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# BUSINESS MODELING IN PATHOLOGY

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## VERSIONS

<b>Date</b>	<b>Version</b>	<b>Author</b>	<b>Comments</b>
2008-07-08	0.1	Thomas Schrader	Creation of the Document
2008-07-09	0.2	Thomas Schrader	Add comments and images
2008-11-21	0.3	Thomas Schrader	Results of WG-Meeting, Evora
2008-11-29	0.4	Thomas Schrader	Complete the description of the results of evora and a new extension: Immunochemistry

# DEVELOPMENT OF BUSINESS CASES

FROM THE SKETCH

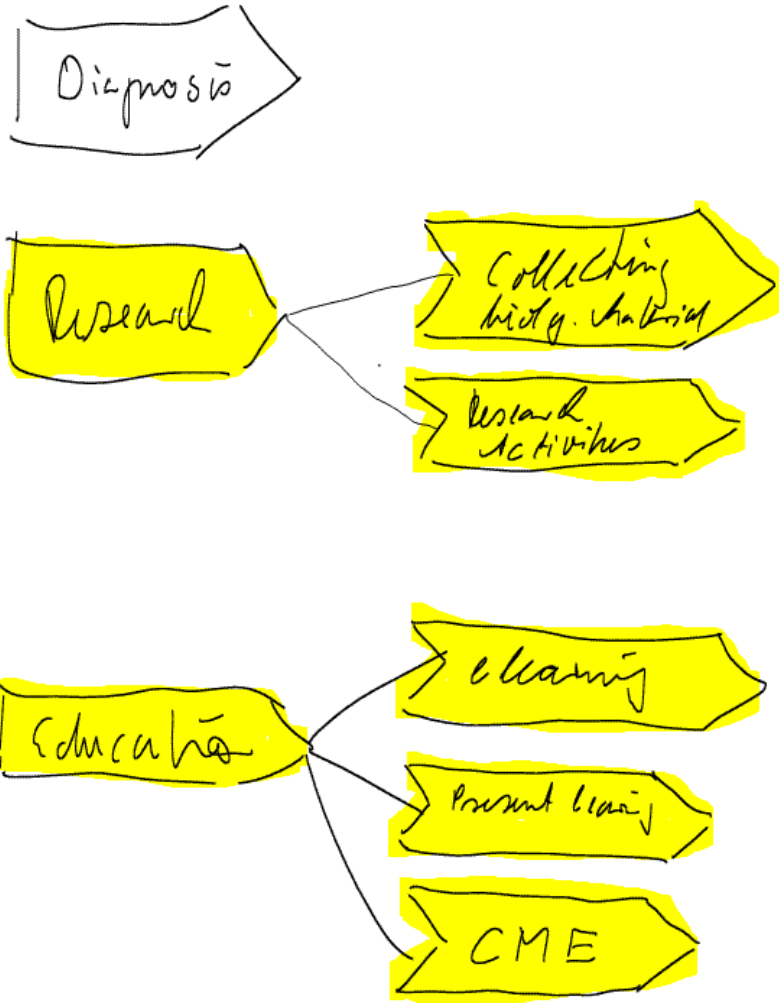
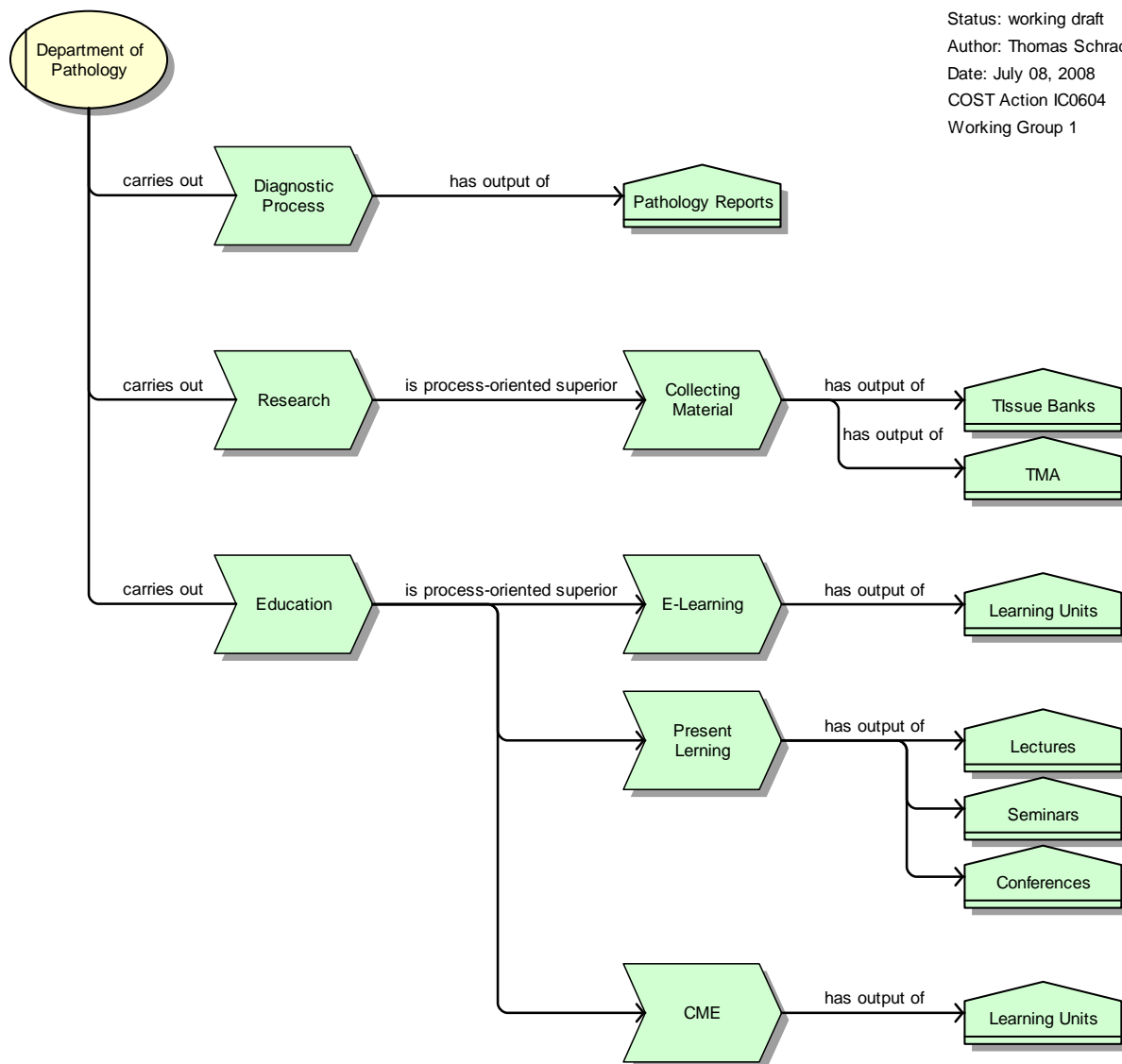


FIGURE 1: THE MAIN BUSINESS CASES IN PATHOLOGY

## FORMAL LEVEL – VALUES ADDED CHAIN DIAGRAM

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**FIGURE 2: VALUE ADDED CHAIN DIAGRAM TO GIVE AN OVERVIEW ABOUT THE MAIN TASKS (BUSINESS CASES) AND THE RESULTS (PRODUCTS/SERVICES)**

It was suggested to split the diagnostic process into different subprocesses such as

- Cytology
- Hematocytology
- Frozen section
- Biopsy
- Teleconsultation
- Fresh tissue processing
- Teleconsultation

After the analysis of the business process the classification was refined.

