D1.1

Business Process Model (BPM) and Specification Sheet

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Abstract:	This deliverable describes how the ADMONT distributed pilot line will be set up to provide project partners and later on customers access to all essential capabilities offered by the manufacturing sites.
Keywords:	Business Process Model, Supply Chain Management, Requirement Analysis, Virtual Factory, Distributed Manufacturing

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Disclaimer

Executive Summary

This deliverable provides a description of the conceptual approach for the ADMONT distributed pilot line from view of business model perspective.

Chapter 1 introduces into the content of that work package and specifically into this deliverable. Chapter 2 refers about the strategic idea behind ADMONT Pilot Line and discusses what business model will fit for the distributed pilot line. Chapter 3 provides detailed information about the essential capabilities of each ADMONT Pilot Line member. The information to the ADMONT consortium is completed by contact information and information how to get access to the pilot line. Chapter 4 introduces the supply chain processes that are needed in order to set up data and material flow in order to realize a prototyping run.

The open platform and the „one stop shop“ approach of the ADMONT pilot line define quite tight framework conditions and require different business models in parallel and cooperation with subcontractors. Every line partner can be the first contact to a customer and the manager for one individual business case. In the business case evaluation phase we have to decide which business model is adequate for this individual project. ADMONT needs a step by step implementation approach over the project run time and the last step follows the vision to have a 'One stop Shop' solution for all potential customers.

We will evaluate and test two typical business models, added value and centralized model, with internal project partner on two selected demonstrator products. The centralized model demonstrator included external partner for subcontracting.

For analysing and build up an understanding of what business processes, communication processes and manufacturing processes are required in order to succeed with developing and manufacturing of pilot products we used the SIPOC Model (**S**upplier, **I**nput, **P**rocess, **O**utput, and **C**ustomer). It allows to model a process oriented interaction between business partners with defined relation in terms of who is supplier and who is customer, what input is expected as well as what output should be the result of the process and who benefits from that.

The internal data management structure for the ADMONT pilot line is defined based on typical foundry requirements. In WP6 we will define standard formats for data and wafermap exchange between the partners and customers. Basic information's are also included in our Data Management Plan (D8.1).

For monitoring the pilot line performance a first set of key parameter is defined and agreed between the partners.

The information of the essential capabilities together with contact information from all ADMONT pilot line partners are available on our ADMONT webpage.

In conclusion the business processes and models, the data management and key performance parameter are not finally fixed yet. We need learning phases and development cycles and a periodic review on yearly basis.

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Chapter 1 Introduction

This chapter introduces the first delivery of the work package one. It provides information about the strategic purpose of ADMONT as well as business targets.

The overall goal and strategy of ADMONT is to implement a distributed More-than-Moore pilot line for products and services based on a wide-ranging set of technologies or essential capability modules (ECM) not available within one manufacturing facility. In order to allow development and industrialization of innovation projects, a virtual facility capable to provide divers process flows as a ‘one-stop-shop’ needs to be carefully specified, planned and implemented. Besides the specific challenges of More-than-Moore manufacturing lines (flexibility, high level of technology and product mix) the distribution of capabilities is an important consideration in order to achieve cost-, cycle time-, quality- and yield-competitive manufacturing solutions.

The ADMONT is organized along the value chain from CMOS wafer processing with MtM 0.35µm high and ultrahigh voltage and integrated sensor technologies at X-FAB Dresden, sensor processing and sensor material development at FhG-IPMS Dresden, organic semiconductor materials and OLED processing at FhG-FEP and 2.5/3D silicon-system integration at FhG-ASSID. Therefore, the pilot line offers four distinct essential capability modules (ECM) on its four locations: CMOS capabilities, sensor actuator capabilities, organic capabilities and silicon system integration. The ADMONT pilot line is working as an open platform and customers can select and use single processes or technology modules or combinations of it from all capabilities for smart system integration. These advantages for ADMONT customer require variability and flexibility for different business models, a deep analysis from potential business cases and well defined work flows between the pilot line partners.

As visualized by Figure 1 several elements need to be taken care of in order to transfer the strategic idea into a real business model with the ability to comply with different considerations. The key partners are the main essential capability provider the ADMONT line is made of. They provide the key resources which are essential for the key activities to drive value proposition. Using different channels to build up and maintain customer relationships in order to create revenue streams by being successful in different customer segments. Due to the fact that the key partners have different business models based on their already existing business it needs to be considered how they look like and how they benefit or even suffer from the strategic business concept of ADMONT.

ADMONT - The Business Model Canvas

Key Partners

+ ADMONT Manufacturing Line Member with their Resources to enable and support development as well as production of Pilot-Products

Key Activities

A) Development and provisioning of capabilities required for Pilot Products
B) Manufacturing of Pilot Products (small, medium volumes)
C) Manufacturing of Products (high volumes)

Key Resources

A) Process Engineering, Process Development Staff, Project Management Staff

B) & C) Manufacturing Equipment, Manufacturing Staff, SupplyChain&CustomerService

Value Propositions

A) industrialization and integration of semiconductor processes and technologies by using distributed development and process/product integration competencies and capabilities

B) & C) Manufacturing of semiconductor products by using distributed manufacturing competencies and capabilities

ACCESSIBILITY on wide portfolio of semiconductor processes, process and integration IP as well as appropriate compentencies to integrate and combine those overcoming limitations due to distributed capabillities

Customer Relationships

+ Service approach based on trust, transparency
+ centralized communication interface for access on essential capabilities of whole ADMONT line
+ various business models available for product development and manufacturing

Channels

+ WEB Interface 'ADMONT'
+ Business Development Departments of specific 'ADMONT' line member
+ Central business development interface of 'ADMONT'

Customer Segments

+ medical industry
+ automotive industry
+ consumer industry

Cost Structure

A) Value Driven (Economies of Scope)
B) & C) Cost Driven (Economies of Scale)
Engineering Staff and equipment assets as most cost intensive resources

Revenue Streams

A) Revenue (NRE) from service for Pilots and Demonstrators
B) & C) Revenue from mass production (medium and high volumes)

Figure 1: ADMONT – Business Model Canvas

While one member follows a classical foundry business model, generating revenue by offering manufacturing technologies and capacity to materialize mixed signal semiconductors, the other members are research institutes, generating revenue by developing IP especially, customized technologies, process modules and silicon-based smart system solutions of integrated circuits, sensors, actuators and MEMS elements. Additionally they also generate a significant portion of their revenue streams doing pilot production and manufacturing of small and medium product series.

The partner who aims to set up business cases of mass production benefits symbiotically from the activities of the partners targeting for projects and industrialization challenges. It can be considered as a valuable partnership combining those different business models if the management organization considers it that way and sets up processes to synchronize and communicate plans and visions between the partners.

Finally it can be said that the business model canvas describes how the two different business models of production and research work and coexist mutually. Obviously the semiconductor foundry has an intrinsic motivation to support development activities leading to pilot-products, pilot-production and production with high volumes. The research and development institutes provide a wide range of process capabilities as well as significant know how and expertise especially beyond current manufacturing-scope of foundry partner. The combination of experiences and capabilities for development and volume production makes the strategic concept interesting for potential customers who want to develop products and required process capability and transferring them to high volume production. Finally the business approach fits well for partners and customers towards new technologies and device functionalities using new materials and manufacturing processes.

Chapter 2 The ADMONT Business Model

Chapter 2 refers about the strategic idea behind ADMONT Pilot Line and discusses what business model will fit for the distributed pilot line.

2.1 Strategy

The strategic idea of ADMONT pilot line was created as a result of a market study considering offerings within the semiconductor market addressing potential needs of medium and smaller customers which are looking for a suitable development, industrialization and finally manufacturing environment to realize their product ideas. Based on the assumption smaller customers are hindered by financial and organisational barriers in entering into IDM-manufacturing environments, simply due to the fact that significant capex is not easily possible to afford, it may become beneficial for them to find an IDM-like environment within ADMONT (Figure 2).

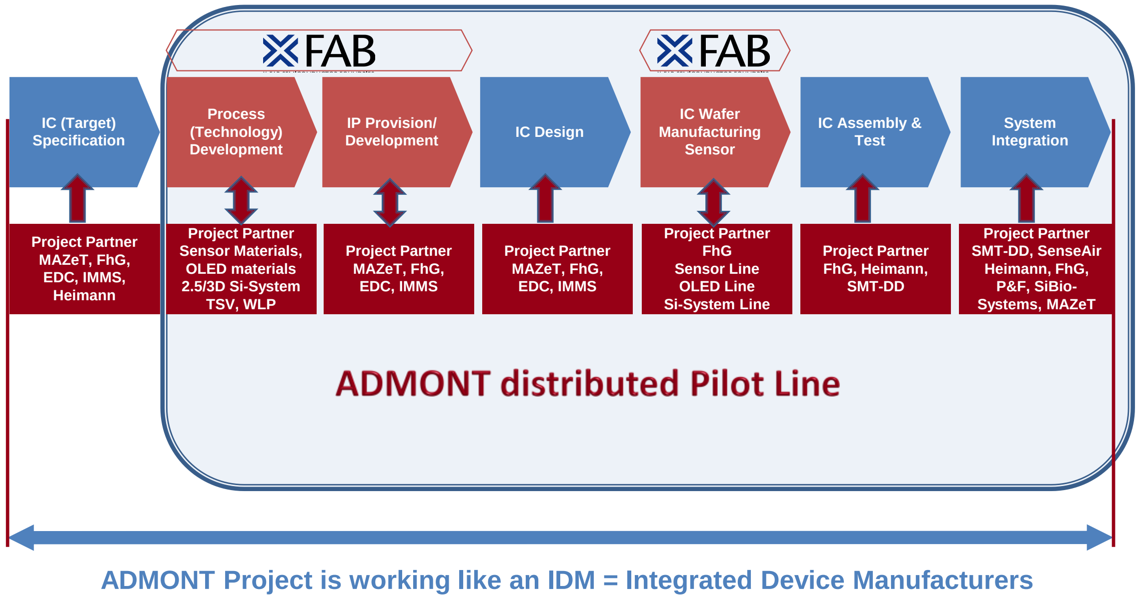


Figure 2: combination of business models (BM) to provide IDM-like business conditions

Another fundamental question needed to be answered, which business model fits best for ADMONT pilot line? The ADMONT line members themselves are following individual and different business models. In order to provide an attractive offer towards potential customers it may fit well to provide a rather flexible and adaptive offer in terms of business model to address different customer needs and strategies. How to handle that business model flexibility will be discussed within the next chapter. It starts with an overview about what basic and mixed business models could be thought of and closes with a short discussion what may fit best for ADMONT.

2.2 Overview Business Models

The following subchapter provides an overview of potential business models, which were taken into consideration for the ADMONT Pilot Line.

2.2.1 Customer Centric

The customer centric model (Figure 3) is often used if customers want and/or need to manage a portfolio of manufacturing capabilities on their own to realize the product. They subcontract the processes where they do not have the capability to do on their own. Also in combination with IP protection this approach is often used. Due to the fact that the customer manages each individual manufacturer the complete information and data is available to itself only.

