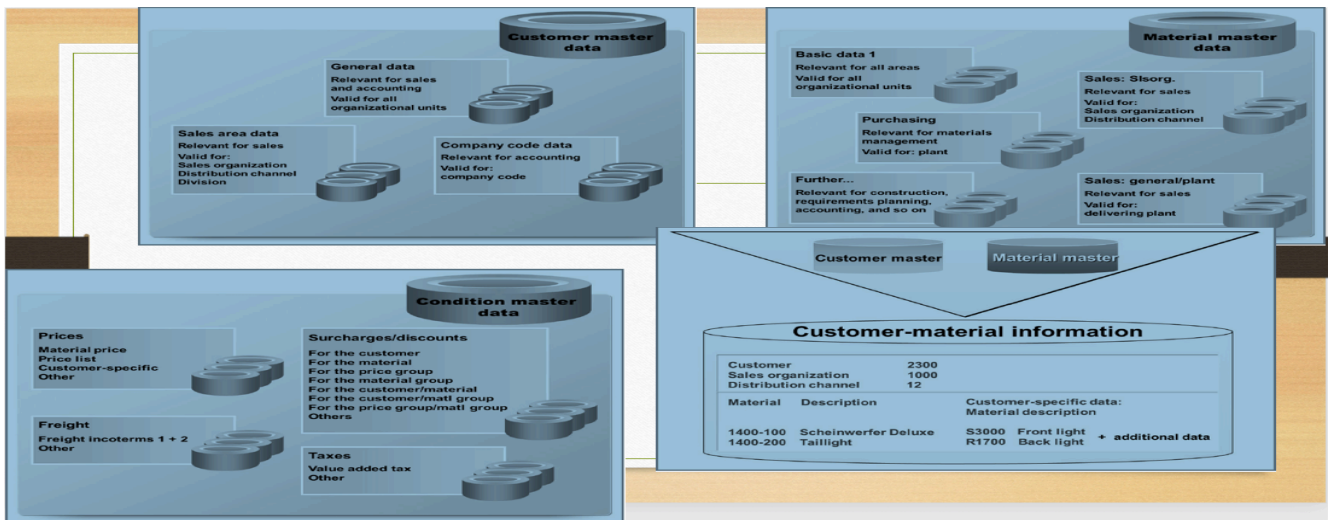


FIGURE 16. Sales and Distribution master data (adapted from TERP10 SAP ERP Integration of Business Process 2013, 447, 456, 458, 465)

There is the fact that the order’s information involves to several parties. To define the role of each party exactly, the partner function needs to be assigned to the master record. For customer master, the four

mandatory partner functions are sold-to party, ship-to party, bill-to party, and payer. The sold-to party means the order places, and assigns to a sales office. It includes the sales data as well as the price list. The ship-to party describes the shipping details such as goods or services receiving, delivery hour, and so on. Invoicing information, namely address, documentations, can find in the bill-to party. Last but not least, the payment term, payment period, bank details are the purposes of the payer function. The agents, contact persons, to name but a few, are other functions of master record, nevertheless, they are optional. (TERP10 SAP ERP Integration of Business Process 2013, 448-449.)

### **3.4 SAP Human Capital Management (SAP HCM)**

As one of the most valuable assets of organization, human participates in all companies' activities from strategies' decision making to sales. Motivating and managing employees effectively and efficiently are the top priorities that enterprises need to bear in mind. To emphasize employees, SAP SE releases the component named SAP ERP Human Capital Management (SAP ERP HCM), which was called SAP Human Resources before 2004 (Schulz 2017, 309). The SAP ERP HCM tasks, organizational structure, and master data are described.

#### **3.4.1 HCM processes**

There are nine steps involved in HCM circle, from organizational management, to recruiting, employees' wellness, travel, and payroll and cost. The HCM provides tools that support the recruiting process from collecting and evaluating potential applicants, to managing and communicating. Working hours as well as travel information are collected and managed under the time management and travel management. The salary transfer and cost management integrate closely to SAP FI and SAP CO used the data from time accounts, and travel costs. For the training events, the requirements, for example, participants, dates, locations, costs, are handled within the training and event management. (Schulz 2017, 310-311.)





FIGURE 17. SAP ERP HCM (adapted from TERP10 SAP ERP Integration of Business Process 2013, 779)

### 3.4.2 Organizational structure

For HCM organizational structure, there are three layers in its structure that are enterprise structure, personnel structure, and organizational structure. An infotype is used to perform employee which is not only useful to enter master data, but also the data for HR decision making. The functionalities of three structures enterprise, personnel, and organizational are employee's performant reports, and company working policies such as wages, payroll terms, etc. applied. By assigned employees to organizational, the SAP system automatically updates data to enterprise, personnel, and organizational structures. The subcomponents company code, positions, cost center, for instance, also are assigned. The employee in Personnel Structure is separated into employee group, and employee subgroup. Also, a subdivision named payrolls area is nailed in here. (TERP10 SAP ERP Integration of Business Process 2013, 782-785.)

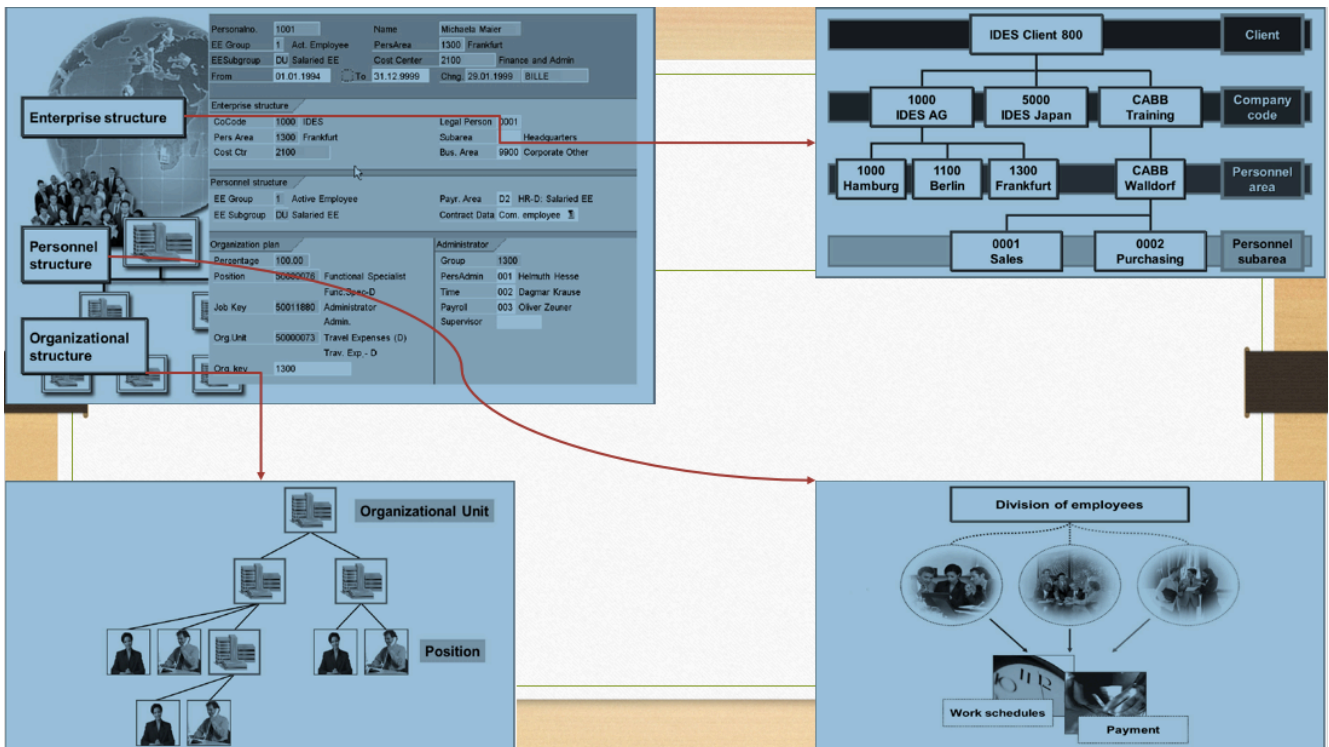


FIGURE 18. HCM Enterprise, Personnel, and Organizational Structures (adapted from TERP10 SAP ERP Integration of Business Process 2013, 782, 783, 785, 789)

The employee master is entered and maintained into the infotype which is as short of information type. The employee data such as name, date of birth, address, is logically stored according to its content. The first name, last name, date of birth, gender can be combined as the employee personal information for illustration of a group of content. To maintain and update employee master, users may use the single screen maintenance, personnel actions, or fast entry. (TERP10 SAP ERP Integration of Business Process 2013, 802-804.)