# TELCONSULTATION AS A BASIC BUSINESS CASE

As a result of the meeting in Evora, basic business cases were modified >

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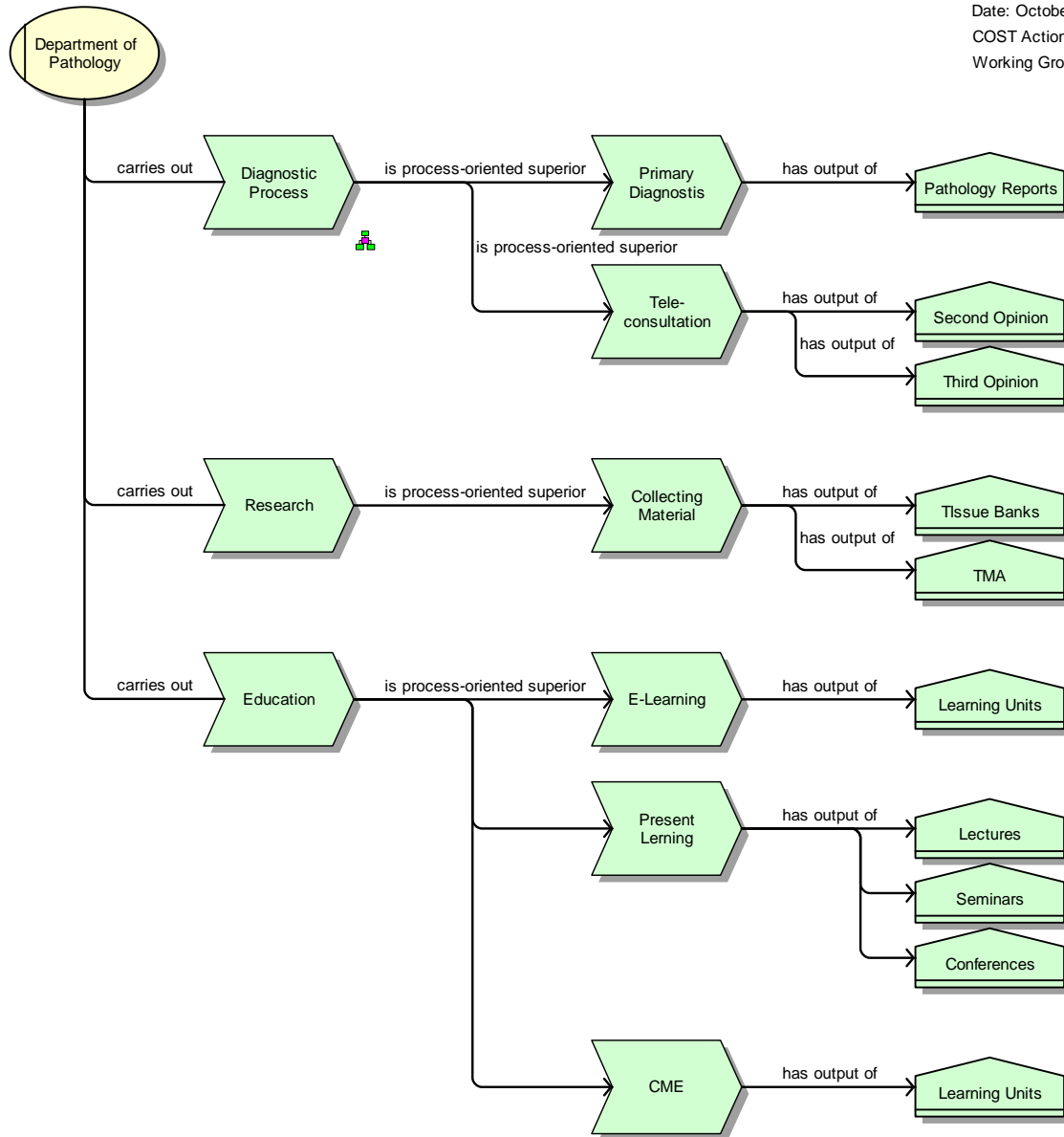