On the low side the customer lives with X different manufacturing- and quality systems which drives overhead effort and costs. On the other hand the customer reduces the risk of IP/knowledge loss to their manufacturer and they can individually negotiate with every manufacturing partner. This customer centric approach is mostly used by large/medium companies since they can afford the staff costs to organize a large amount of individual supplier. Potentials to improve efficiency for mass production are probably not easy to find.

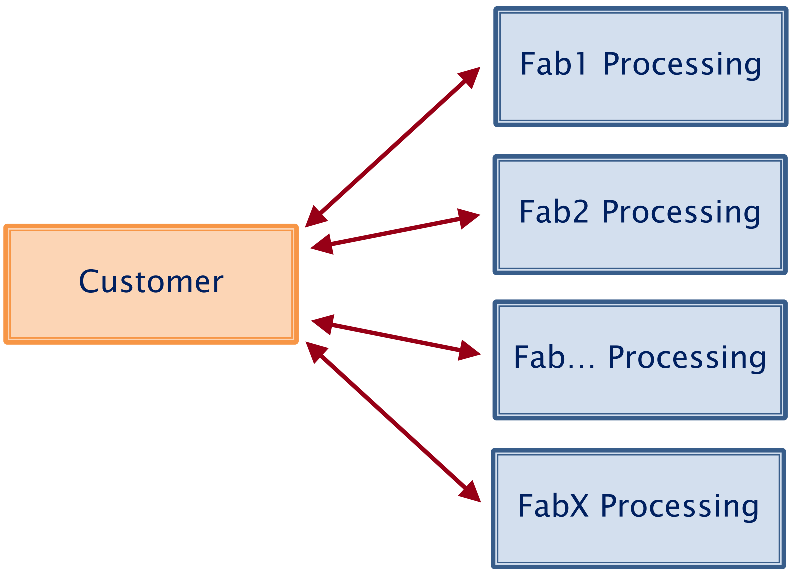


Figure 3: Business Model ‘Customer centric’

2.2.2 Subcontracting

The subcontracting model (Figure 4) becomes very useful for customers if they miss specific services and capabilities within their own company. Different services can be subcontracted from single process mass production till development projects or parts of it. The prime contractor (FAB 1 in Figure 4) manages the other subcontractors (Fab 2…X) on the one hand and has the supplier / customer relation to manage on the other hand This model fits well to the needs of small and medium companies which are not able to provide staff and organization budget to handle individual suppliers. Especially if customer want to enter a new market or want to test new devices concepts this business model lowers the costs to find, negotiate, organize and manage supplier to manufacture a new device.

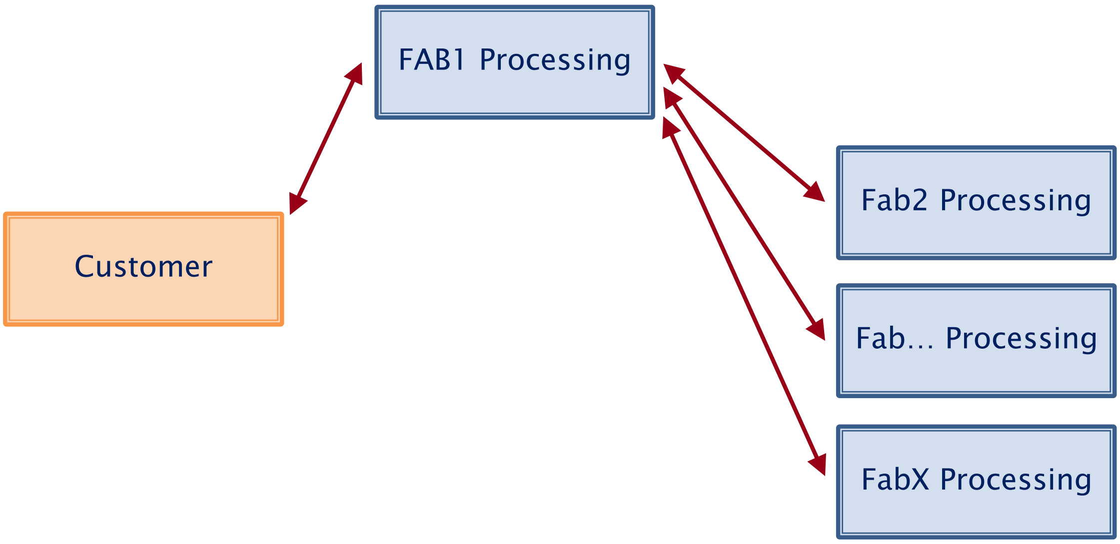


Figure 4: Business Model 'Subcontracting'

2.2.3 Added Value

The model is characterized by data, material flow and value exchange along the supply chain (Figure 5). Each member of the supply chain has its own business model. This approach can be found very often within all markets for strong supply chain structures with long life cycles like automotive products. It may be found for supply chains with requirements for high efficiency.

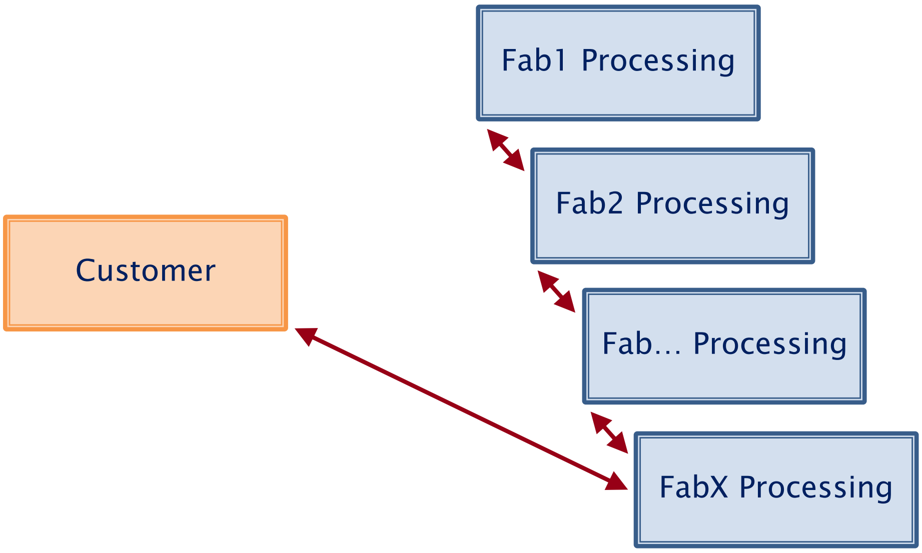


Figure 5: Business Model 'Added Value'

This business model offers the low management cost of only one subcontractor to the customer. On the other hand development of new processes and materials get more complicated in terms of documentation, quality management and trouble shooting.

2.2.4 Mix Model

A mix of business models within a supply chain structure may also occur and makes sense if the supply chain member just can benefit from existing business case. In the example given by Figure 6 the data and material are exchanged between customer and individual suppliers, supplier Fab2 acts as prime contractor and subcontracts some service.

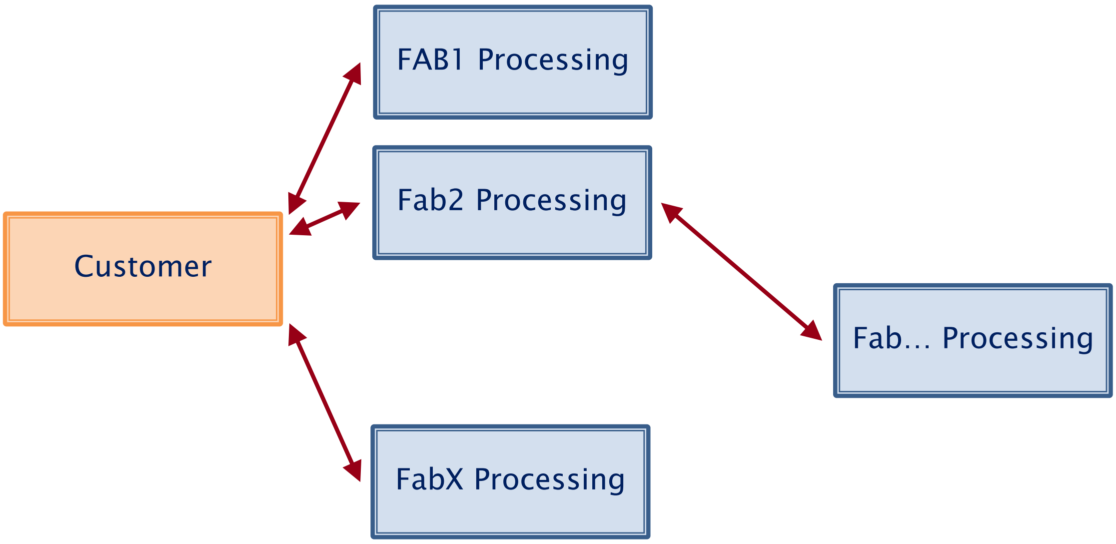


Figure 6: Business Model 'Mix Model'

2.3 Business Model within ADMONT

In order to address best the costumers needs, the following subchapters will focus on how will meet them. We followed the question, if one business model fits to all business cases and also provided a first schedule for the business models.

2.3.1 Does one Business Model fit to all Business Cases?

Referring to chapter 2.1 the question of which business model fits for the ADMONT pilot line can be answered best by offering different business models to customers.

Within the period of the project several specific prototypes will be developed and later on also manufactured. From specific prototyping-projects and related business cases it can be derived that more than one single business model needs to cover those different business cases. Based on the various experiences of the research and production partner, the ADMONT partners agreed that there are very different customers subcontractor strategies and thus ADMONT has to offer different business models otherwise some customers cannot be addressed.

From the strategic perspective it also makes sense to choose the optimal business model for each business case, considering technical aspects, involved partners and their specific needs as well as how the ADMONT project progressed at the given point in time.

2.3.2 ADMONT Schedule and Business Models

ADMONT needs a step by step implementation approach over the project run time, visualized by the following graph (Figure 7). While early steps just enable to start with the ADMONT pilot development and production later steps will complement additional services and business process support. Finally a last step follows the vision to have a 'One stop Shop' perception for all potential customers of ADMONT pilot line.