### 3.5 SAP Finance Accounting (SAP FI)

Finance component plays an important role for SAP products portfolio. The very first system Realtime Financials that is created on the customer's computer was the first SAP product (Schulz 2017, 21). Until now, its significance is continuing as it gathers all information concerning the companies' operations from logistic to human resources.

### 3.5.1 Overview

Due to the transactions are linked to the documents in the SAP FI system, the transparent and traceable features of these transactions are available. Data collected from SAP FI can also be evaluated and interpreted to show the management team their concerns about owners' capital, profit and loss status, liquidity and so on. The financial reports such as balance sheet and profit and loss can be gathered automatically via SAP FI functions (Monk & Wagner 2013, 118-122). To make its more clearly, there are internal accounting and external accounting in SAP Finance component. While external accounting or financial accounting (SAP FI) mostly deals with company financial status to tax authorization, investors, holders, banks and so on such as assets, liabilities, equities, cash to name but a few, internal accounting or controlling (SAP CO) evaluates and analyzes profitability related to whole firm activities. (Schulz 2017, 257-258.)

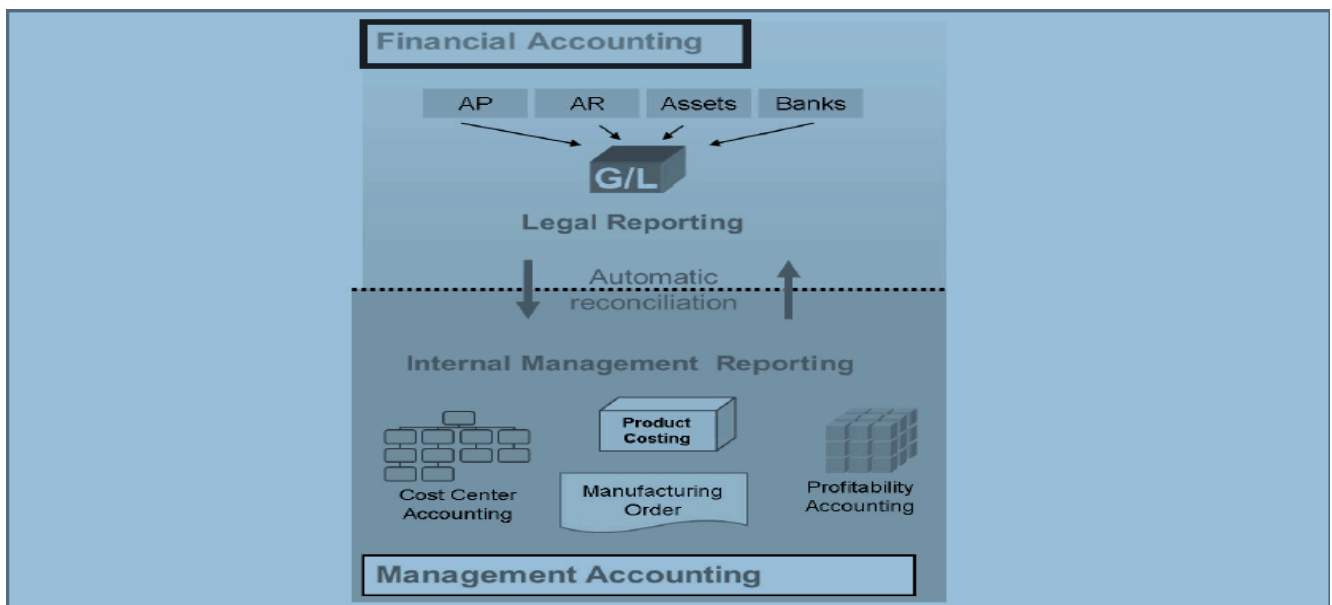


FIGURE 19. Financial Accounting and Management Accounting (adapted from TERP10 SAP ERP Integration of Business Process 2013, 86)

The company's accounts which are general ledger (GL) accounts and sub ledgers accounts are recorded the occurred business transactions with integrated components simultaneously (Monk & Wagner 2013). While relevant with the rest components, the data is kept in the GL account from the beginning fiscal year, through all the posting period (normally 12 posting periods) to prepared for the report at the closing period. Since account is the central unit in accounting, the account's number and credit and debit site (T

form) are needed. Posting data in the sub ledgers such as Account Receivable (AR), or Account Payable (AP) automatically synchronizes with GL account. (Schulz 2017, 259.)

For accurate posting purpose, each posting in the SAP system should content needed information in its header or item: document date, posting date, document type, account number, amount and posting key (Schulz 2017, 260). By using posting key, the type of account, type of posting such as debit or credit is applied. The most used posting keys are from 01 to 11 for customers, 21 to 31 for vendors, 40 and 50 for general ledger (SAP Documentation 2019c). Table 2 is illustrated several standard posting keys.

TABLE 2. Standard posting key (adapted from SAP Documentation 2019c)

Description	Debit	Credit
Customer	01	
Customer		11
Vendor	21	
Vendor		31
General Ledger	40	
General Ledger		50
Asset	70	
Asset		75
Material	89	
Material		99

The components described can be seen as the essential functions in SAP FI that are: SAP General Ledger Account (FI-G/L) noted all the business transactions integrated with GL accounts; Account Payable (FI-AP) suggested the payment for the goods received, and all the stocks movements within the organization, the data in addition gathered from material management mostly; Account Receivable (FI-AR) involved with sales and distribution business transactions that customers owing money. In addition, Bank Accounting (FI-BL), Asset Accounting (FI-AA), Funds Management (FI-FM), and Travel Management (FI-TV) are also financial functions but unlikely implemented by all companies. (Schulz 2017, 260-261.)