FIGURE 3: NEW VERSION OF THE BASIC BUSINESS CASES - NOW WITH TELECONSULTATION

# DEVELOPMENT OF BUSINESS PROCESSES

## DIAGNOSTIC PROCESS – NAMED USUAL CASE – INFORMAL LEVEL (SKETCH)

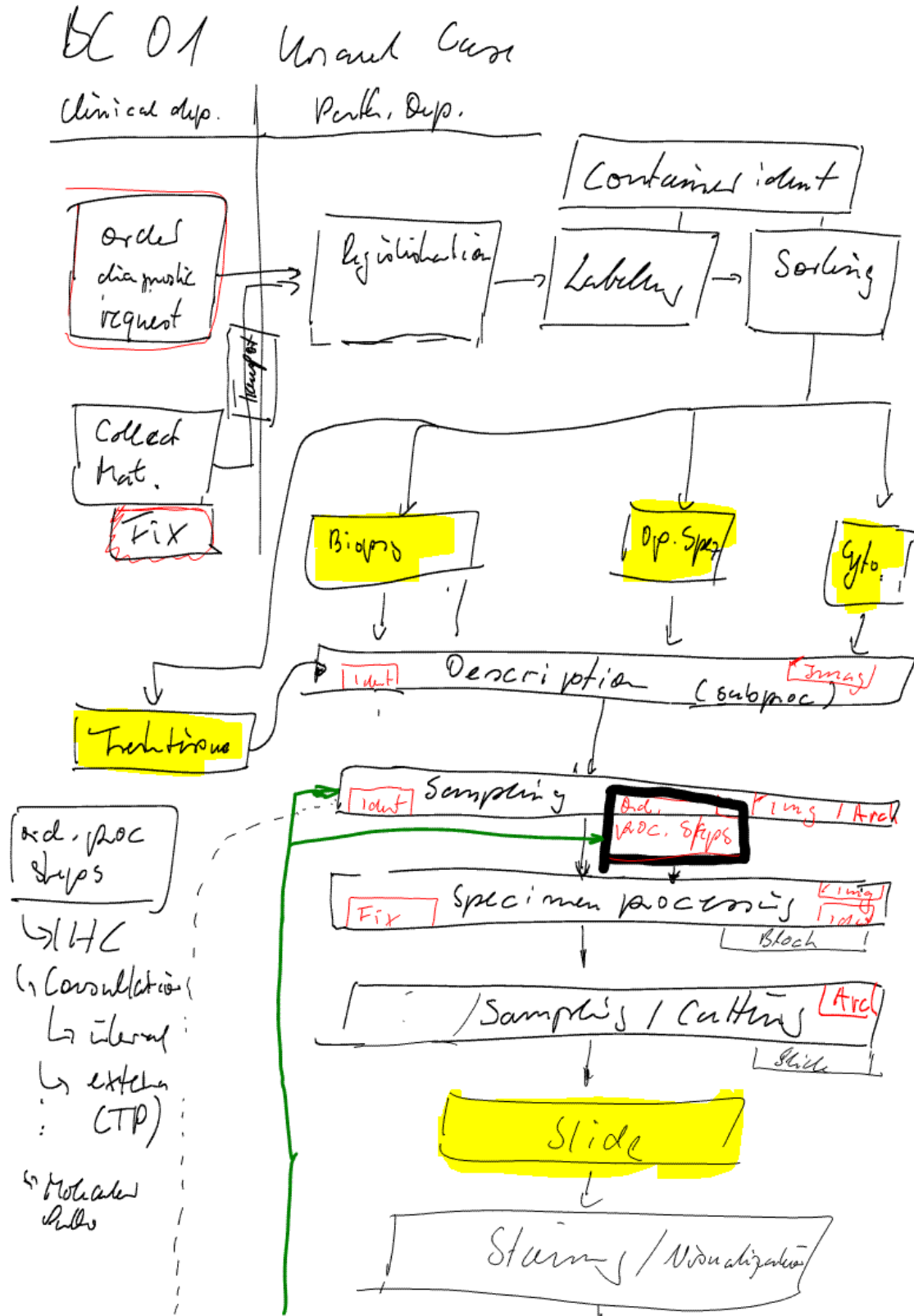


FIGURE 4: DIAGNOSTIC PROCESS PART I



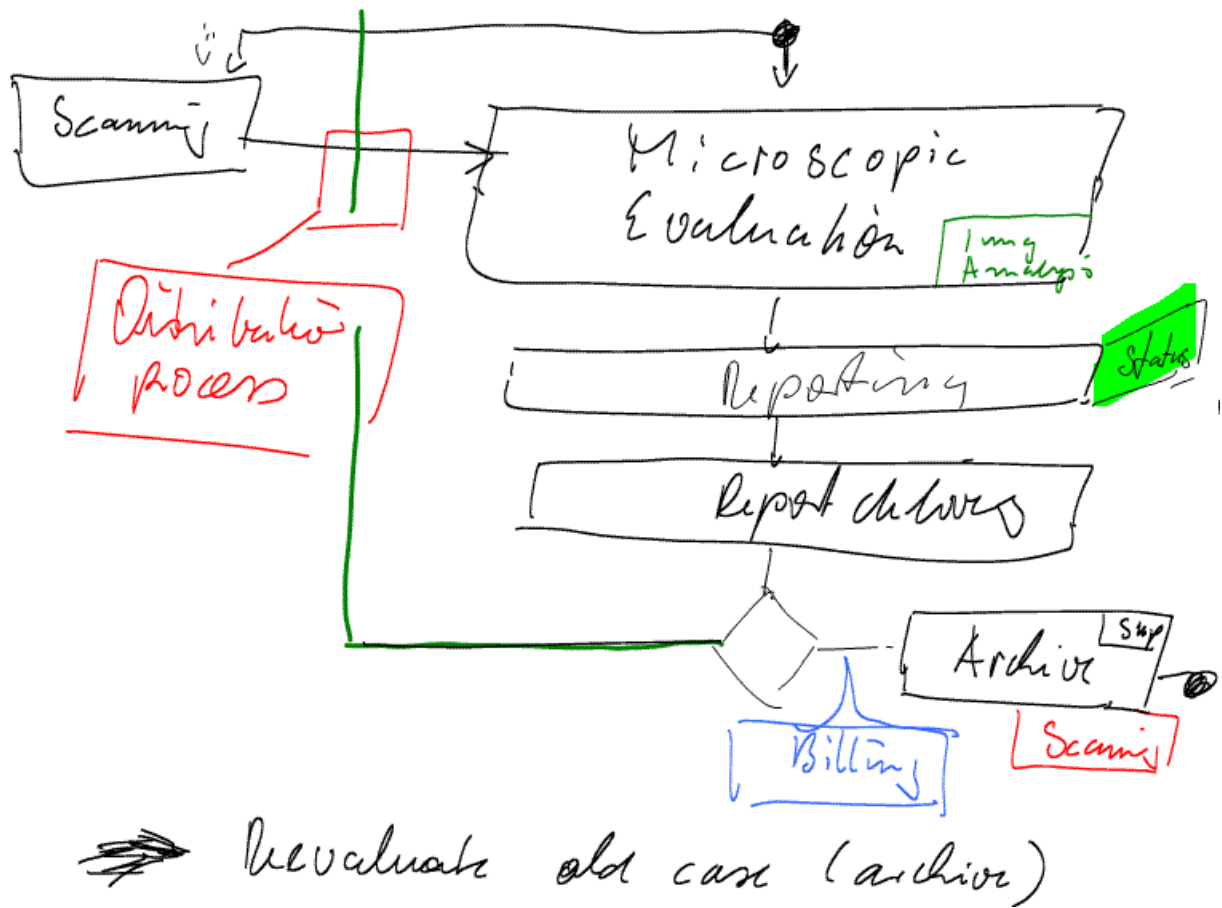


FIGURE 5: THE DIAGNOSTIC PROCESS PART II

# DIAGNOSTIC PROCESS – FORMAL LEVEL (EVEN-PROCESS-CHAIN-DIAGRAM)

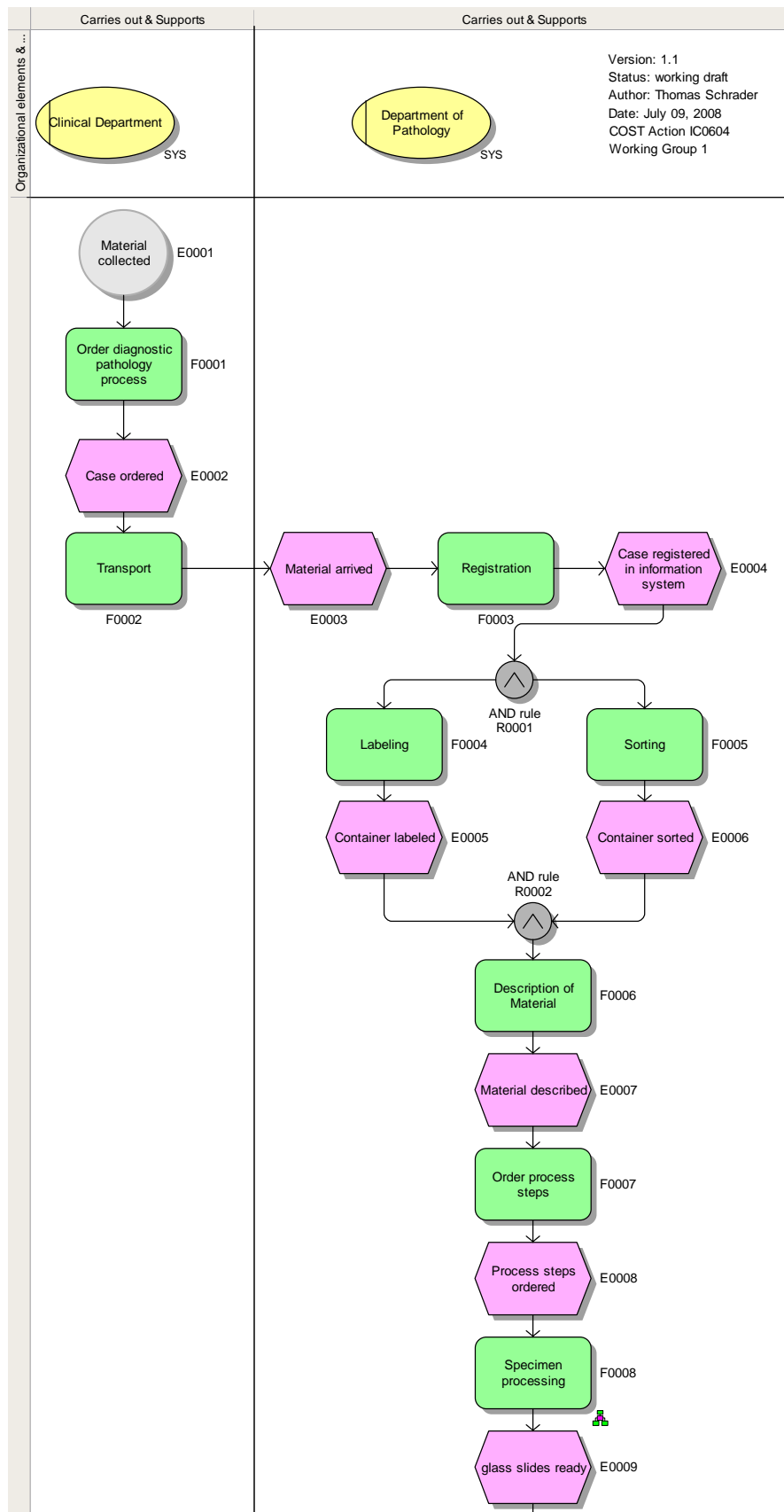


FIGURE 6: THE MAIN DIAGNOSTIC PROCESS (PART I)