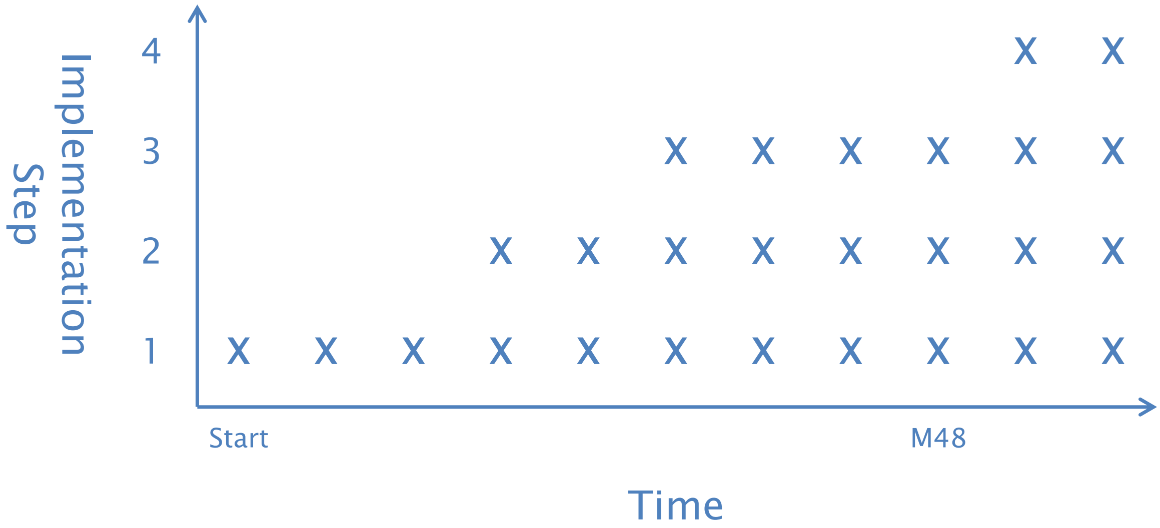


Figure 7: Implementation of ADMONT within 4 steps

The steps are characterized in the following paragraphs.

2.3.3 'Step 1'; decentralized Pilot Line

This implementation step is characterized by:

- No change in the specific business models of the ADMONT-PILOT-Line members
- Each ADMONT-Pilot-Line member acts as potential contact point for customers
- A common web site provides information for contact as well as the portfolio of 'essential capabilities'
- Data and Material are exchanged between Customer and ADMONT-Pilot-Line-member according to chosen business model

All BM described in section 2.2 are already available, besides the naming of ADMONT-consortium.

2.3.4 ‘Step 2’; Centralized ADMONT I

This implementation step is characterized by:

- No change in the specific business models of the ADMONT-Pilot-Line members
- No change in Data and Material handling
- A common 1st contact point for customers is defined and authority is given to do 1st assessment of customer requirements and questions
- A process is defined and implemented to manage the distribution of information and involvement of ADMONT-MF-Line members for specific business cases
- The common web site will be updated to provide additional information about this 1st contact details and related processes

2.3.5 ‘Step 3’; Centralized ADMONT II

This implementation step is characterized by:

- No change in the specific business models of the ADMONT-Pilot-Line members
- In addition to ‘Step 2’ the centralized point of contact manages the whole project (kind of project office)
- The common web site will be updated to provide additional information about contact details and related processes
- Data and Material are exchanged between Customer and ADMONT-Pilot-Line member according to chosen business model
- Data formats and content of information about quality and logistics are aligned in order to have common data formats between ADMONT-Pilot-Line-members

In case of the chosen business model fits well with the approach of single business contact (refer to Figure 8), it makes sense to reorganize the point of contact. All Data, information and Material can be easily exchanged between customer and the centralized ADMONT interface. The example given in Figure 8 illustrates the case that the ADMONT-MF-member Fab2 takes over the role of the business case specific central ADMONT Interface.

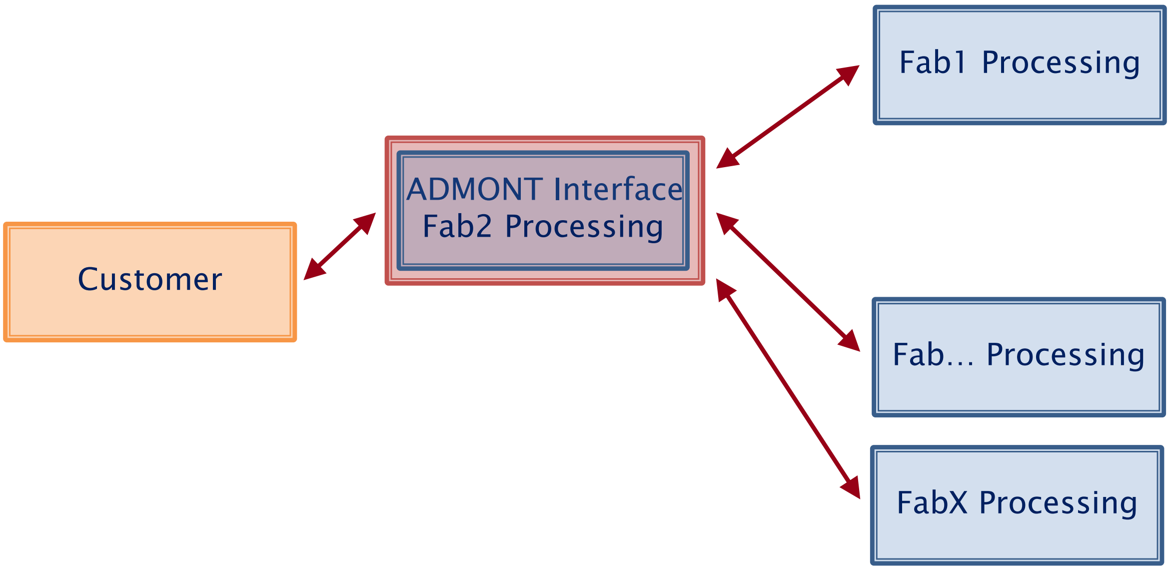


Figure 8: Business case specific central ADMONT Interface

2.3.6 *‘Step 4’; Centralized ADMONT III*

As an option and potential outcome of the project a new organizational structure, even separate company (legal entity) finds its own business case by marketing ‘essential capabilities’ of the ADMONT line and managing business cases. Their value proposition might be the project management and organization of development activities or pilot production for customers or even its own projects.

Data and Material are exchanged between customer and ADMONT interface as well as ADMONT-MF-members. This case is illustrated in Figure 9.

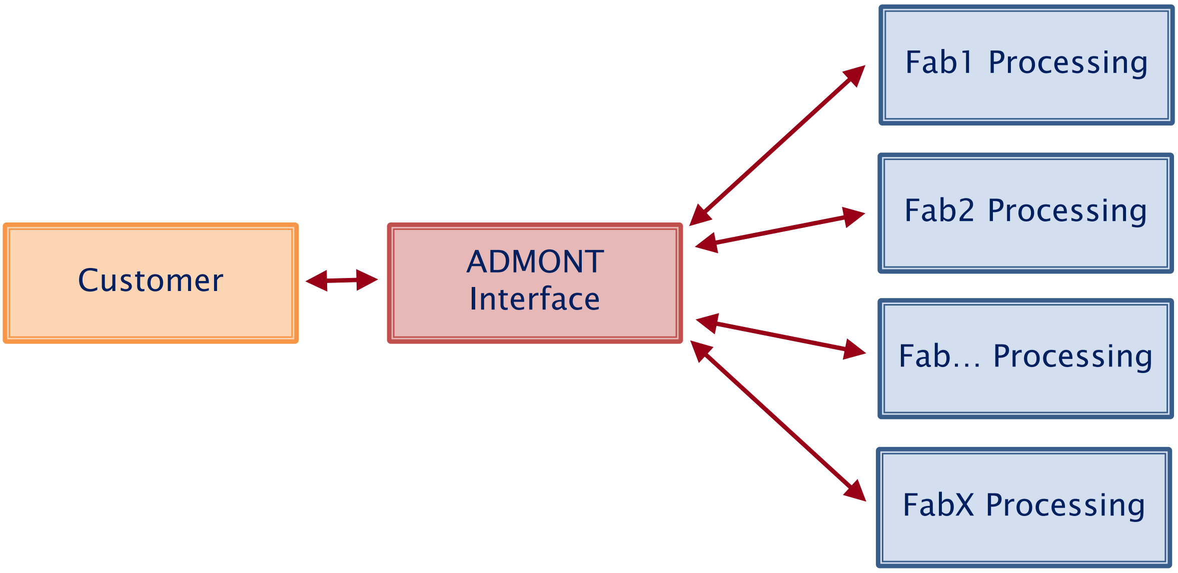


Figure 9: Central ADMONT Interface

2.3.7 ADMONT Business Model Demonstration

Different business models under ADMONT will be manageable and the strategy “one stop shop” approach will be demonstrated at two business cases. Based on our SIPOC Model Analysis (**S**upplier, **I**nput, **P**rocess, **O**utput, **C**ustomers), detailed information are in chapter 4, we select two of our demonstrators.

<u>Case A: Added Value Model, Deliverable D5.4 TRL6</u>

“Prototypes of disposable lab-on-a-chip devices based on MtM pilot line CMOS process integrated with MEMS and Microfluidics for rare cells manipulation and sorting”

The project partners KPS and IMMS act as the external customer (system specification, sensor specification, CMOS and sensor design). Pilot line partners are X-FAB, FhG-FEP and FhG-IZM/ASSID.

- Customer KPS/IMMS
- 1st Fab X-FAB, CMOS preparation with special sensor interface for OLED
- 2nd Fab FhG-FEP, OLED on CMOS preparation
- 3rd Fab FhG-IZM/ASSIS, packaging and silicon system integration
- Customer KPS/IMMS test and evaluation

Process and quality data will be delivered from each fab separately with respect to customer requirements.

<u>Case B: Centralized ADMONT Interface, Deliverable D7.3, TRL7/8</u>

“Demonstrator smart health & safety mobile gas sensors”

The project partner SenseAir AB is the final customer and system integrator. Heimann Sensor is acting as the central interface to the ADMONT pilot line and is managing additional subcontracting. Pilot Line partner are X-FAB and FhG-IPMS.

- Customer SenseAir AB, system specification and integration
- Heimann Sensor central ADMONT Interface and sensor specification
- 1st Fab X-FAB, thermopile in CMOS preparation
- 2nd Fab FhG-IPMS, back side membrane processing
- 1st Subcontractor, design house for CMOS and sensor design
- 2nd Subcontractor, thermopile packaging and test
- Customer SenseAir AB thermopile integration, gas sensor assembly and test

Process and quality data will be delivered from each fab separately regarding to central ADMONT interface requirements. Heimann Sensor is managing for SenseAir AB the complete value chain and data processing.

After two years project run time and ADMONT pilot line business model experiences additional demonstrator examples are possible.

2.4 Summary

The ADMONT pilot line will start with a flexible model in order to maximize the potential resonance within the market according to the strategic idea of ADMONT addressing the needs of very different customers.

By stepwise development and implementation of further services and improved support the ADMONT line will become more and more attractive for customers. By offering an additional central interface and facilitating the handling and management of business cases for them will complement the offering. Furthermore, it supports the alignment between the ADMONT pilot line members with purpose to satisfy customers by aligned data structures and definitions (quality as well as logistics).