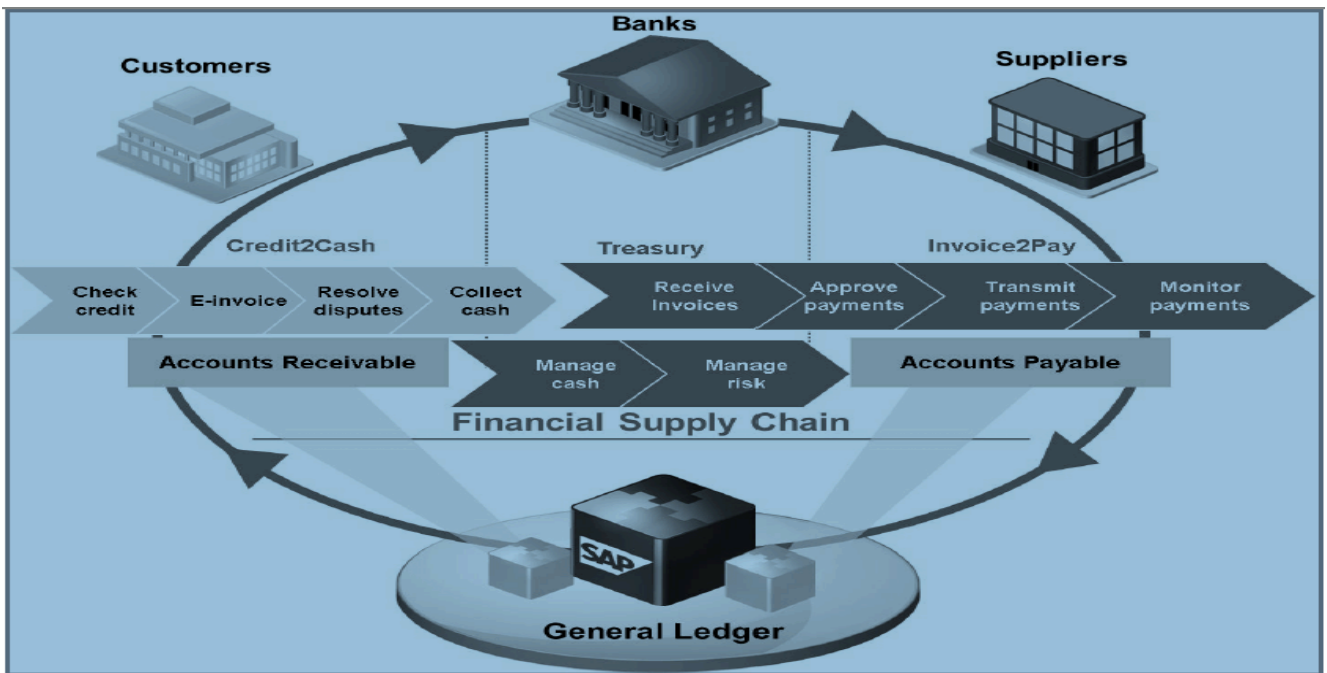


FIGURE 20. Financial Accounting Overview (adapted from TERP10 SAP ERP Integration of Business Process 2013, 80)

### 3.5.2 Organizational Structure

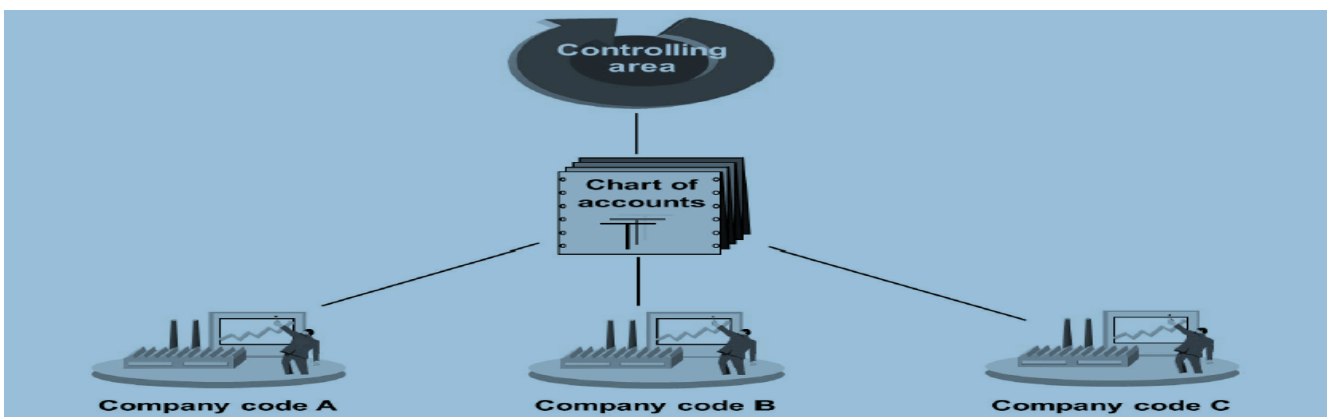


FIGURE 21. Financial Accounting structure (adapted from TERP10 SAP ERP Integration of Business Process 2013, 90)

As a smallest organizational unit in SAP FI, company code completes the accounting in SAP system, and its definition is required. All legal statements balance sheet, profit and loss statement details are formed under company code, together with chart of accounts and currency following geographically legal policies (TERP10 SAP ERP Integration of Business Process 2013, 88). The G/L accounts are

structured based on the chart of accounts (COA). The account should content an account number, its definition or description, and G/L account type. The relationship between the company code and COA is that the COA has to be assigned to the company code. Moreover, the COA can be assigned to several company code (Schulz 2017, 262). Representing a unit of cost controlling separately, a controlling area manages and allocates costs and revenues. Several company codes may be assigned to a controlling area following the same fiscal year and the COA. (TERP10 SAP ERP Integration of Business Process 2013, 90.)

Since now, the information of ERP and SAP SE is generally discussed. Technically speaking, SAP BW on HANA may use different types of raw data from SAP applications to non-SAP application (Palekar, Patel & Shiralkar 20152015, 36). However, there are the advantages when using SAP application as fundamental data source. A better query performance, data loading process improvement, for instance, are the benefits when the SAP application data is the primary data source for SAP BW (SAP Community 2014b). FPT also uses SAP S/4HANA finance data as the source when processing the client implementing SAP BW on HANA project (see chapter 6). In the next chapter, the author will describe the SAP BW on HANA.

## 4 SAP BW 7.4

Before going into the SAP BW 7.4, one should discover the benefits of business intelligent (BI). According to Lukasiak (2018), companies can gain these advantages from deploying BI systems that save cost, drive the business effectively and productively, reinforce the decision-making process, increase sales data, and notice the upcoming opportunity. The oil and gas industry sticks to the BI at the beginning to evaluate the market segments, be aware of the price changing from the international market. The industry so can force the competitive advantage, augment profits and its liquidity. BI also streamlines the business process efficient and productive. A patient from healthcare industry can illustrate for the pros. When using BI, they can easily access to the healthcare center's system to make the appointment, raise a complaint, reduce the appointment lead time, and service cost awareness. Using BI and predictive analytics is a tendency for company nowadays. With the accurate information at the exact time, the decision-making process is effectively made. Supply chain management, from sales and distribution to inventory management can be better managed by using the BI. Indeed, the retail industry may not only get deeper customers understanding that allocations and buying habits, fashion company Charming Charlie applies BI for instance, but also win customer choices. Lastly, being a pioneer in the industry requires satisfying customers' needs and wants at the current period as well as future time. The power of analyzing big data supports the predictive process more accuracy and help company stay ahead.

As a market leader, SAP also provides business intelligent solutions within its wide range enterprise resource planning (ERP) products. For business intelligent (BI) solutions, SAP Business Warehouse (SAP BW) 7.4 is one of them which was released in 2014. Since then, SAP has developed its solutions and released the new version of BW that SAP BW/4 HANA in 2016 (SAP News 2016). For a scope of the thesis, the SAP BW 7.4 is mainly discussed, which includes InfoProviders, query, and its tools. Besides, Online Analytical Processing (OLAP) is discussed and compared with Online Transaction Processing (OLTP)

### 4.1 Overview of SAP BW 7.4

An ability to group, extract, interpret, format raw data is an advantage of SAP BW 7.4. The transactional data that created during companies' activities is used in all companies' transactions. The data then man-

aged in Online Transaction Processing (OLTP) is a source of the single decision making. Using Enterprise Data Warehousing, large amount of data from different sources are grouped, formatted, and analyzed. Online Analytical Processing (OLAP) that designed for BI tools in SAP Business Explorer (SAP BEx) suites data better, reduces the analyzing data process time. For these reason, companies' tactics and strategies are more effective and productive based on the quickly react process to win the market and maintain company advantages. (SAP Help Portal 2019a.)

The tools of SAP BW provide a wide range of choices for reporting, dashboards, analysis, data interpretation. The data collection from SAP and non-SAP applications also supports within SAP BW. Management team can now make full use of the advantages of SAP BW to manage the company and decide decisions promptly and precisely thanks to the evaluating and interpreting data. (SAP Help Portal 2019b.)

Moreover, there are several advanced and unique tools and functions offering from SAP BW that are the easy-to-use modelling and interfaces; tools like process chain, remodeling, support the maintaining process: BEx Web analyzer with the ad hoc analysis tools power allows to create and perform the dashboard, reporting, and analysis both a portal and excel interface; integration with SAP Business Objects tools. The cost saving thanks to the integration of metadata combined with these mentioned benefits led customers to cite the end-to-end of the SAP BW. (Palekar, Patel & Shiralkar 2015, 34-35.)