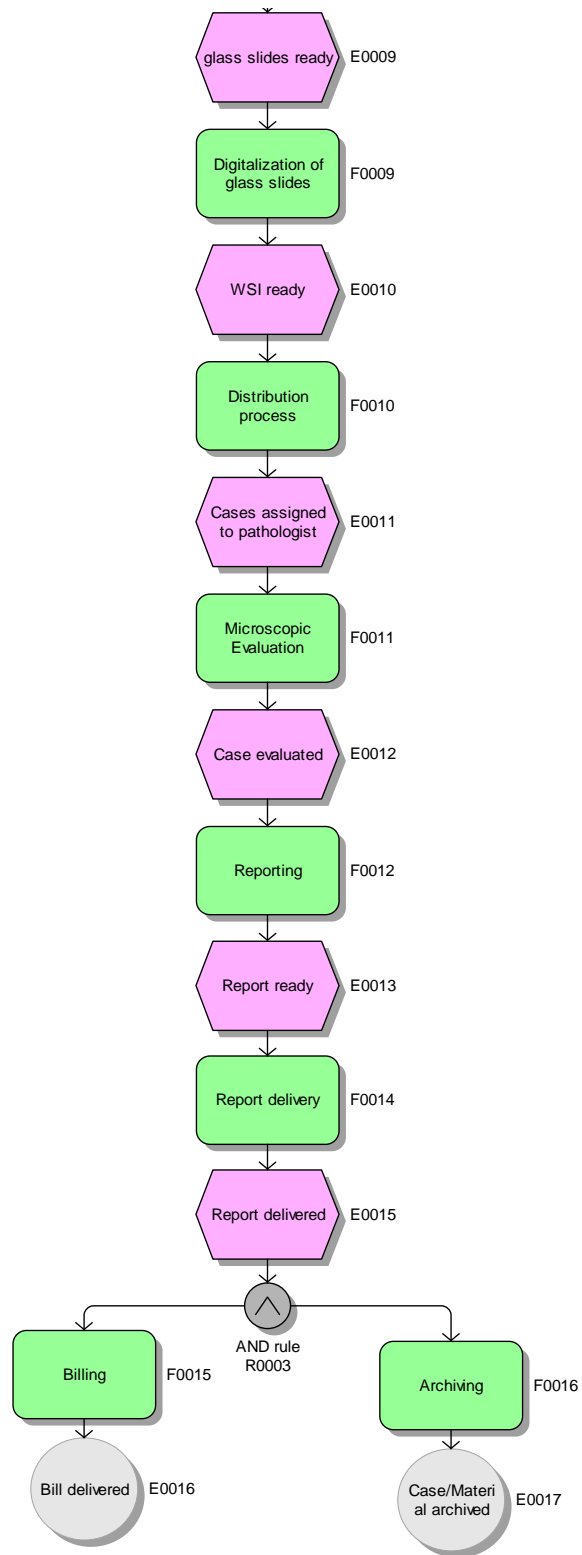


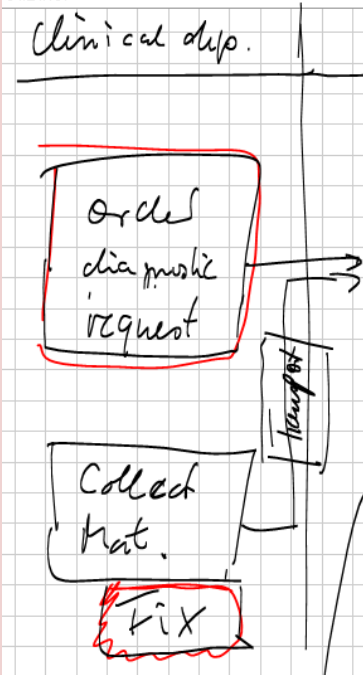
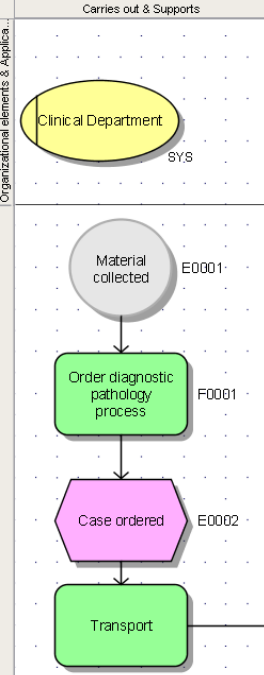
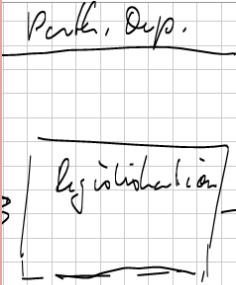
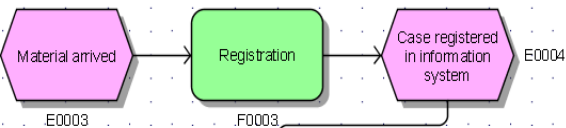
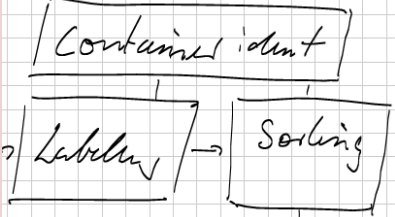
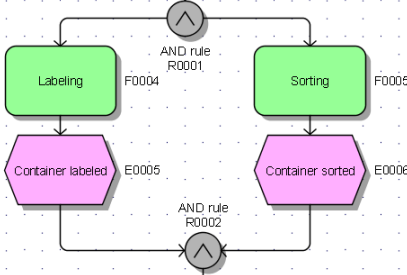
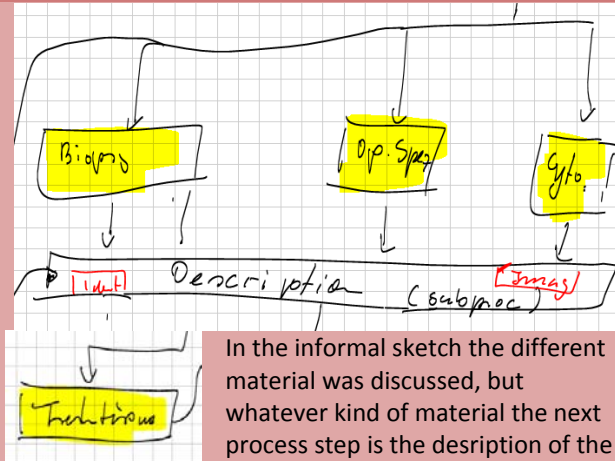


FIGURE 7: THE MAIN DIAGNOSTIC PROCESS (PART II)

These two formal figures (Figure 6: the main diagnostic process (Part I) and Figure 7: The main diagnostic process (PART II)) express the content of the informal sketch about the business process of the usual situation and should be explained step by step more in detail:

Informal sketch of business case	Formal diagram of the same business case
 <p>Two different institutions are involved in this business process</p>	 <p>Two columns express the involvement of the two institutions.</p>
 <p>The process begins with the order of the diagnostic process after or before the material is collected. The material has to be transported to the department. A special problem is the fixation.</p>	 <p>In the formal description the event E0001 (it is the so called start event): after the collection of material the material the request of a diagnostic process (F0001) will be done. The fixation is not really a process. It is an action in contrast to a transport, which consist of different steps e.g. order of transport, preparation of the container etc.</p>
 <p>The material should be registered in the system of the department of pathology.</p>	 <p>In the formal diagram the event E0003 (Material arrived) is the precondition for the Registration (F0003). The result of the registration is the event (E0004).</p>
 <p>(labeling and sorting)</p> <p>The container identification is in the informal description a separate process which consists of two processes</p>	 <p>In the formal description the container identification is here only expressed with these two processes (F0004, F0005). The AND-roles (R0001, R0002) mean that both processes will be done at the same time – this is the meaning of container identification.</p>

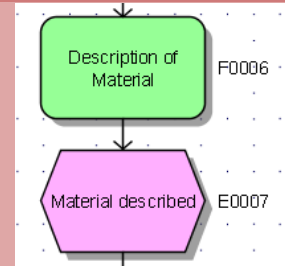
**Informal sketch of business case**



In the informal sketch the different material was discussed, but whatever kind of material the next process step is the description of the material. The material influences the type of description.

the type of description.