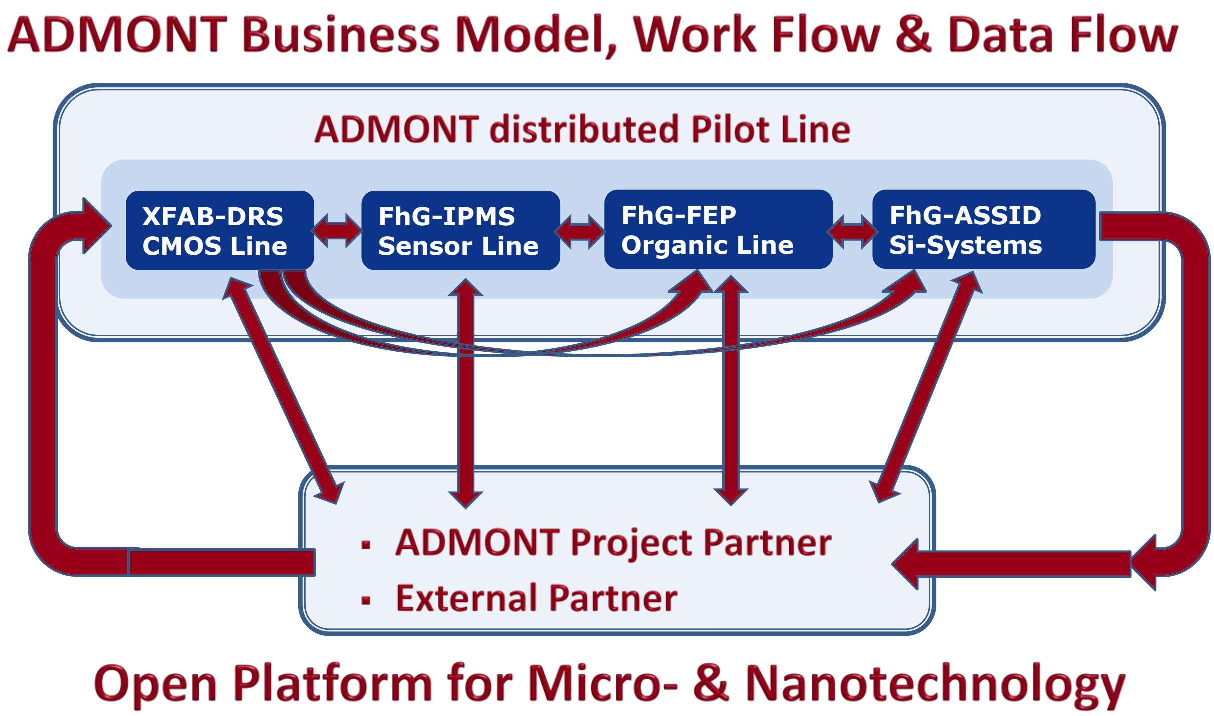


Figure 10: ADMONT Business Model and Process Flow

Chapter 3 ADMONT Essential Capabilities

Chapter 3 provides detailed information about the essential capabilities of each ADMONT Pilot Line member. The information to the ADMONT consortium is completed by contact information and information how to get access to the pilot line.

3.1 ADMONT Pilot Line members

The pilot line is organized along the value chain from CMOS wafer processing with MtM 0.35µm high and ultrahigh voltage and integrated sensor technologies at X-FAB Dresden, sensor processing and sensor material development at FhG-IPMS Dresden, organic semiconductor materials and OLED processing at FhG-FEP and 2.5/3D silicon-system integration at FhG-ASSID. The ADMONT Pilot Line members are located in Germany (Saxony) and belong to one of the biggest microelectronic clusters worldwide.

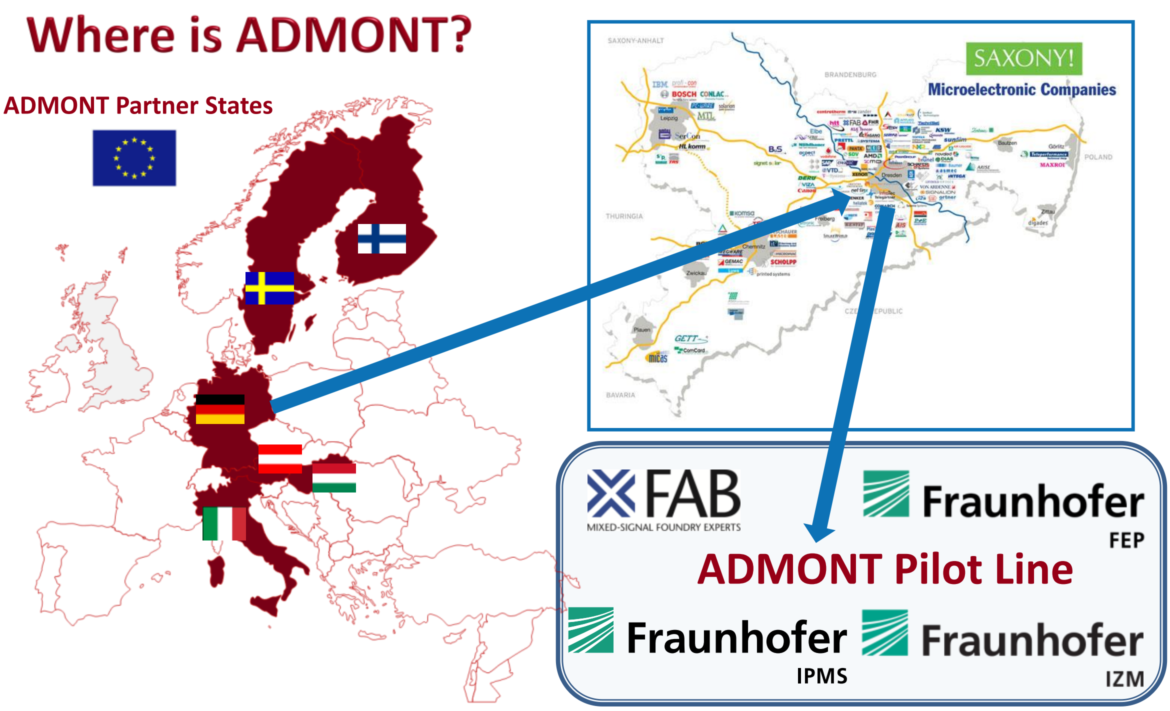


Figure 11: Where is ADMONT Pilot Line

The advantages for customers collaborating with the ADMONT Pilot Line are:

- On-stop-shop for from ASIC design support to wafer manufacturing and silicon system integration
- Established material and design flow between partner and their pilot lines (clean rooms are located close together)
- Monitoring of manufacturing status, in-line parameter, PCM parameter and quality parameter across all partner

- Easy access to standard CMOS processes and highly specialized sensor, actuator, organic semiconductor materials processes and modules
- Wafer level packaging and 3D silicon system integration together with thin wafer handling and processing

All Line members provide their own specific essential capabilities. Some details are provided within the following paragraphs.

3.1.1 X-FAB Dresden

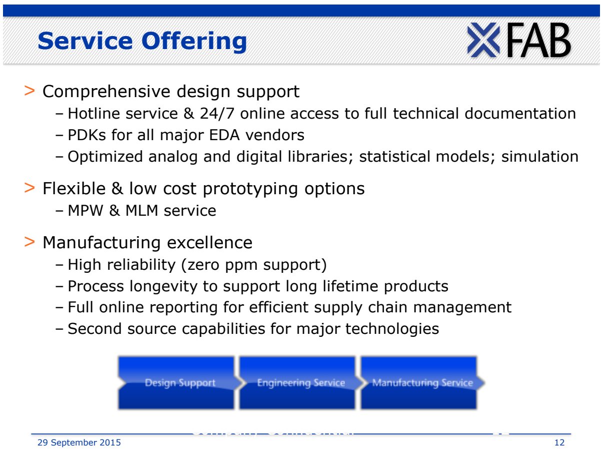
The X-FAB Dresden specific essential capabilities as of today are:

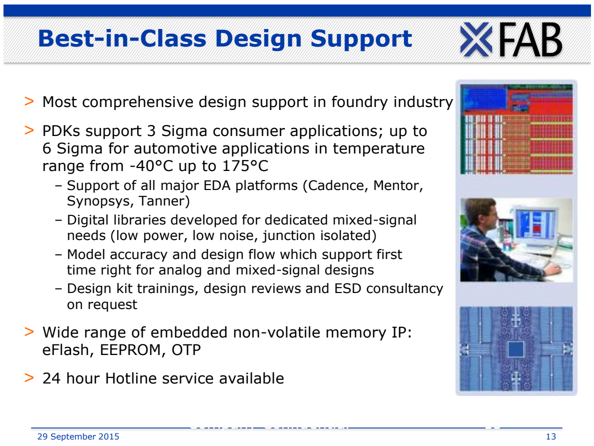
Manufacturing Processes:

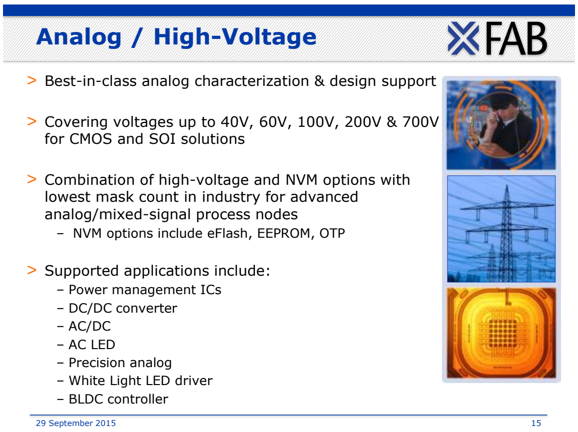
- 0.35µm ultra-high-voltage CMOS process (XU035)
- 0.35µm HV and analog/mixed-signal CMOS (XH035)
- 0.35µ integrated Thermopile in CMOS XT-035
- 0.6µm HV and analog/mixed-signal CMO
- customer specific 0.6 and 0.35µm analog/mixed-signal/HV CMOS processes
- customer specific process and module development and integration
- first class design support (PDK, IP, simulation) and automotive quality

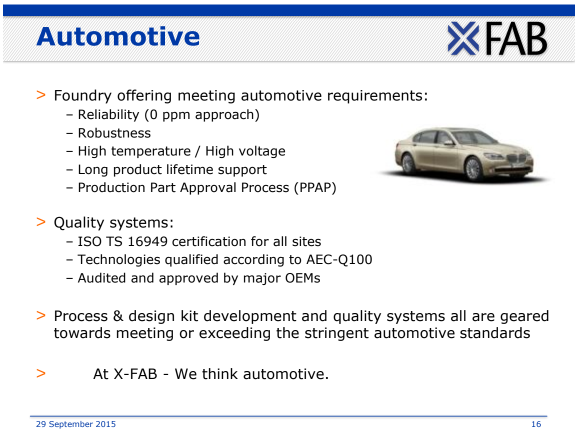
Capacity:

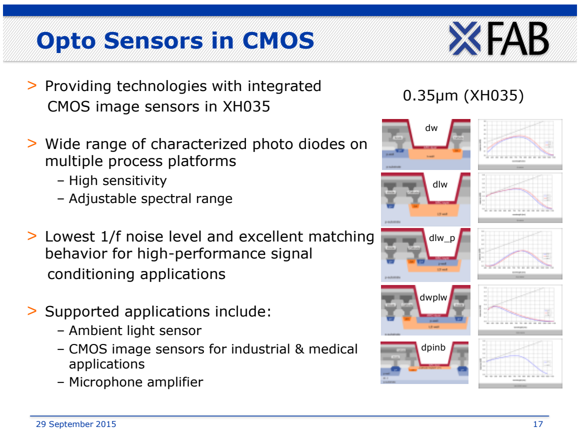
- 8,000 wafer starts per month
- Wafer size 8" (200mm)
- Clean Room   ISO Class 3