## 4.2 SAP BW 7.4 Structure

SAP BW is able to interpret with data sources through various interfaces and different layers. For non-SAP data such as excel or other ERP data, SAP BusinessObject Data Service is used to transfer data. The first layer is extraction layer (❶ in FIGURE 22) that extracts and collects data from sources into InfoPackage. There are two modes of the extraction named pull mode and push mode. The pull mode is used in the data trigger process to data from SAP BW via InfoPackage, data parameters also defined here. For the wide range of sources, SAP BW provides a supported to acquire data. The data service that Extraction, Transformation, and Loading (ETL) accesses to the source system and integrates with SAP BW. For the files with the format as CSV and ASCII, the flat file interface can help the extraction process. For data from business suite, SAP BW offers an extraction from SAP systems. The users may customize the extractors and apply the delta loading data. By using the deal-enable extractor, only the new and changed data from previous extraction is extracted instead of extracting the full data set. The



delta loading is beneficial because of time and resources savings. The gigabytes of transactional data from years ago, for instance, can be avoided and only the updated data transaction from last period is extracted by using the delta-enable extractor. A Database (DB) connect and Universal Data (UD) connect are used in direct extraction from databases. For some databases, UB connect may access to the tables content data, however, the specific conditions should be followed. The relational and multidimensional dataset can be accessed and extracted with the UB connect. Several third-party tools may interface with SAP BW via staging business application Programming Interfaces (BABPs) to extract data from legacy systems. (Palekar, Patel & Shiralkar 2015, 36-37.)

The staging layer is next data location (② in FIGURE 22) that presents by the Persistent Staging Area. Data here can be enriched by the master data via transformation process that provides the attributes, texts, so on (SAP Help Portal 2019c). Also, data is cleansed to prepare for the reporting and analyzing. The transformation layer that involves data mapping, customizing, and formulas data to meet the requirements; and loading layer which transfers data via a data transfer process (DTP), the full, delta loading from data source to data target being defined here are the following two layers of the SAP BW. The data now is formatted into the InfoProvider. (Palekar, Patel & Shiralkar 2015, 38.)

For presenting data as reports or dashboards, the reporting and analysis layer (⑤ in FIGURE 22) can perform OLAT data from previous steps. The BEx Query Designer generates queries from the InfoProviders to form the basis dashboards, reports, and so on. The data display using SAP Business Explorers (SAP BEx) that integrates the third-party tools into the SAP Enterprise Portal at the sixth layer planning and advanced analytics layer. A crystal reports, SAP Lumira, SAP Business Objects BI Lunch Pad, SAP BusinessObjects Analysis for Microsoft Office, to name but a few, are the tools for data accessing. (SAP Help Portal 2019c.)



FIGURE 22. SAP BW 7.4 Architecture (adapted from Grob 2015)

### 4.3 OLAP and OLTP

The understanding of OLAP and OLTP is important for a business analyst. OLTP or Online Transaction Processing is a layer where manages transactions of master data. The highlight functionality of OLTP is to control, run, and update business transactions accurately and immediately. As handling regular business activities, the data status is current and can add, modify, delete, update, read data from the last 18 months to present. The queries applied are mostly standardization and simple, which reveal business strategies and situations of business processes. (SAP Community Wiki 2010.)

On the other hand, Online Analytical Processing (OLAP) is empowered SAP BW. It is a data analyzing platform that stages the well-build data. Thanks to OLAP technology, users can analyze data into multidimensional from operative and historical data of various business functions. The database structure under a star schema or OLAP cube is a fundamental idea of OLAP. As mentioned, OLAP may use the relevant business OLTP data as its sources to support the decision-making process. Because of using historical data, OLAP can only operate read mode. However, it may store and analyze data from the last seven years and create complex customized queries. (SAP Community Wiki 2010.)

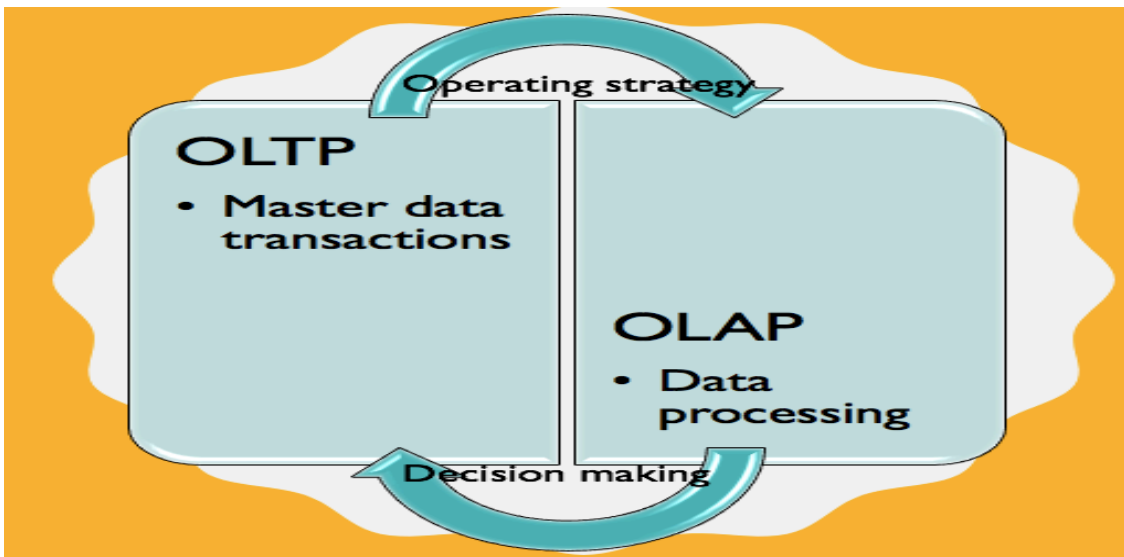


FIGURE 23. OLTP and OLAP (adapted from Manivannan 2017)

#### 4.4 Query

In SAP BW, a simple drag-and-drop function on a characteristic or key figure from InfoProviders is used to create a query. The tool enables users to create a query called Business Explorer Query Designer. By creating various reusable or global query elements, different queries may use them. The queries can later use as sources to analyze, and present reports and dashboards. The SAP SE provides several tools to support its processes BEx Analyzer, Bex Web Analyzer, BEx WebApplication Designer, BEx Report Designer. To log in to the BEx Query Designer, the users need to have the application which is standalone with SAP BW (see FIGURE 24). The user ID and password are the same as the SAP BW system.

The BEx Query Designer is a user-friendly tool that enables users can use it efficiently. After log in to the system, the default screen layer shows InfoProvider, Filter which includes Characteristic Restrictions and Default Values, Rows/Columns, Properties, Tasks, Messages (see ❶, ❷, ❸, ❹, ❺, ❻ in FIGURE 25).

To create a query, users have to have the InfoProvider as the source. As shown in figure 25, the key figures and characteristics of the chosen InfoProvider are grouped in their dimensions. To restrict a result of a report or dashboard, users can drag and drop characteristics into the Characteristic Restrictions.

Fiscal Year Variant, Version, Value Type, Currency, Company Code, for example, are restricted in figure 25.