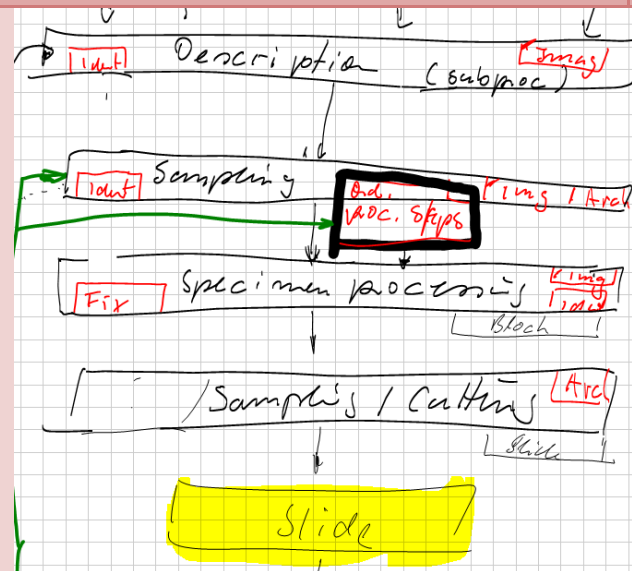
**Formal diagram of the same business case**



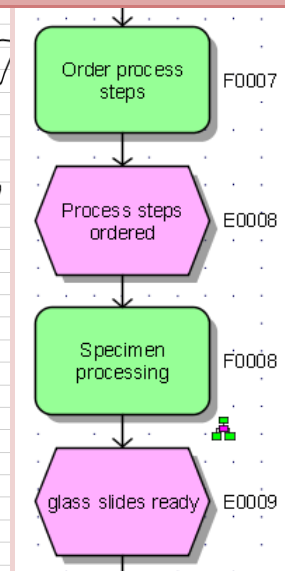
In the formal diagram the different material is not explicit expressed because the design of the description process depends on the material but it is clear that any type of material has to be

described.

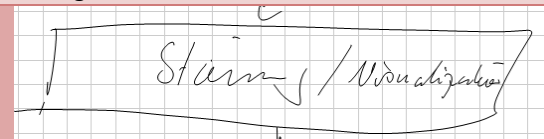
Every Process has an result (called event), in this case E0007 (Material described).



The next steps are sampling, specimen processing and cutting and the result is the slide.

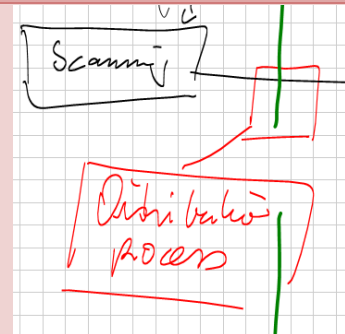


The formal diagram summarize the different informal process steps to two main processes: order process steps (F0007) and specimen processing (F0008). The small symbol in the right lowercorner of F0008 means that a diagram is linked to the this process. This is useful to simplify the the diagram.

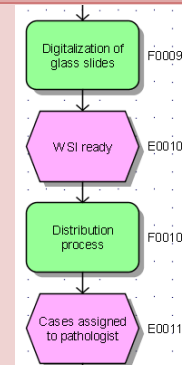


The staining and/or visualization was recognized as a separate process

In the formal diagram is no expression for that process step. It is added to the linked diagram of F0008.

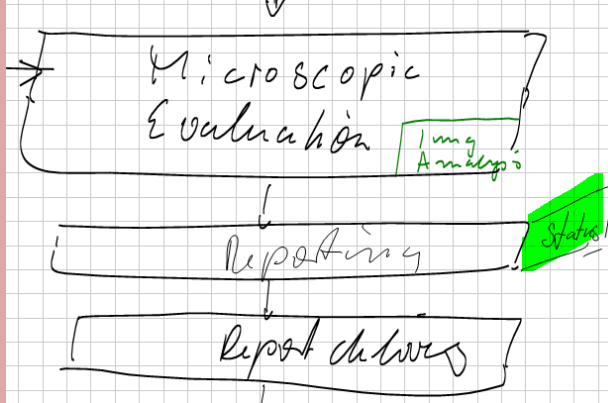


The scanning and distribution process is integrated in the general process flow.



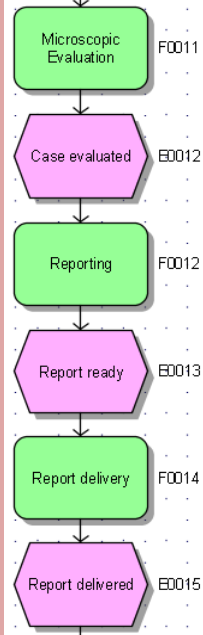
The scanning (F0009) and distribution process (F0010) is integrated in the general process flow.

**Informal sketch of business case**

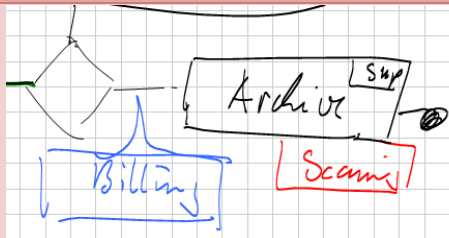


The microscopic evaluation is followed by the reporting process (with different status) and after the reporting by the delivery.

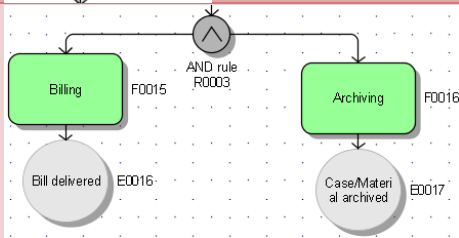
**Formal diagram of the same business case**



The microscopic evaluation F0011 has the result event E0012 and is followed by the reporting process F0012. The result event E0013 (report ready) triggers the report delivery (F0014). The result event is E0015 (report delivered). The different status are not expressed here because this is not a process or an event.



The diagnostic process is finished by the billing and archiving activity.



In the formal diagram the event E0015 triggers both:

the billing process (F0015) and the archiving process (F0016). The results of both are end events (E0016, E0017).

## ANALYSIS OF THE CURRENT BUSINESS PROCESS

The business process was analyzed to find out gaps and the relationship to the efforts of the IHE Technical Framework Pathology.

The following figure summarizes some aspects of the analysis.