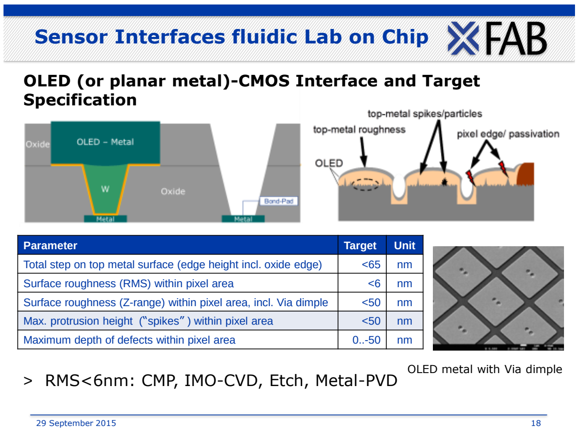


Table 1: Representative selection of ECs for X-FAB Dresden

3.1.2 FHG IPMS

The specific essential capabilities of Fraunhofer IPMS as of today – covering the full value chain from applied R&D up to low volume / pilot manufacturing – are:

Manufacturing Processes:

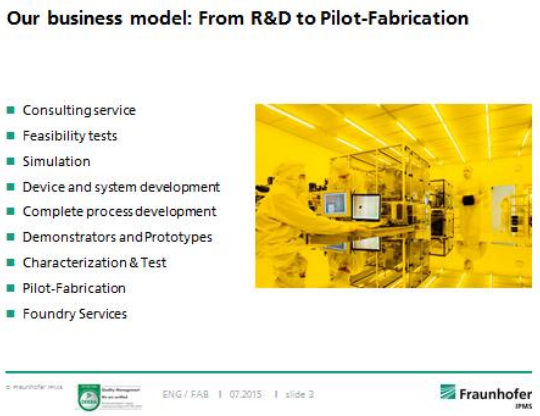
- Surface MEMS Technology (e.g. Spatial Light Modulators, Capacitive Micromachined Ultrasonic Transducers - CMUT)
- Bulk MEMS Technology (e.g. Micro Scanning Devices, pressure sensors)
- Integration technologies (SoC, e.g. Spatial Light Modulators)
- Backend-of-line technology for leading edge CMOS

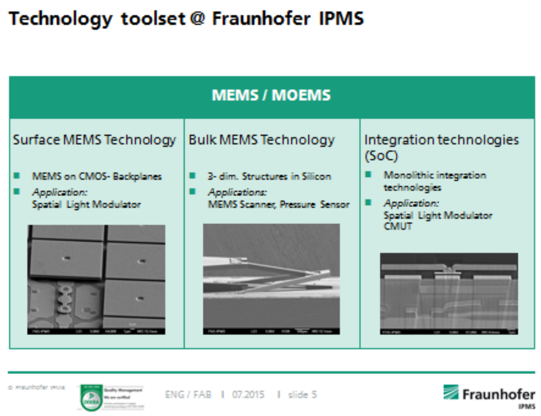
Capacity:

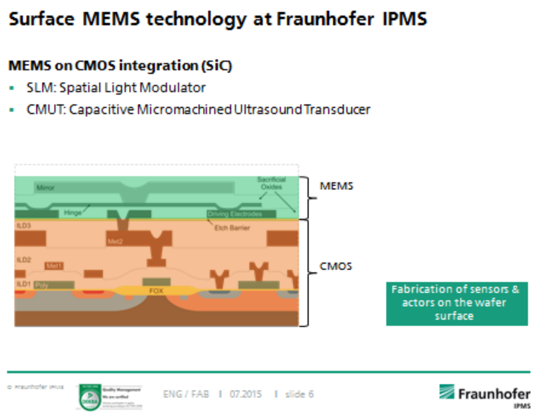
- 1,000 wafer starts per month
- M(O)EMS: 1.500m² ISO 4 (class 10)
- Nano-Tech: 800m² ISO 6 (class 1000)

Fraunhofer IPMS plans to develop the following new capabilities within ADMONT:

- Thermopiles with new thermo-couple materials for improved sensor parameters
- Improved technology for monolithically integrated thermopile sensor arrays
- CMUT for airborne applications
- SoC and SiP solutions for integrated CMUT systems
- IP core development for transponder solutions







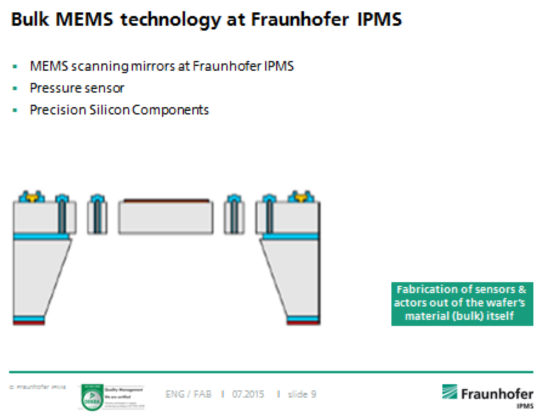


Table 2: Representative selection of ECs for Fraunhofer IPMS

3.1.3 FHG FEP

The specific essential capabilities of Fraunhofer FEP as of today are:

Manufacturing Processes:

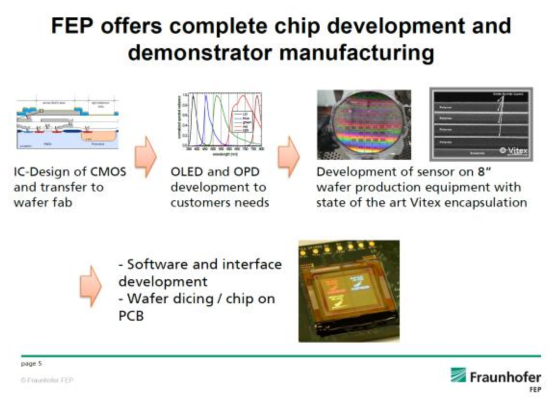
- Deposition and structuring of polymer and small molecule organic multilayer for organic light emitting diodes and photodiodes
- Deposition of oxides, nitrides, fluorides as well as standard and uncommon metals (Al, Ca, Ag, Au) as electrodes and functional layer
- Encapsulation of devices against oxygen and water by using a multilayer thin film encapsulation or a glass wafer
- 1:1 Lithography of standard and orthogonal resists to structure organic devices below 10 µm
- High precision wafer to wafer alignment and various wafer bond processes
- Electro-optical characterization of organic devices on chip and wafer-level
- design- and technology support from specification, wafer production till single chip packaging of integrated circuits

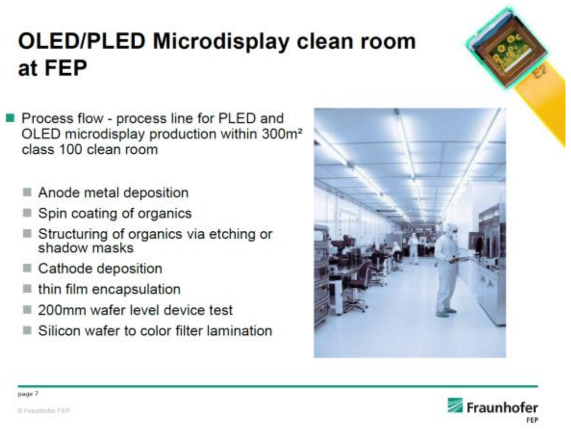
Capacity:

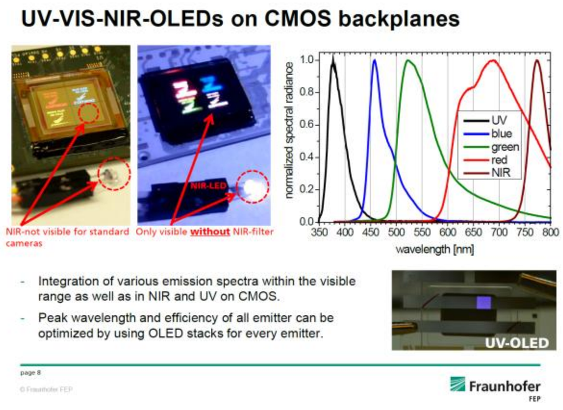
- Wafer size 8" (200mm)
- Clean Room ISO Class 5 ECs as of today

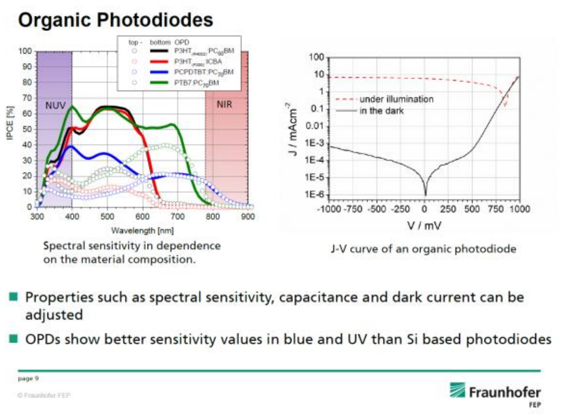
Fraunhofer FEP plans to develop the following new capabilities within ADMONT:

- Light emitting diodes with emission within the ultra violet spectral range
- Inorganic encapsulation layer for scratch and handling protection of miniaturized sensor devices
- Implementation of thinned (<500µm thick) CMOS wafer with TSV (through silicon via) within the organic device process flow and handling processes









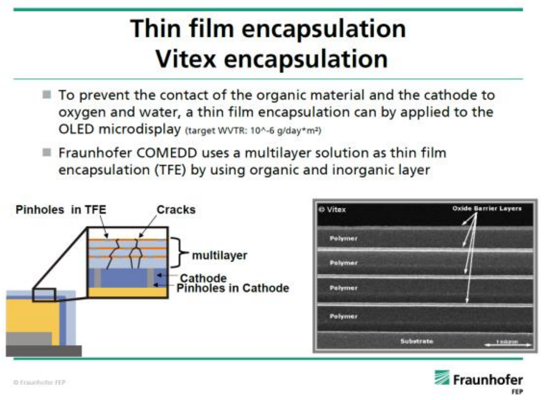


Table 3: Representative selection of ECs for Fraunhofer FEP

3.1.4 FHG ASSID

The specific essential capabilities of Fraunhofer IZM-ASSID are:

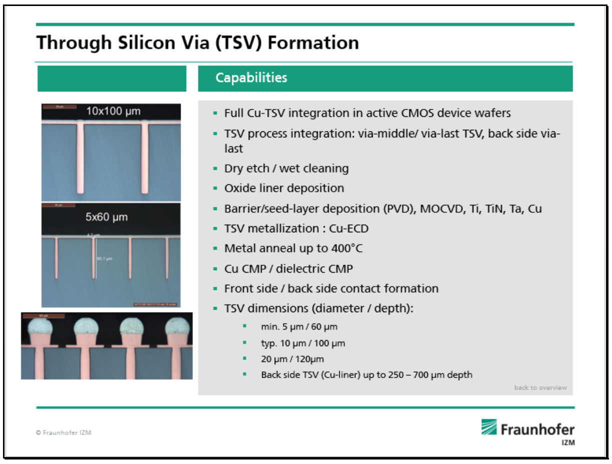
- 3D Wafer levels system integration
- Through Silicon Via (Cu-TSV) formation
- Wafer thinning, thin wafer handling
- Wafer bumping (SnAg, Cu Pillar)
- TSV Interposer with high-density redistribution layers
- Single processes for PVD, CVD, plasma etch, lithography
- Electroplating, wet cleaning, CMP
- Wafer grinding (incl. TAIKO) / polish, dicing (blade/laser), temporary bonding / debonding
- Flip chip assembly, under filling
- Die bonding, screen bonding
- Metrology and test

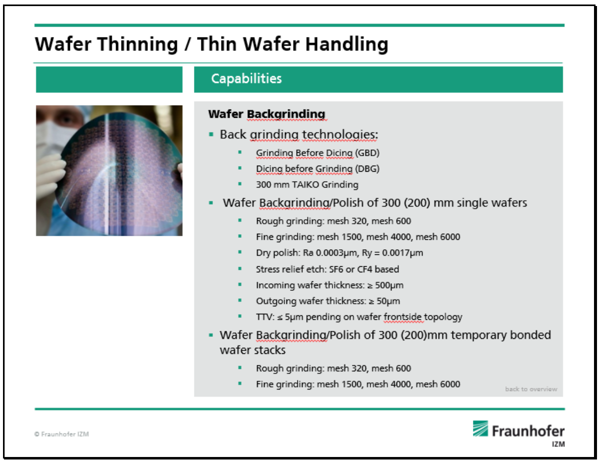
Capacity:

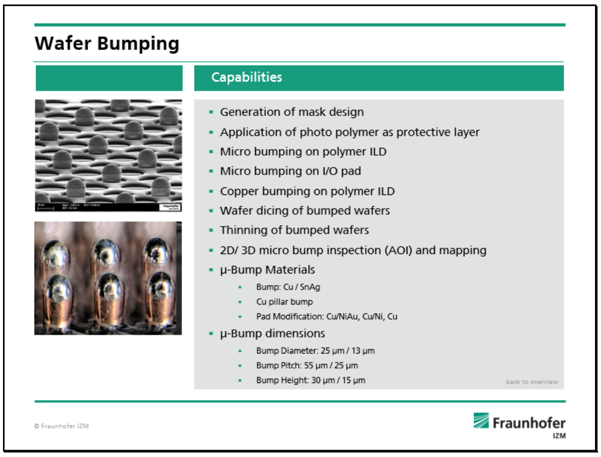
- Clean room size: 1100m2 ISO Class 5
- Wafer Size 200mm/300mm

Fraunhofer IZM/ASSID plans to develop the following new capabilities within ADMONT:

- System-In-Package (SIP) solution, based on an Cu interposer technology for CMOS and CMUT sensor / actuator integration
- TSV and silicon interposer technology for OLED on CMOS for medical application
- TSV interconnect and second level low temperature assembly process to PCB







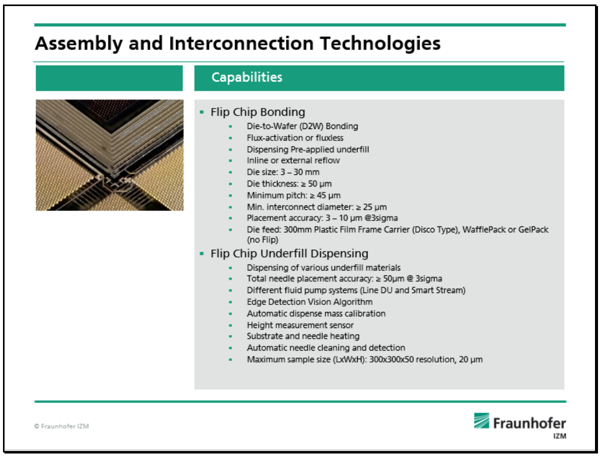


Table 3: Representative selection of ECs for Fraunhofer IZM-ASSID

3.2 ADMONT Essential Capabilities and provision of information

The ADMONT Pilot Line members contribute with information about their offerings of essential capabilities to the ADMONT related internet site which is accessible using the link: http://www.admont-project.eu/.

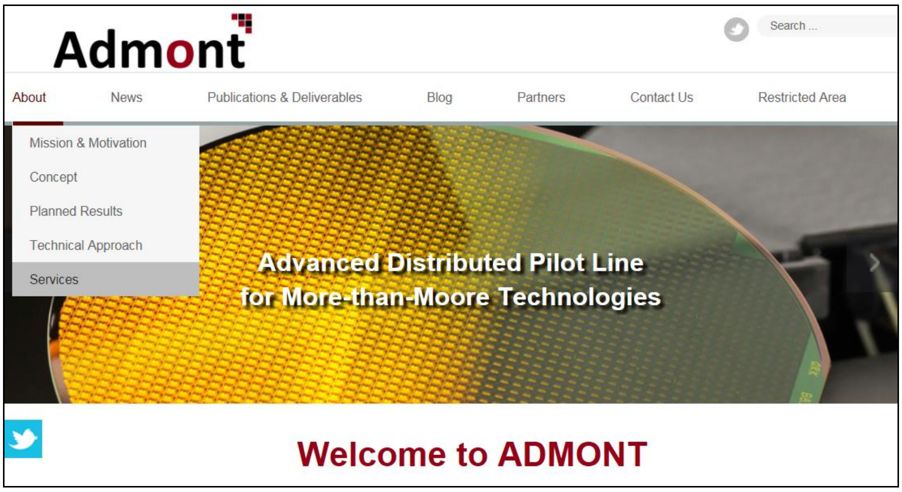


Figure 12: ADMONT internet site and menu to find information about EC

3.3 ADMONT point of contact, How to start?

In order to find a 1st point of contact for an ADMONT Pilot Line member, please find below appropriate contact information.

- ADMONT Project and Pilot Line and X-FAB Dresden
  - E-Mail: karl-heinz.stegemann@xfab.com
  - Phone: +49 351 40756 214
- FhG-IPMS
  - E-Mail: michael.mueller@ipms.fraunhofer.de
  - Phone: +49 351 8823 130
- FhG-FEP
  - E-Mail: karsten.fehse@comedd.fraunhofer.de
  - Phone: +49 (0) 351 8823 367
- FhG-IZM/ASSID
  - E-Mail: Juergen.Wolf@izm.fraunhofer.de
  - Phone: +49(0) 351 795572 12

The given information might be used to initiate first contact. All people will share information with each other to spread information or support your business case as best as they can.

Chapter 4 ADMONT Concept

Chapter 4 introduces the supply chain processes that are needed in order to set up data and material flow in order to realize a prototyping run.

4.1 Concept Study

In order to make business, a bunch of single tasks need to be planned, initiated and executed in parallel or sequentially. They follow rules, may have defined responsibilities and work flows that are known as business processes. Usually they are available as defined and documented processes on local level for each project partner.

The same is true for ADMONT - tasks need to be run and executed and they also need to follow a set of rules, may have defined responsibilities and work flows. A lot of ADMONT related business processes are already given by defined processes on individual partner level; some may not be given yet. Following a stepwise approach for the implementation of ADMONT as a 'One stop Shop' the relevant ADMONT related business processes need to be identified, defined, documented and agreed by business partners. Within this chapter this work started based on internal perspective, meaning that the ADMONT Pilot line member anticipated the needs of potential customers and based on external perspective given by some feedback on a requirement questionnaire, first thoughts and results are documented.

4.2 Internal Perspective, Requirements for ADMONT

4.2.1 SIPOC Model

A pragmatic way to build up an understanding of what business processes, communication processes and manufacturing processes are required in order to succeed with developing and manufacturing of pilot products it may be useful to abstract what needs to happen and model it. A very helpful tool to do that has been found with the SIPOC Model (**S**upplier, **I**nput, **P**rocess, **O**utput, **C**ustomers). It allows to model a process oriented interaction between business partners with defined relation in terms of who is supplier and who is customer, what input is expected as well as what output should be the result of the process and who benefits from that.

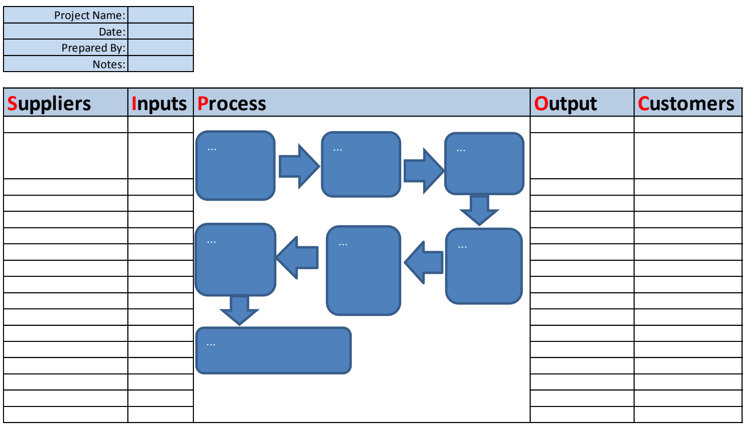


Figure 13: Basic SIPOC concept

4.2.2 ADMONT SIPOCs

Within ADMONT several pilot products are planned to be realized in WP6, WP7. It is known which partner will contribute to the specific demonstrators. To demonstrate the process oriented interaction between all partners in the supply chain for different prototypes and demonstrators a generic SIPOC Model process flow (**S**upplier, **I**nput, **P**rocess, **O**utput, **C**ustomers) is generated (Table 4: Table of available SIPOC below lists all available SIPOCs). In Chapter 7 are for two prototypes SIPOC graphs to demonstrate the principle work flow, interactions and responsibilities of each partner. The interaction with subcontractors sand external partners is also included. The SIPOS graphs are never the less usable for business case analyses.