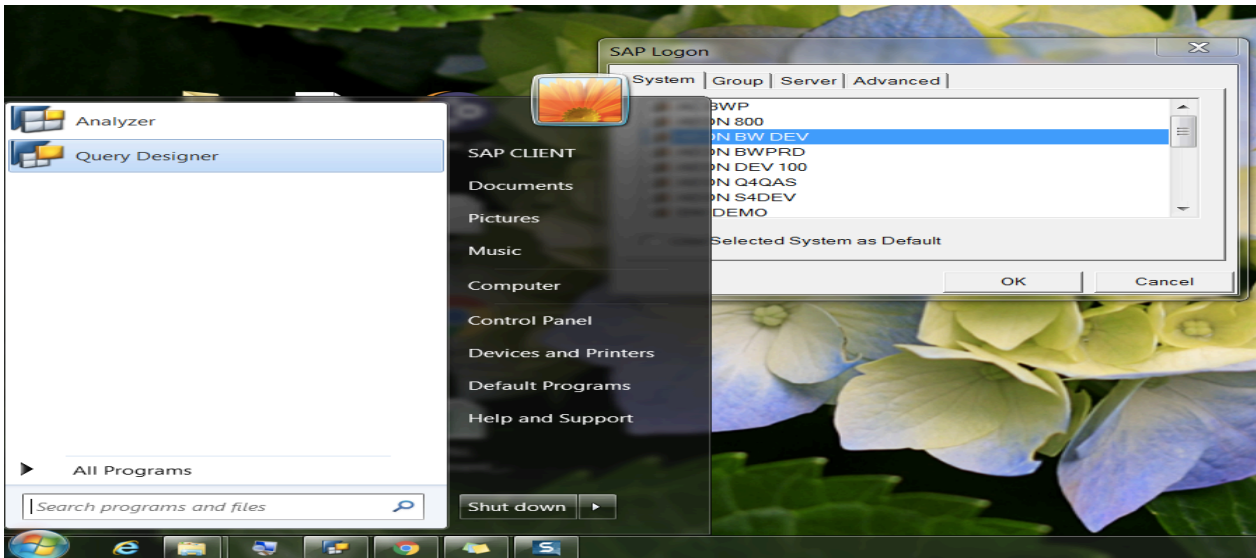


FIGURE 24. BEx Query Designer log in

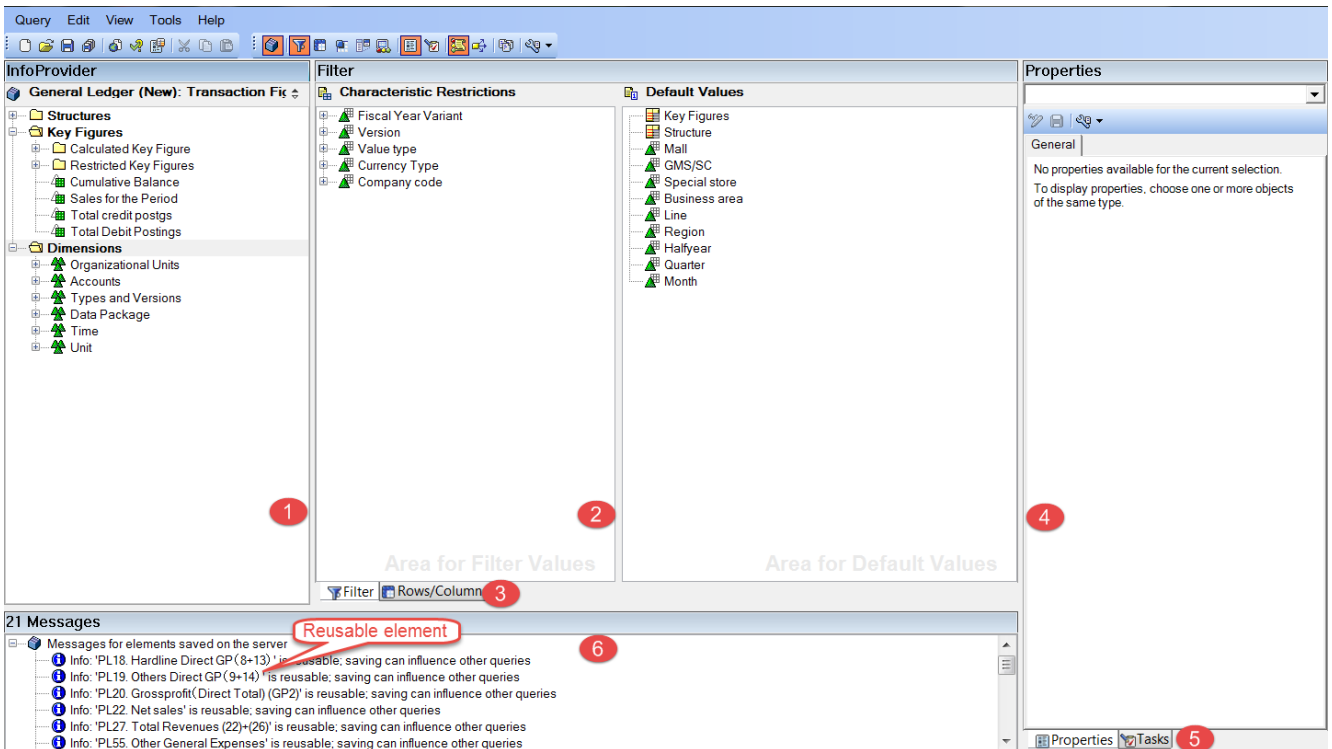


FIGURE 25. BEx Query Designer Layout (adapted from Nguyen 2019)

After doing restriction, users need to move to Rows/Columns (❸ in FIGURE 25) to define the queries. As a default, the characteristics from InfoProvider are dragged and dropped on the Rows. The columns

may contain both Key Figures and Characteristics. The characteristics in the Free Characteristics are invisible in the query result. However, in case these characteristics are needed, they may be brought into the query display. The query result may be viewed as a preview version in Preview after the rows and columns of the query are well-defined. (Palekar, Patel & Shiralkar 2015, 427-440.)

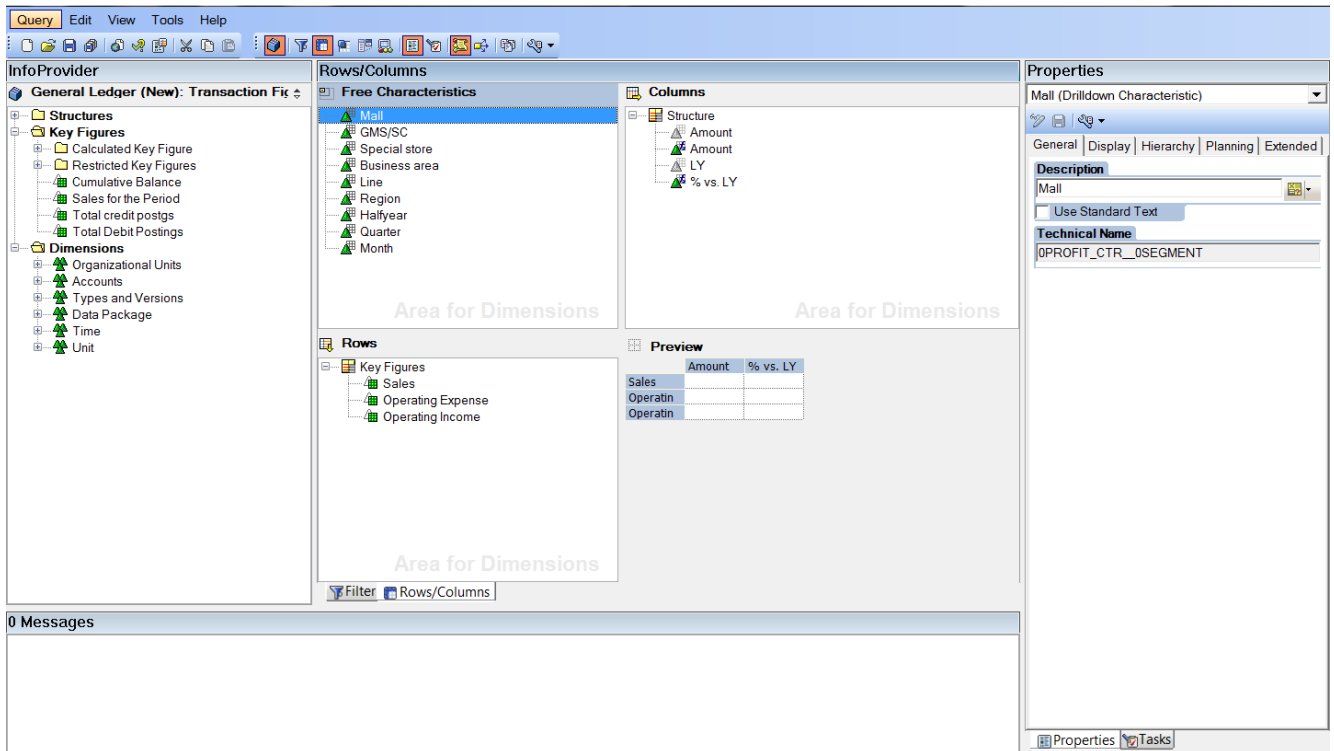


FIGURE 26. BEx Rows/Columns (adapted from Nguyen 2019)

#### 4.5 SAP BusinessObjects BI for reporting

The development of technology enables data presenting with several reporting formats. The options can be excel-based reports, dashboards, ad hoc analysis, reports with mobile devices, broadcasted reports, to name but a few, thanks to the integrations between SAP BW and SAP BusinessObjects BI. Data from SAP and non-SAP sources such as excel or web service now can store in the unified semantic layer that empowers by Information Design Tool (IDT). In this layer, data is processed and available for the tools SAP BusinessObjects Web Intelligent, SAP BusinessObjects Dashboards, SAP Lumira, for instance.