# Evaluation of the status

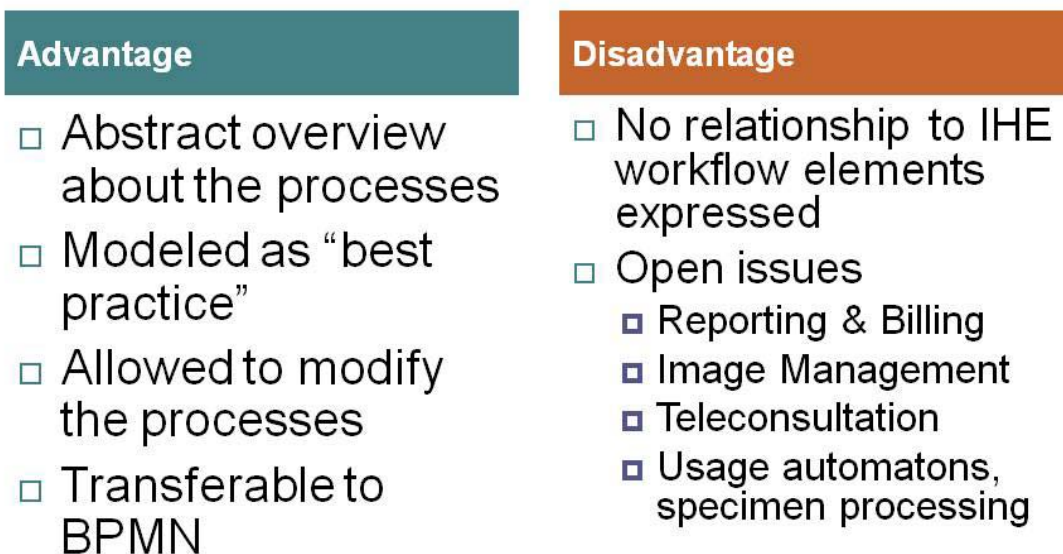


Figure 8: Results of the evaluation of the Version 1.2 of diagnostic pathology business process

For the evaluation of the relationship of the actors of IHE Technical Framework the business process was redesigned. During this process an additional process step was added: the report evaluation by the clinicians at the end of the complete process.

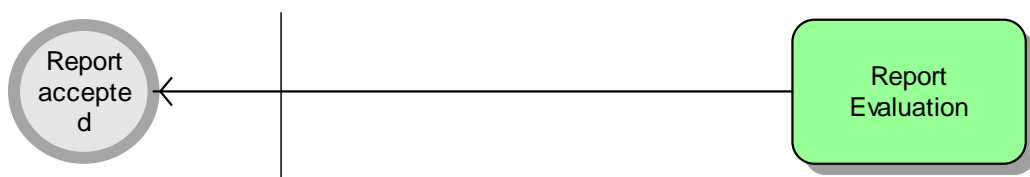


FIGURE 9: NEW PROCESS STEP IN THE GENERAL BUSINESS PROCESS

The complete business process is arranged to columns and rows. The different columns express different aspects of the business process such as events, functions and application systems. The different system units such as Department of Pathology, Clinical Department are located in the different rows.

The main process steps are unchanged; only the some actors of IHE were added.

In the technical framework the following actors exist:

# IHE Actors

- Acquisition Modality
  - A system that acquires and creates medical images while a patient is present, e.g. a Computed Tomography scanner or Nuclear Medicine camera. A modality may also create other evidence objects such as Grayscale Softcopy Presentation States for the consistent viewing of images or Evidence Documents containing measurements.
- Department System Scheduler/Order Filler
  - A pathology department-based information system that provides functions related to the management of orders received from external systems or through the department system's user interface. The system receives orders from Order Placer actors, collects or controls the related specimens, accepts or rejects the order, schedules work orders, and sends them to processing room, receives the results of gross study (specimen status and adequacy), controls the status of each specimen, and appropriately manages all state changes of the order.
- Image Manager
  - A system that provides functions related to safe storage and management of evidence objects. It supplies availability information for those objects to the Department System Scheduler.
- Image Archive
  - A system that provides long term storage of evidence objects such as images, presentation states, Key Image Notes and Evidence Documents.
- Image Display
  - ...
- Order Result Tracker
  - A system that stores pathology observations obtained for the patients of the healthcare institution, registers all state changes in the results notified by Order Fillers. This actor stores observations in the context of their Order or Order Group. This actor also stores reports outside the Pathology department.
- Evidence Creator
  - A system that creates additional evidence objects such as images, presentation states, Key Image Notes, and/or Evidence Documents and transmits them to an Image Archive. It also makes requests for storage commitment to the Image Manager for the data previously transmitted.
- Order Placer
  - A hospital or enterprise-wide system that generates orders for various departments and distributes those orders to the correct department, and appropriately manages all state changes of those orders. In some cases the Order Placer is responsible for collecting and identifying the specimens. The transaction between Order Placer and Order Filler may carry specimen related information.