Deliverables	ADMONT results, prototypes and demonstrator	TRL	Design/System Spec	Wafer Prod.	Packaging	System Integration
D5.1	Prototype smart health, miniaturised electronic system for molecular diagnostic	TRL6	IMMS/KPS	XFAB/FhG-FEP	IMMS	FhG-ASSID
D5.2	Smart energy, low power sensor and energy efficient micro pump driver IC	TRL6	FhG-EMFT	XFAB	FhG-EMFT	FhG-EMFT
D5.3	Prototype of smart health disposable bioanalytical sensors and wireless biosensor systems	TRL6	IMMS/KPS	XFAB/FhG-FEP	IMMS	SMT-DD/FhG-ASSID
D5.4	Prototypes of disposable lab-on-a-chip devices based on MtM pilot line CMOS process integrated with MEMS and Microfluidics for rare cells manipulation and sorting	TRL6	IMMS/KPS	XFAB/FHG-FEP	FhG-ASSID	FhG-ASSID
D7.3	Prototype smart production miniaturized near field ultrasonic sensor (based on CMUT technology)	TRL6	FhG-IPMS	FhG-IPMS (XFAB)	FhG-IPMS	P&F/FhG-IPMS
D7.3	Demonstrator smart energy true-colour-sensor ASIC	TRL6/7	MAZeT	XFAB	MAZeT	MAZeT
D7.3	Demonstrator smart mobility transponder ASIC for RFID	TRL7	FhG-IPMS	XFAB	SMT-DD	SMT-DD
D7.3	Demonstrator smart health & safety mobile gas sensors	TRL7/8	Heimann/SA	XFAB	Heimann	SA
D7.4	Demonstrator smart health & safety IR TP array system	TRL7/8	Heimann/SA	XFAB	Heimann	SA
D7.4	Demonstrator smart mobility integrated RFID sensor transponder	TRL7/8	FhG-IPMS	XFAB	SMT-DD	SMT-DD
D7.4	Demonstrator smart health automatic platform for rare cell sorting	TRL7/8	SiBo	XFAB	XFAB-MSF(extern)	SiBo
D7.4	Demonstrator smart energy RGB true-colour-sensor smart system	TRL7/8	MAZeT	XFAB	MAZeT	MAZeT

Table 4: Table of available SIPOC model analyses for demonstrators

Detail information in **Fehler! Verweisquelle konnte nicht gefunden werden.** (SIPOC WP5, Deliverable D5.1 and WP7 Deliverable D7.3)

4.3 External Perspective, Requirements for ADMONT

A questionnaire (Figure 14: Overview) has been sent out to all ADMONT partners providing opportunity to feedback what general and specific requirements should be considered for conceptual design and set up of the ADMONT Pilot line.

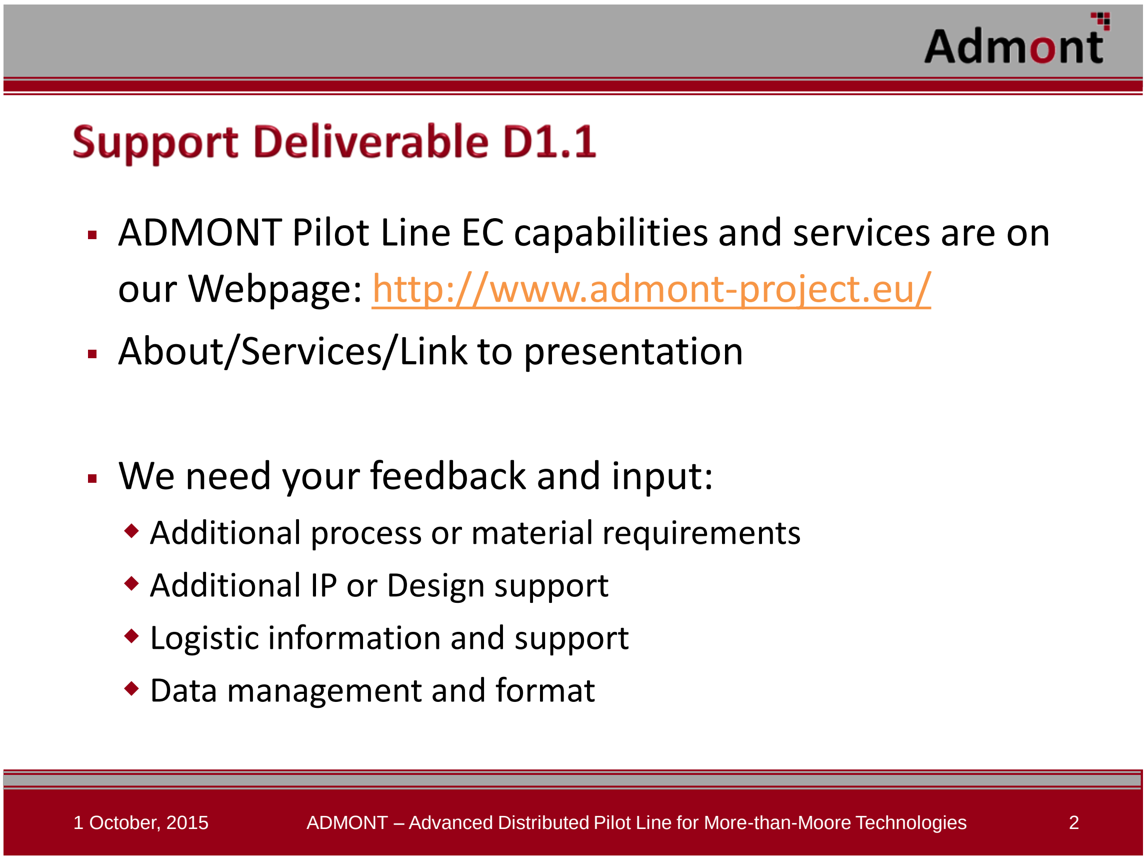


Figure 14: Overview questionnaire

A summary and interpretation of feedback is given in **Fehler! Verweisquelle konnte nicht gefunden werden. Fehler! Verweisquelle konnte nicht gefunden werden.**.

4.4 Results of Concept Study

There are general expectations and requirements representing an intersection of internal and external perspectives.

- Information about material status and development- /manufacturing progress
- Data availability and easy access of data for inline, PCM, characterization data is needed
- Cross site manufacturing topics need to be considered (risk factors, performance factors)
- IP rights need to be clarified

4.4.1 Logistics

The customer as well as the member within the supply chain needs to know what the progress is for their ordered material. The supply chain partners need to align on a common understanding of logistic parameter and data structure. A minimum set of information need to be available. Dates of receiving order, order confirmation, confirmed material start and delivery or defined progress that need to be achieved in time as well as an update schedule for progress are just examples.

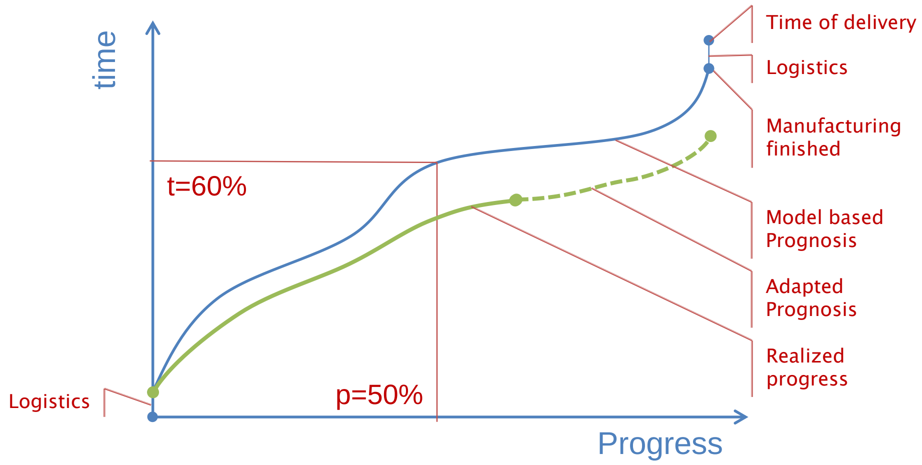


Figure 15: Reporting - realized and prognostic progress

Figure 15: Reporting - realized and prognostic progressillustrates a set of information that can also be given in form of plain numbers.

Especially a prognosis for delivery of the material to the next supply chain member becomes important if cycle time is a critical element to be successful. In Figure 16: Reporting - schedule of flow for whole ADMONT line is shown that additional elements need to be considered if the projects requires cross site interaction.

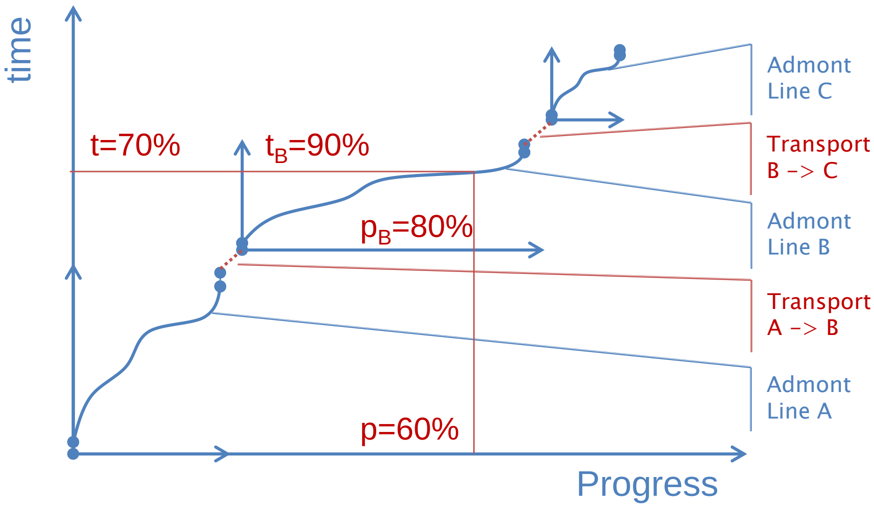


Figure 16: Reporting - schedule of flow for whole ADMONT line

4.4.2 Data Management

A comprehensive set of data is given and available by standard for most of the industrial supply chain members due to the need for continuous improvement of cooperation between them to stay compatible to each other and not to lose ground towards the competition. X-FAB offers the following data towards their supply chain partners.

Quality Data	Data Format X-FAB
WIP, cycle time, WI/WO	E-Mail, XTIC as central customer interface
PCM measurement data, including WAT	Csv
Wafer map data	Customer format
Optical outgoing Inspection map data	Customer format
Specific In-line data	Csv
Test data	Customer format
Shipment information	Word, pdf
Packaging information	Word, pdf
Process deviation	Word, pdf
Process change notes	Word, pdf
Yield data	Word, pdf
SPC Reports	Excel, pdf

Table 5: Data portfolio X-FAB

The ADMONT Pilot line members will align on data formats as well as on needed capabilities to have a common software interface to exchange data within the ADMONT consortium.

4.4.3 Cross site manufacturing topics

Due to the fact that pilot products require subsequent manufacturing of processes that may only be available of different manufacturing sites it becomes mandatory to define or rather adapt business processes that are available on local level like contamination risk analysis by FMEA method to be available and obligate part of business case assessment on cross site level. Performance of such cross site processes need to be measured reviewed and continuously improved.