SAP Lumira empowers users to create reports and dashboards by using the sources from SAP BW, SAP HANA and SAP S/4HANA, local data sources, and so on. The combinational functionality from enterprise data to local data added provides the SAP Lumira an ability to create data visualizations. The

reports or infographics from SAP Lumira can be shared via email or view on other SAP BusinessObjects platform such as SAP BusinessObjects BI Lunch Pad. The BI Launch Pad is a platform that end users can assess and view the reports and dashboards from other tools available in the SAP BusinessObjects tools. (Palekar, Patel & Shiralkar 2015, 703-723.)

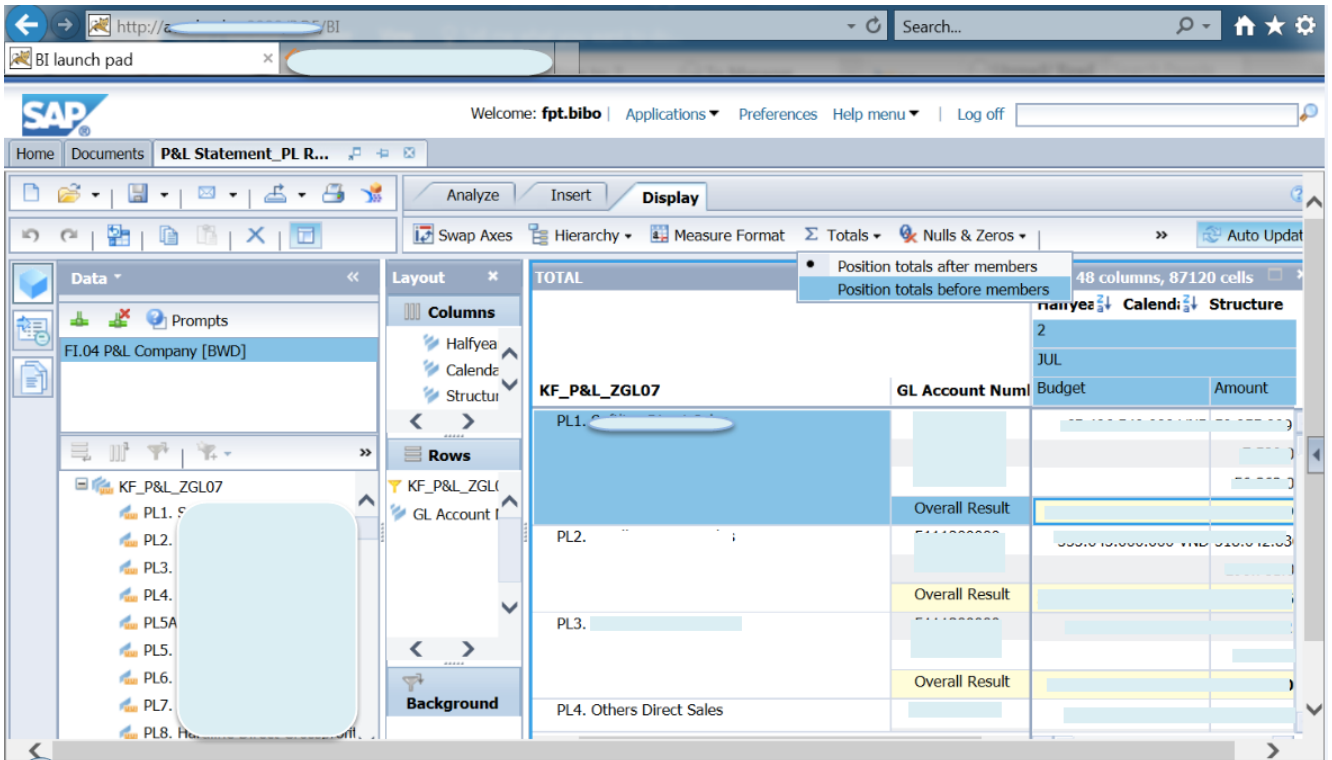


FIGURE 27. BI Launch Pad (adapted from Nguyen 2019)

## 5 FPT INFORMATION SYSTEM COMPANY

### 5.1 History

Thanks to the Doi Moi policy published by the Vietnamese Government at the Sixth Party Congress in 1986 that encouraged the new way of doing businesses in Vietnam the Food Processing Technology Company was launched on 13 September 1988. Mr. Truong Gia Binh, a director of the company and a team with 13 brilliant scientists who proved themselves as the pioneers in the technological field was the first generation of the firm. In 1990, the company was changed its name to The Corporation for Financing and Promoting Technology (FPT for short) to vision company strategy. After deploying the first software to Vietnam Airline named the Reservation and Booking system, FPT targeted to develop software for all business sectors from banking to telecommunications.

Adapting quickly with changes and opportunity, FPT became the first partner with IBM in Vietnam, following by Compaq, HP, and so on after the US embargo was null and void in 1994. The global financial crisis in 1997 putting the negative effects on the economic worldwide included Vietnam in general and FPT in particular was an alarm for FPT. The Dien Hong conference in 1998 defined company for the next decade that became a software outsourcing to face and adapt with globalization.

Achieving the ISO 9001:1994 certificate CMM 5 (Capability Maturity Model) certificate in 2000 and 2004 respectively, following by the comprehensive management system in 2005, and the Balanced Scorecard tool in strategic management in 2012, FPT proved as the leader in the technology industry in Vietnam. Within this period, FPT also diversified its businesses by launching the online newspaper VnExpress in 2001.

The year 2006 can be seen as the important year for FPT as there were two outstanding events that happened in this year. The FPT university, which was represented as the educational business of FPT, was introduced in September 2006. The university's goal was to provide the high-quality IT resources for both soft and hard skills requirements. At the end of the year, FPT was the first Vietnamese IT company listed on the Ho Chi Minh City Stock Exchange (HOSE). Until now, FPT still keeps its position into the investors' trust that stayed in top five Best Investor Relations by Vietstock in 2014.

Currently, FPT gains the great achievements such as expanding its retail stores to 150 and presenting in 63/63 provinces in Vietnam. For e-commerce market, Sendo.vn is now developing to become the most popular application. Internationally, the M&A deal with RWE IT Slovakia in 2014, the telecom services license provider in 2015, becoming GE Pridix partner in 2016 that participated in IoT, AI, have shown the correct strategy that FPT focuses. FPT now has approximately 30000 employees globally, presents in 45 countries, and its revenues in 2108 is VND 23,214 billion. (FPT History 2019.)

**5.2 Organizational structure**

As a corporation, FPT consists of several subsidiary and associate companies. The company headquarters is located in FPT Tower Cau Giay, Cau Giay district, Ha Noi city, Vietnam. In Vietnam, there are three main branches in Da Nang city, Ho Chi Minh City, and Can Tho City. Figure 28 shows FPT structure in more details.