FIGURE 10: ACTORS OF IHE TECHNICAL FRAMEWORK PATHOLOGY



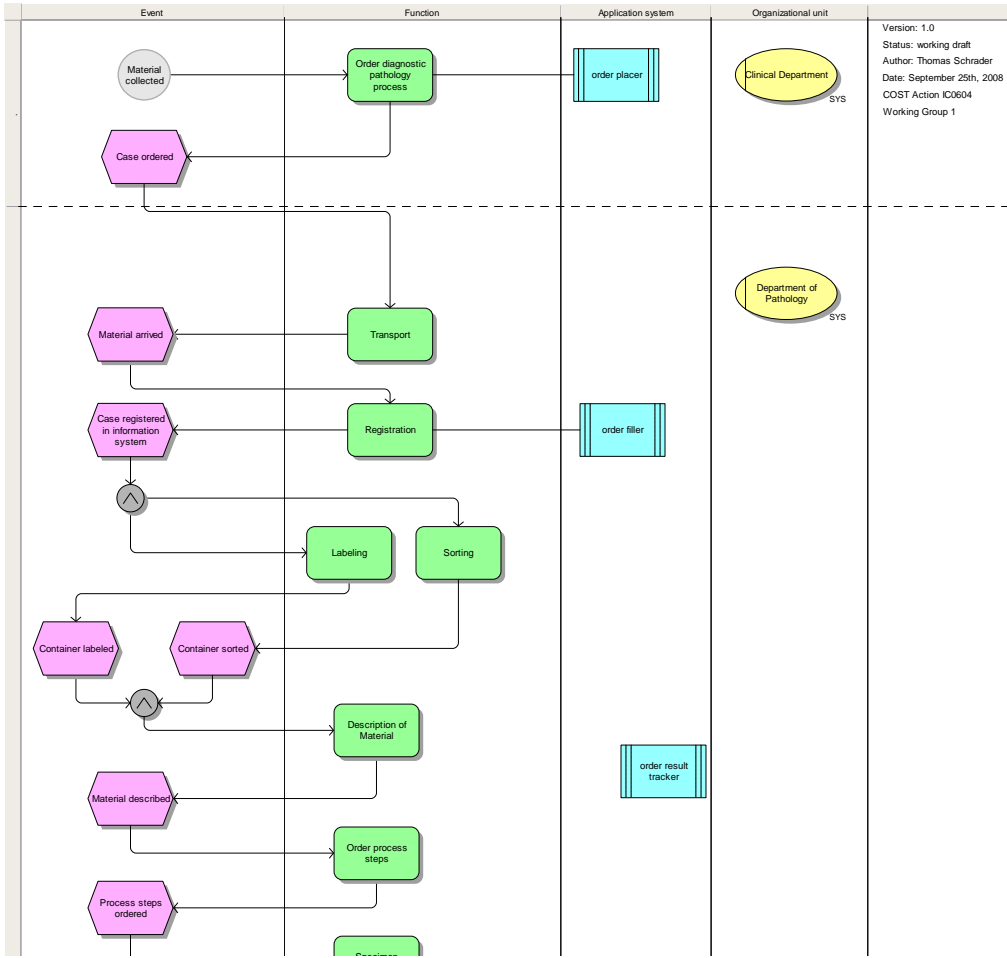


FIGURE 11: BUSINESS PROCESS DIAGNOSTIC PATHOLOGY IN RELATION TO ACTORS OF IHE TECHNICAL FRAMEWORK PART I

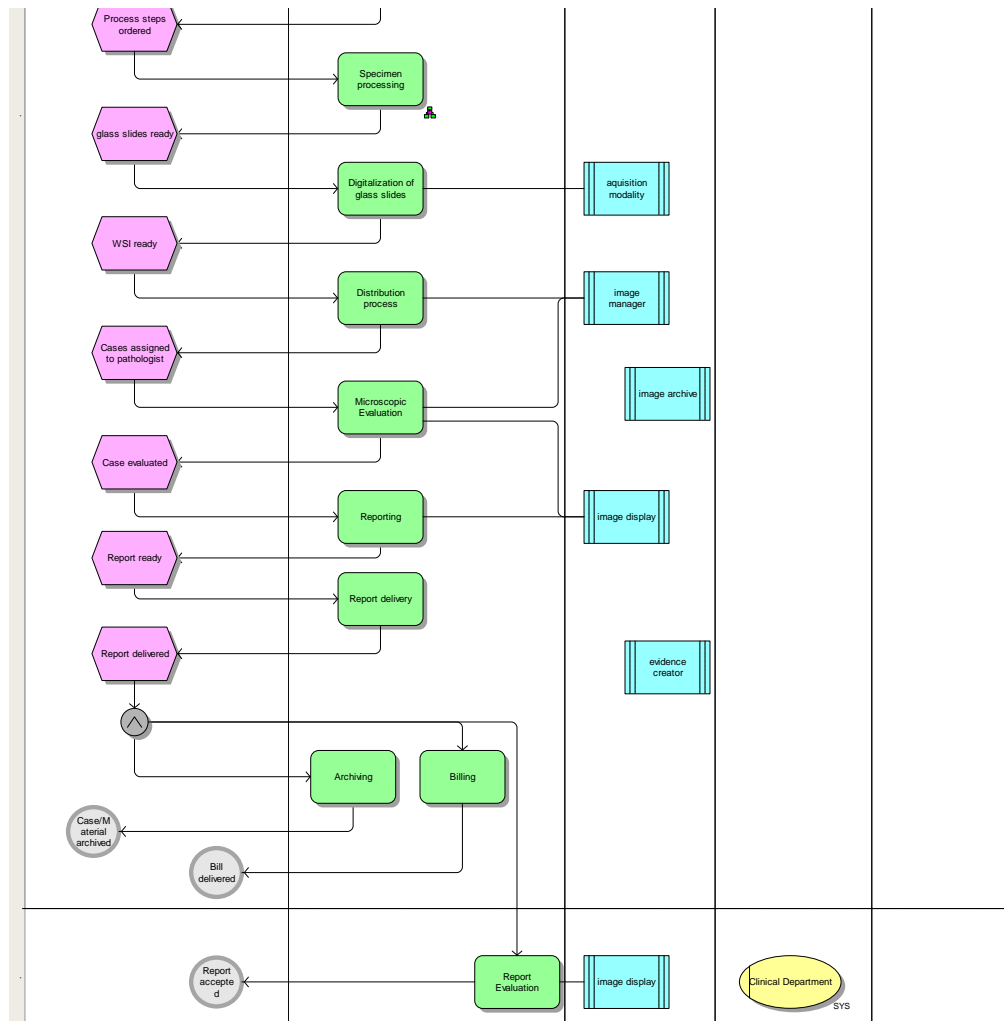


FIGURE 12: BUSINESS PROCESS DIAGNOSTIC PATHOLOGY IN RELATION TO ACTORS OF IHE TECHNICAL FRAMEWORK PART II

The analysis of the relation of the process steps in the diagnostic pathology and the actors discovered the following gaps:

## Result of Analysis

- Missing actor for order process steps
- Missing actor for report generation, management and distribution
- Missing actor for telepathology consultation

FIGURE 13: PROBLEMS OF THE ACTORS IN IHE TF PATHOLOGY AND THEIR RELATIONS TO THE BUSINESS PROCESS

## EXTENSION OF THE BASIC BUSINESS PROCESS: TELECONSULTATION

### INFORMAL DESCRIPTION OF THE CONSULTATION PROCESS

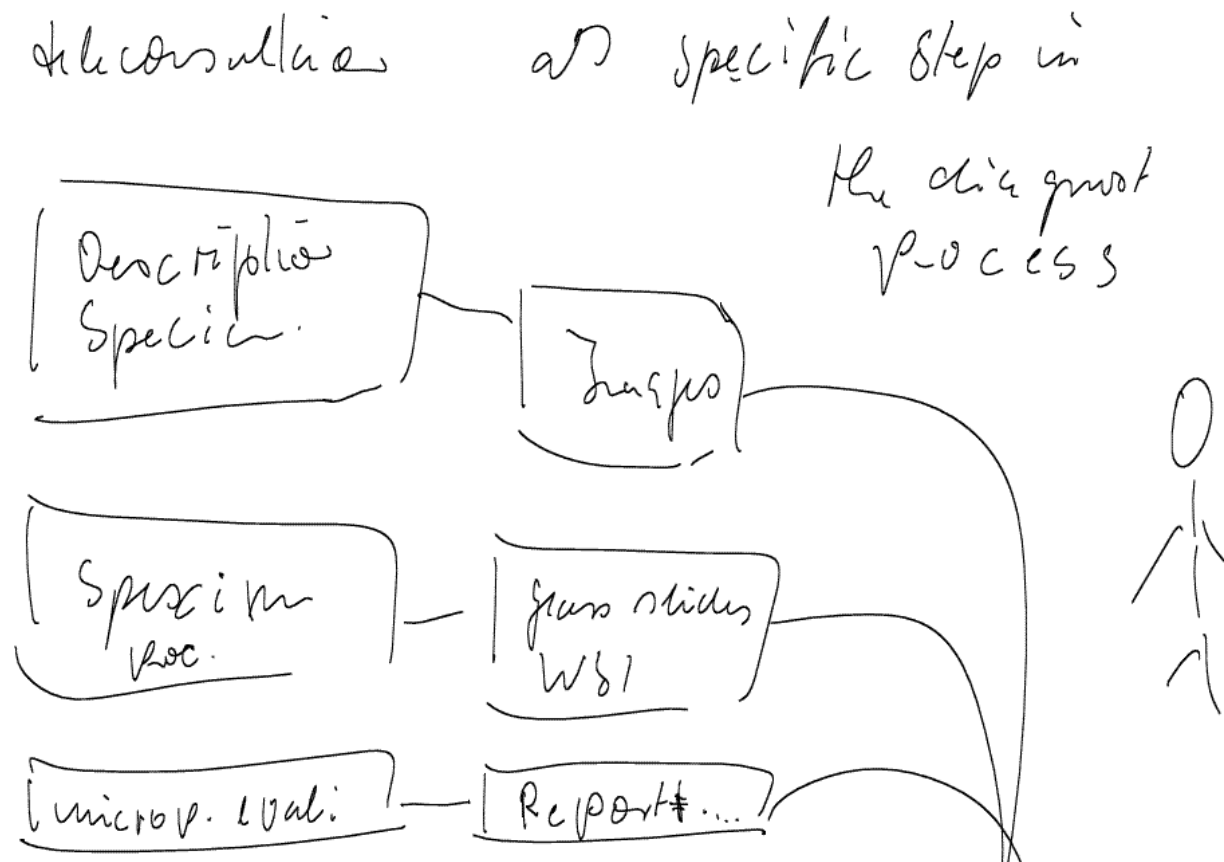


FIGURE 14: FIRST PROCEDURE PART - COLLECT THE RELEVANT INFORMATION

Different information elements will be collected to prepare a case for conventional as well as teleconsultation (Figure 14):

1. Specimen description
2. Information about specimen preparation process (fixating, staining, ...)
3. Description of the microscopic findings
4. Preliminary result – preliminary diagnosis

After the collection the pathologist has to choose an expert /consultant and send the case to him/her in a conventional way (by mail) or by Internet using email or a teleconsultation service (Figure 15).