4.4.4 General ADMONT Line Performance

In order to measure the effectiveness of business processes it may be useful to define appropriate measures, define targets and some rules in case of failing targets. Main aspects to consider separately are:

- Performance Overall ADMONT Line
- Performance Individual ADMONT Line Member
- Performance of Processes that need Interaction of Line Members
- Performance of Processes that need Interaction between ADMONT and Customer

ADMONT PERFORMANCE METRIC					2015											
					1	2	3	4	5	6	7	8	9	10	11	12
Overall Representive KPI (to illustrate general major capability performance)	Admont One Stop Shop	Overall Yield	Definition	Target	no data 2015			no data 2015			no data 2015			no data 2015		
				Actual												
		On time delivery		Target												
				Actual												
		Critical cpk percentage achivement		Target												
				Actual												
		Percentage Logistic time		Target												
				Actual												
		Return Material (Quality)		Target												
				Actual												
		...		Target												
				Actual												
Cross Dependency KPI (to demonsrate specific improvement between two partners)	X-FAB - IPMS			Target												
				Actual												
		Wafer Reject Rate	Wafer have to be rejected to previous partner, because	Target												
				Actual												
	X-FAB FEP			Target												
				Actual												
				Target												
				Actual												
	FEP - ASSID			Target												
				Actual												
				Target												
				Actual												
Individual KPI to illustrate major capability of each line	X-FAB (3)	Cycle Time 0,35 CMOS		Target												
				Actual												
		Line Yield 0,35 CMOS		Target												
				Actual												
		cpk critical parameter percantage 0,35 CMOS		Target												
				Actual												
	IPMS	Line Yield Sensor / Actor		Target												
				Actual												
				Target												
				Actual												
		Project specific Scientific Papers published / Exibitions	Ensure FHG and Admont Specific Awarness ...	Target												
				Actual												
	FEP			Target												
				Actual												
				Target												
				Actual												
		Project specific Scientific Papers published / Exibitions	Ensure FHG and Admont Specific Awarness ...	Target												
				Actual												
	ASSID			Target												
				Actual												
				Target												
				Actual												
		Project specific Scientific Papers published / Exibitions	Ensure FHG and Admont Specific Awarness ...	Target												
				Actual												

Table 6: Performance Measures

Within this work package the performance measures will be defined, aligned and agreed between ADMONT Pilot line members. A first report will be given with the deliverable D1.2.

4.4.5 IP

Most of the IP related questions have been agreed within the consortium agreement but some questions might arise within the project duration and have to be agreed. Up to now no blocking points have been found but for business cases the customers need reliable IP statements from the ADMONT network.

Chapter 5 Summary and conclusion

The open platform and the „one stop shop" approach of the ADMONT pilot line define quite tight framework conditions and require different business models in parallel and cooperation with subcontractors. Every line partner can be the first contact to a customer and the manager for one individual business case. In the business case evaluation phase we have to decide which business model is adequate for this individual project. ADMONT needs a step by step implementation approach over the project run time and a last step follows the vision to have a 'One stop Shop' solution for all potential customers.

We will evaluate and test two typical business models, added value and central model, with internal project partner on two selected demonstrator products. The central model demonstrator included external partner for subcontracting.

For analysing and build up an understanding of what business processes, communication processes and manufacturing processes are required in order to succeed with developing and manufacturing of pilot products we used the SIPOC Model (**S**upplier, **I**nput, **P**rocess, **O**utput, **and Customer**). It allows to model a process oriented interaction between business partners with defined relation in terms of who is supplier and who is customer, what input is expected as well as what output should be the result of the process and who benefits from that.

The internal data management structure for the ADMONT pilot line is defined based on typical foundry requirements. In WP6 we will define standard formats for data and wafermap exchange between the partners and customers. Basic information's are also included in our Data Management Plan (D8.1).

For monitoring the pilot line performance a first set of key parameter is defined and agreed between the partners.

The information's of the essential capabilities together with contact information from all ADMONT pilot line partners are available on our ADMONT webpage.

In conclusion the business processes and models, the data management and key performance parameter are not finally fixed yet. We need learning phases and development cycles and a periodic review on yearly basis.

Chapter 6 List of Abbreviations

Abbreviation	Explanation
SC	Supply Chain
BM	Business Model
EC	Essential Capability
SIPOC	Supplier Input Process Output Customer
BMPN	Business Model Process Notation
IP	Intellectual Property
WIP	Wafer in Progress
WI	Wafer In
WO	Wafer Out
SPC	Statistical Process Control
PCM	Process Control Monitor
WAT	Wafer Acceptance Test
XTIC	X-FAB Technical Interface for Customer

Table 7: List of Abbreviations

Chapter 7 Appendix

SIPOC Graph ADMONT

Project Name: Demonstrator smart health disposable bioanalytical sensors — Click for a List of Prototypes within ADMONT Project
Date: 22.06.2015
Prepared By: Karsten Fehse/ FEP
Notes: first draft OLED-Bio-sensor V1.0

Responsibility: R=Responsible; C=Contributor; NA

Id	Category	Supplier	Inputs	Process	Outputs	Customer	Partner A IMMS	Partner B XFAB DD	Partner C FEP	Partner D ASSID
1	Data	Customer	System Design, System Specification, Requirement portfolio	Contact ADMONT-consortium or partner	Summary of used technology and specification of planned device	Responsible contact person to customer: IMMS	R			
2.1	Engineering	XFAB-Dresden CMOS Manufacturing	System Design, System Specification, Requirement portfolio	Capability Evaluation by X-FAB Dresden (Partner B)	Capability Sheet (CMOS)	Responsible contact person to customer: IMMS		R		
2.2	Engineering	FEP	System Design, System Specification, Requirement portfolio	Capability Evaluation by FEP (Partner C)	Capability Sheet (OLED)	Responsible contact person to customer: IMMS			R	
2.3	Engineering	ASSID	System Design, System Specification, Requirement portfolio	Capability Evaluation by ASSID (Partner D)	Capability Sheet (TSV/dicing/ bond)	Responsible contact person to customer: IMMS				R
2.4	Engineering	IMMS	System Design, System Specification, Requirement portfolio	Capability Evaluation by IMMS (Partner A)	Capability Sheet (Bio-Sensor)	Responsible contact person to customer: IMMS	R			
2	Data	Responsible contact person to customer: IMMS	System Design, System Specification, Requirement portfolio	Capability Evaluation of all partner processes	Capability Sheet (Package)	Customer	R	C	C	C
3	quotation/ Order	Customer	Production Order (Quantity, Price, Quality)	prepair quotation - receive order	ADMONT internal Order (Quantity, Price, Quality)	Responsible contact person to customer: IMMS	R			
4	Material	all partner	Order and Specification provided by customer	all partner/ calculate needed material and consumables	order material/consumables	all partner		R	R	R
5	Engineering	XFAB-Dresden CMOS Manufacturing	Raw Wafer	CMOS Manufacturing	CMOS processed Wafer	ASSID		R		
6	Engineering	ASSID	CMOS processed Wafer	apply TSV process to wafer	CMOS processed Wafer with TSV	FEP				R
7	Engineering	FEP	CMOS processed Wafer with TSV	integrate OLED onto wafer	CMOS processed Wafer with TSV, OLED	ASSID			R	
8	Engineering	ASSID	CMOS processed Wafer with TSV, OLED	apply laser dicing and low temperature bond process to wafer	diced chips and mounted on pcb	Responsible contact person to customer: IMMS				R
9	Engineering	Responsible contact person to customer: IMMS	diced chips and mounted on pcb	final test of devices	devices ready for shipment	Customer	R			
10	quotation/ Order	Customer	devices ready for shipment	effort compensation	$	ADMONT consortium	R			
11	quotation/ Order	Customer	Complain (Quality for Example)	apply ADMONT consortium rules to customer complain	Complain Acceptance/Reject	Responsible contact person to customer: IMMS	R	R	R	R
12	quotation/ Order	ADMONT consortium rules to customer complain	Complain 8D and Compensation Offer	ADMONT consortium solves problem or decides on next steps	$, or Wafer	Customer	R	R	R	R

Comment: **Fehse, Karsten:** Was ist ein capability sheet? Bestätigung der Machbarkeit einer Kundenanfrage?

Figure 17: SIPOC Graph, Deliverable D5.1

SIPOC Graph ADMONT

Project Name: Demonstrator smart energy RGB true-colour-sensor smart system — Click for a List of Prototypes within ADMONT Project
Date: 30.06.2015
Prepared By: K.-H. Stegemann
Notes: SIPOC_DF.3_MAZeT_ASIC

Responsibility: R=Responsible; C=Contributor; NA

Id	Category	Supplier	Inputs	Process	Outputs	Customer	Partner A MAZeT	Partner B XFAB DD	Partner C	Partner D External
1	Data	external (Partner D)	Spec for True-Color-Sensor System	Capability Evaluation by MAZeT (Partner A)	System Spec, Packaging Spec, IC-Design Spec	MAZeT	C			R
2	Data	MAZeT	IC-Design Spec	Device & Technology Spec for Opto-Sensor, IP-Requirement Definition	Check List for Technology & Foundry Selection	MAZeT	R			C
3	Engineering	MAZeT	IC-Foundry Selection	Foundry Process & IP Evaluation	Foundry Decision & Quotation & Order	XFAB-Dresden (Partner B)	R	C		
4	Engineering	MAZeT	Foundry PDK X-FAB XH035 Opto & IP Blocks	IP-Development & Simulation	GDSII Data and Foundry Form Request	XFAB-Dresden	R	C		
5	Material	Raw Wafer Supplier	Raw Wafer	XFAB-Dresden CMOS Manufacturing	CMOS processed Wafer MPW Run XH035 Opto	MAZeT		R		
6	Engineering	MAZeT	MPW 40 Chips	IP Design Evaluation & Test	Final IP Spec & Test Report	MAZeT	R	C		
7	Engineering	MAZeT	Foundry PDK X-FAB XH035 Opto & IP Blocks	ASIC-Design & Simulation IP-Verification	GDSII Data and Foundry Form Request	XFAB-Dresden	R	C		
8	Material	Raw Wafer Supplier	Raw Wafer	XFAB-Dresden CMOS Manufacturing	CMOS processed Wafer MPW Run XH035 Opto	MAZeT		R		C
9	Engineering	MAZeT	MPW 40 Chips	ASIC Evaluation & Test	Final ASIC Spec & Test Report, Basis for final Design Color System ASIC	MAZeT	R	C		
10	Engineering	MAZeT	Design IP for Color Sensor	PDK Implememntation & Verification	New PDK for XH035 with Opto Module	XFAB-Dresden	C	R		

Figure 18: SIPOC Graph, Deliverable D7.3

Topic	Received Feedback	Interpretation
Process Requirements	Litho Alignment marks for CMOS-MEMS processing	Cross site manufacturing – needs consideration
Data Requirements	Detailed wafermap, in Excel-format (CMOS and MEMS) for wafer prober and pre-assembly analyses	Standard requirement
Process Requirements	No Au, Ag or other CMOS-killing elements in PCM test	Cross contamination – cross manufacturing site – needs risk assessment
Process Requirements	Special In-Line parameter or PCM-test	Standard requirement
Process Requirements	Special spec (thickness variation, roughness, metal, ….)	Standard requirement
IP Requirements	All IP development in *** should lead to Customer specific process for ***	Customer specific requirements need to be considered
Process Requirements	Special Design Rules and PDK Needs Maybe PDK update(tbd.) for XA035-T	Customer specific requirements need to be considered

Table 8: Summary of Feedback to Questionnaire