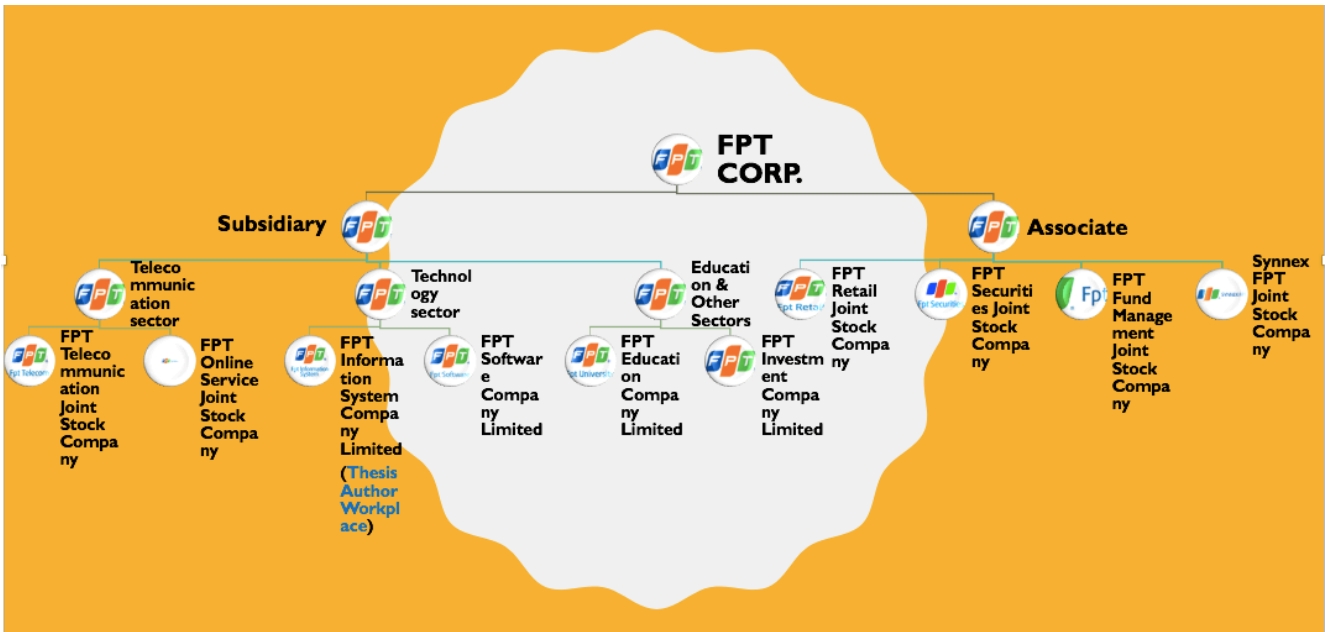


FIGURE 28. FPT Structure (Adapted from FPT member companies 2019)

While a subsidiary has three main sectors namely telecommunication, technology, and education and others, an associate company includes Synnex FPT Joint Stock Company, FPT Retail Joint Stock Company, FPT Security Joint Stock Company, and FPT Fund Management Joint Stock Company. Each sector in subsidiary contend two more companies that are FPT Telecommunication Joint Stock Company and FPT Online Service Joint Stock Company in telecommunication sector, FPT Education Company



Limited and FPT Investment Company Limited in education and other sectors, FPT Information System Company Limited and FPT Software Company Limited in technology sector. The thesis author currently works at FPT Information System Company Limited. (FPT Member companies 2019.)

### **5.3 Business**

FPT solutions portfolio range into three sectors which are technology, telecommunications, and educations. For technology, FPT focuses on IT services, system integration, and solution in specific industry. The cloud services, mobility, Internet of Things, legacy migration, developing and maintaining applications can be seen as the main products of FPT in IT services. Being partner with SAP, Oracle, Microsoft, IBM, HP, to name but a few, FPT provides best services in implementing information systems. Its clients are both domestic and international such as Cambodia, Philippines. In specific industries, FPT designs the foundationally technological solutions for those who are ambitious to adapt with the four industrial revolutions individually. E-government, E.Customs, Smart Banking, Smart Finance, E.Hospital, e.Clinic, E-Ticket, iHotel, and so son are the lists of solutions from FPT to the government, banking, public finance, health care, and hospitality industries.

Providing the internet access service package, leased line, data center, FPT television are the main businesses of FPT telecommunications. VNExpress newspaper, Sendo e-commerce, FPT Play, FSend, Mix666 are several examples of FPT online services.

In educational field, FPT provides the flexibility programs for students' choices. An adolescent can choose to study in the boarding environment of FPT High School. They not only learn high school knowledge but also discover their passion and enthusiasm to decide their future career. The vocational education, under-graduate and post-graduate education systems offer students the best skillsets to apply to the job market after graduated directly. FPT University also cooperates with universities abroad. The transfer program links with several universities from Australia, America, the UK, for instances. (FPT Business Sectors 2019.)

## 6 SAP BW ON HANA FINANCE FOR RETAIL COMPANY’S CASE

According to FPT Information System Company Limited and its client contract, all information related to clients has to be confidential. For that reason, an anonymous ABC name is used when mentioning the client’s name. The solutions that FPT provides to the ABC client included BI reports and dashboards, nonetheless, only the dashboards that are removed client logo, and changed backgrounds are discussed in the thesis. The ABC company is one of the biggest retail corporations in Vietnam. Besides the retail industry, they also invest in real estate that build the shopping malls for rent.

Finance always plays an important role when implementing business intelligence. According to Columbus (2019), Retail and wholesale companies hold a strong interest in technology and business intelligence to maintain their market position. Finance, moreover, is the most used functions daily. Following the ABC strategy that becomes the leader in the retail industry in Vietnam, they decide to implement the SAP S/4HANA for finance function. The SAP BW 7.4 also is deployed to increase the accurate and real-time of the data used as well as the management’s effectiveness.

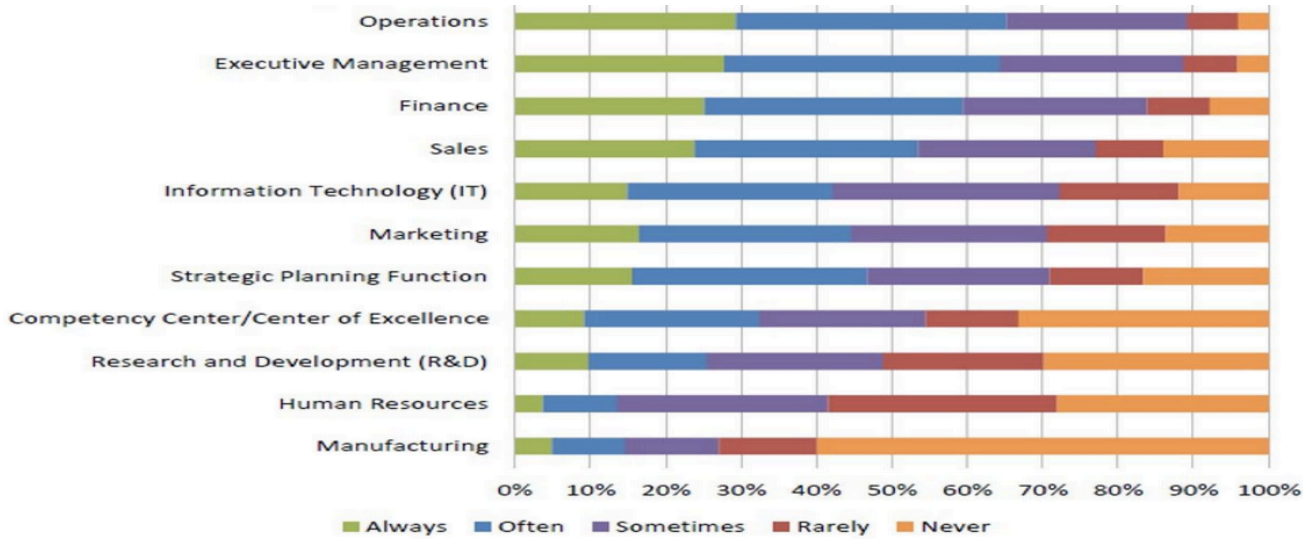


FIGURE 29. Functions used Business Intelligence (adapted from Columbus 2019)

## 6.1 Project Methodology

A project plan is a valid foundation for the successful project. FPT Information System (FIS) uses ASAP methodology when implementing SAP system for ABC client. According to the article on SAP Community (2014a), with its realistic and flexibility characteristics, the project team from project manager, to team leaders and team members, the SAP consultants and IT engineers, SAP partners as well as owners and leaders of the business process likely benefit from applying the approach.

As a standard methodology when implementing SAP system, the ASAP provides a transparency for the entire project period. Another value added is that a clear and easy-to-follow step by step plan, both FIS project and ABC project team can check a project schedule and follow each step due date for example. The various advantages from the ASAP methodology are that save project cost by integrating the SAP Advanced Delivery Management policies into the ASAP milestones; the alternatives between Agile and Standard method increase the flexibility of the project; through the preparation phase to operate, the methodology furnishes substantial reinforcements such as guidance, implementing documentations; project transparency is likely to be controllable because of the project cost, values being reflected to every business stage; enhance the efficiency and effectiveness of the project thanks to project governance and quality management; conjoint a user driven development, a business method, and a technological architect; manage the complete project span between workshops to gather client's opinions and build solutions, support after go live.

SAP presents the ASAP methodology as a standard approach that includes the step by step requirements for all implementing SAP projects. Individual project that holds its specific features, however, should manage the stages to suitable with project's characteristics. There are six phases included in the ASAP methodology that are shown in figure 30. The first step of the approach is project preparation (❶ in FIGURE 30). Depending on project scopes, objectives, expectations, the project team can gather and form the project plan in the phase. The guidance from ASAP methodology may specify documentations that the team can use. The system configuration, which is one of the most essential tasks of every implemented project, is done in this phase and the next step. The following stage of the method is business blueprint (❷ in FIGURE 30). Several meetings and workshops between client and SAP service provider company are held to understanding project priorities, customer's needs, wants, and expectations from the system. The documentations should be the results after the meetings and workshops. (SAP Community 2014a.)

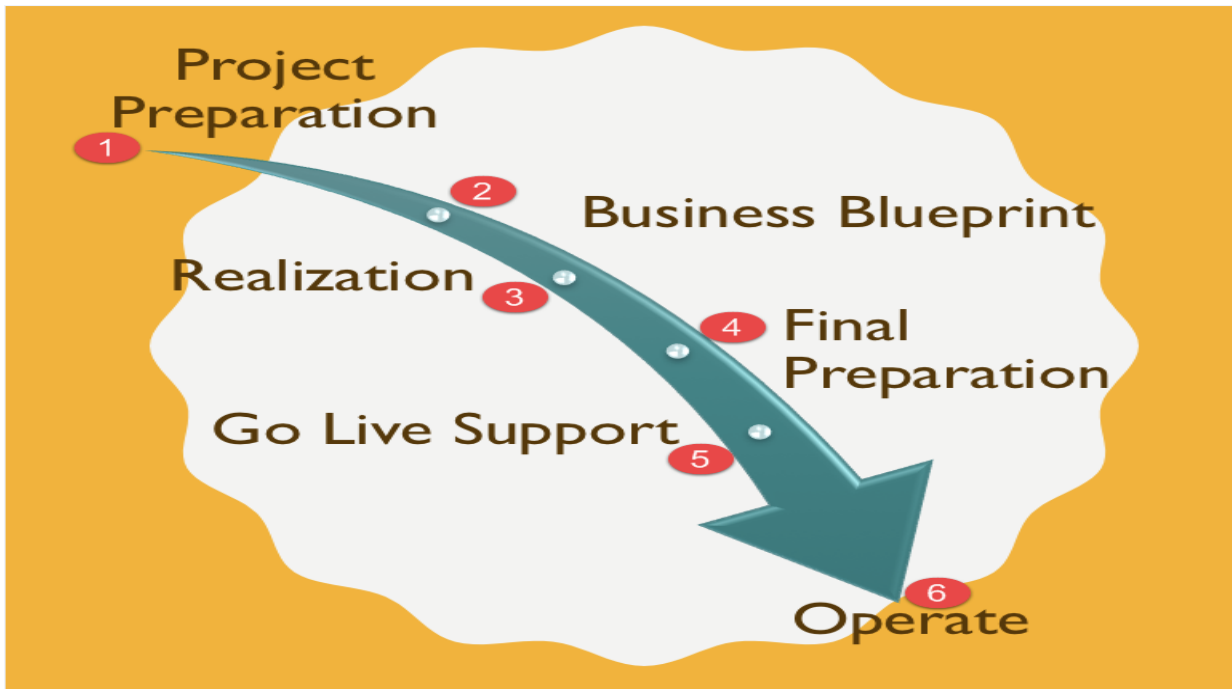


FIGURE 30. The ASAP methodology step by step (adapted from SAP Community 2014a)

Based on the documentations from the previous phase, predefined solutions may portray for further period of the project. Also, because of the blueprint documentations reflected customer's expectation, they indicate which reports and dashboards, for example, client prefer to use. Within the two packages Baseline Configuration and Final Configuration, the SAP system finishes configuration in the third phase Realization (③ in FIGURE 30). The several tasks are split in the stage namely testing the solutions with the landscape, processing data migration, training the key users, testing the system performance. The final testing, key users training for end users under the supervising of SAP service provider company, system checklists are the tasks of the step Final Preparation (④ in FIGURE 30). The Go Live Support (⑤ in FIGURE 30) is run after all the tasks in phase four completed. During this period, the project should be aware that the unexpectedly arising issues may happen without any signal and they should be available to handle the issues as soon as possible. Last but not least, the operation phase (⑥ in FIGURE 30) is maintaining the solutions' operations and guaranteeing the success of the project. (SAP Community 2014a.)

## 6.2 Gather information

The meeting and workshops between FPT project team and ABC client organized in late 2018 to the documentations. There are several reports and six dashboards needed as agreement between two parties.

The reports, nevertheless, do not further discuss data protection but only the dashboards are described. The following interview questions are practically used by FIS to collect data from ABC client. Please note that the information is confidential, only those signed the Confidential Thesis Contract may view it. The information shown below is according to Nguyen (2019) report.

### **6.3 Dashboard**

The cornerstone information from the Gather Information part is crucial for the entire implementation of the project. The dashboards, in addition, require more facts that are described below in the individual dashboard. As discussed, these facts and dashboards also are confidential.

## 7 CONCLUSION

To sum up, the thesis goal that presents the beneficial from SAP BW to an organization is achievable. The author conducts the theoretical background highlights the ERP system, core SAP S/4HANA functions SAP SD, SAP MM, SAP PP, SAP HCM, SAP FI, and SAP BW. While applying mostly qualitative research method, the author hardly uses a quantitative method. Using the case study research, the thesis author emphasizes the practical knowledge to his work. By doing that, the paper is not only to show how SAP BW helps the organization but also guide the ones who are at the entrance level of the thesis topic. In short, the research methods are correctly chosen to favor the author achieving the thesis objectives.

Although several concern persons may allow seeing the financial solutions, the topic question of what and how beneficial can SAP BW on HANA provide customer is well-defined. By illustrating the ASAP methodology, the information gathering processes, and dashboards, the client's current business situations are visualization. The company may apply the analyzing data as a source of the decision-making process and form the strategy to react quickly with the market changes. The company's financial status is in real-time. Since only the finance function implemented, the research only shows the relevant solution. For other functions of SAP BW on HANA solutions, audiences should have further study.

Besides the solution of SAP BW on HANA for the finance function, the concept of ERP and SAP S/4HANA also are portrayed. For those who interested in SAP functionalities, the information can consider as the foundation for their research. Audiences can follow the thesis due to a wide range of practical figures exemplifying without difficulty. The illustrating references are the SAP, SAP Press, and BI experts' reports.

As mentioned, the primary obstacle when doing the thesis is that the practical case cannot be published. Consequently, it prevents a full understanding of the research. The listed solution is not the final one because of the ongoing status of the implementing project so that it is likely another challenge. Following the updated information from the thesis author company, fortunately, the dashboards now are the almost final solution.

The SAP BW on HANA can help customers gain a better perspective about their business insight out. However, the implementing BI project may fail for several reasons. A lesson after researching is that business is changing quickly as well as BI solutions. To successful achieving the result, the client and

SAP consultant should have a better understanding. The solution demonstrated in the practical case varies various times. With the workshops and meetings to share and update information, both parties are likely to achieve the common goal.

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