The expert/consultation starts his/her own diagnostic process related to the external request. The result of this process is the pathology report.

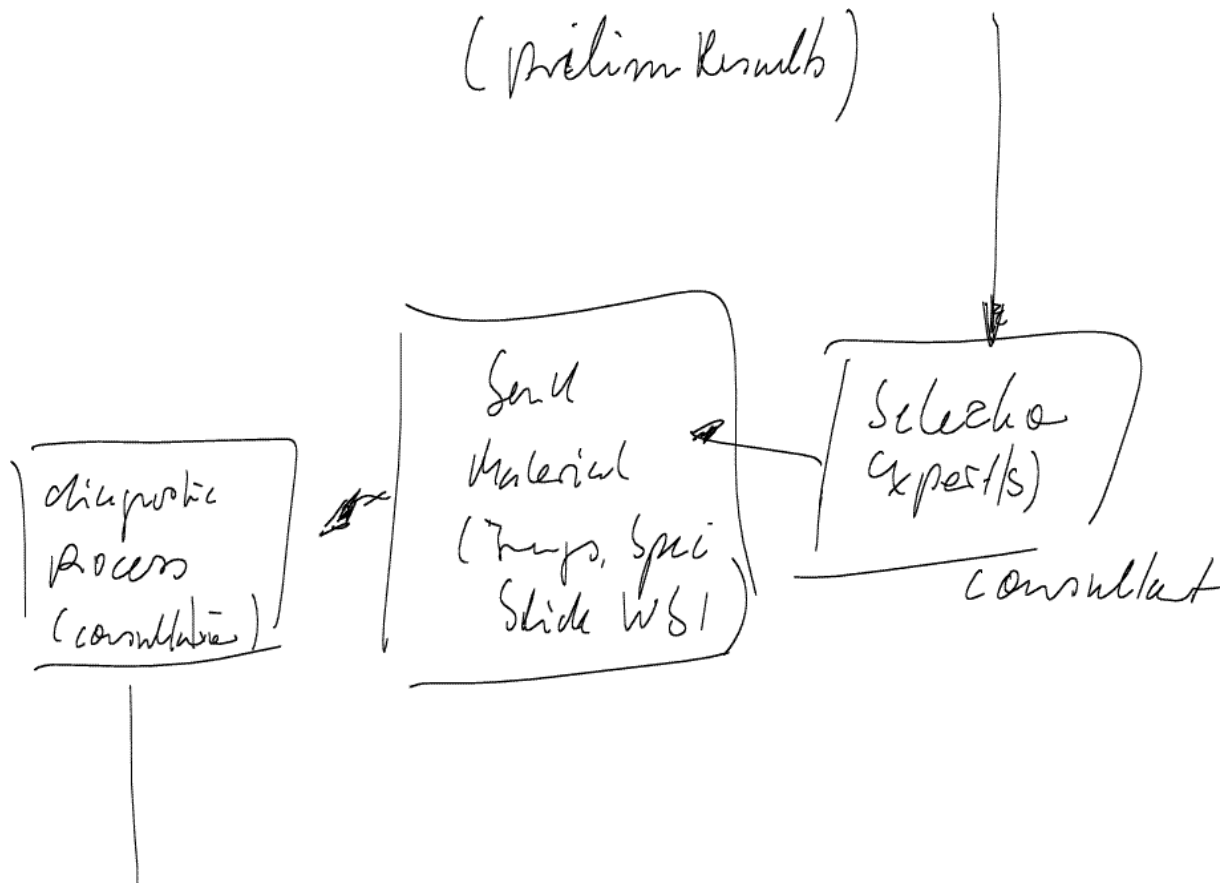


FIGURE 15: PART 2: SELECTION OF EXPOS, SEND THE MALLRAT, AND DIAGNOSTIC (EXTERNAL) PROCESS

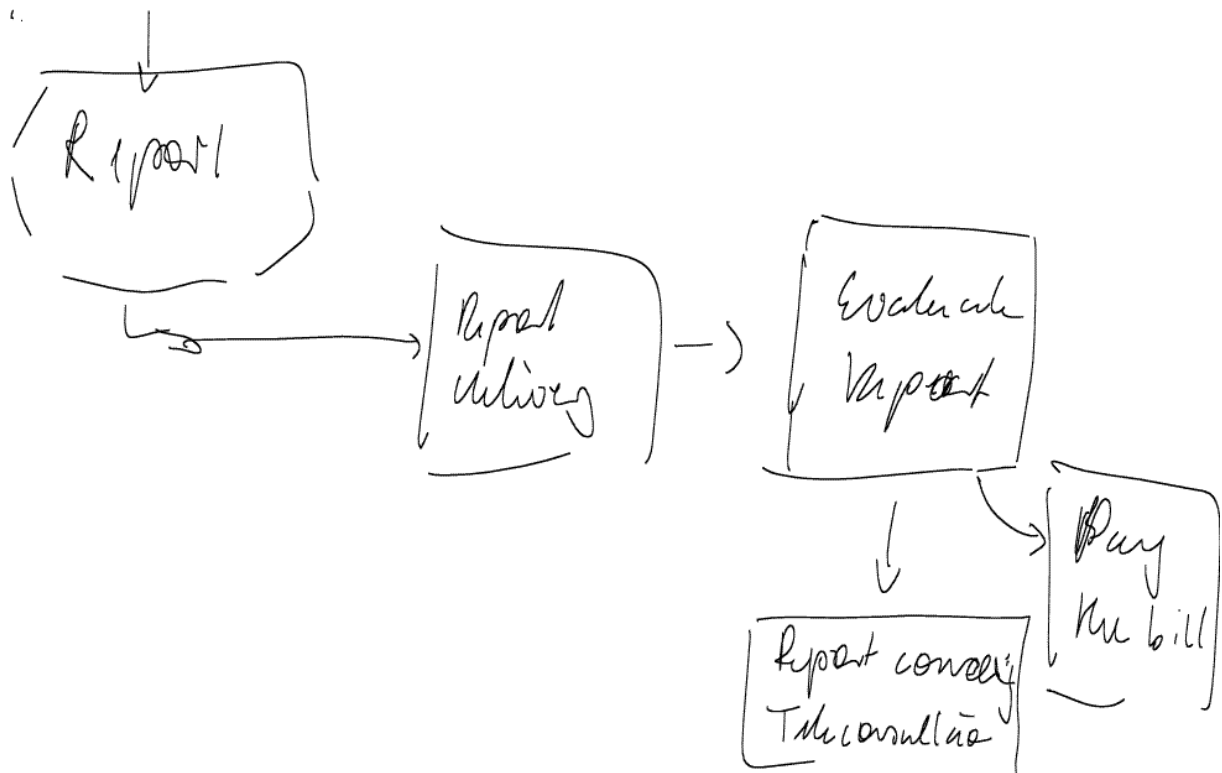


FIGURE 16: LAST PART: RESULTS

The report of the consultant/expert should be evaluated by the requesting pathologist due to the fact that the requesting pathologist is responsible for the final diagnosis. In case of complete agreement the pathologist will

write a final report to the clinicians. In case of disagreement the pathologist has to decide whether to start a new consultation process or to write the final diagnosis concerning the discrepancies.

## FORMAL DESCRIPTION OF CONSULTATION

### EXTENSION OF THE BASIC BUSINESS PROCESS: REPORTING

#### INFORMAL DESCRIPTION OF THE REPORTING PROCESS

One conclusion of the meeting in Evora in October 2008 is that the reporting process is very different from department to department and in the first version only the smallest common sense can be expressed.

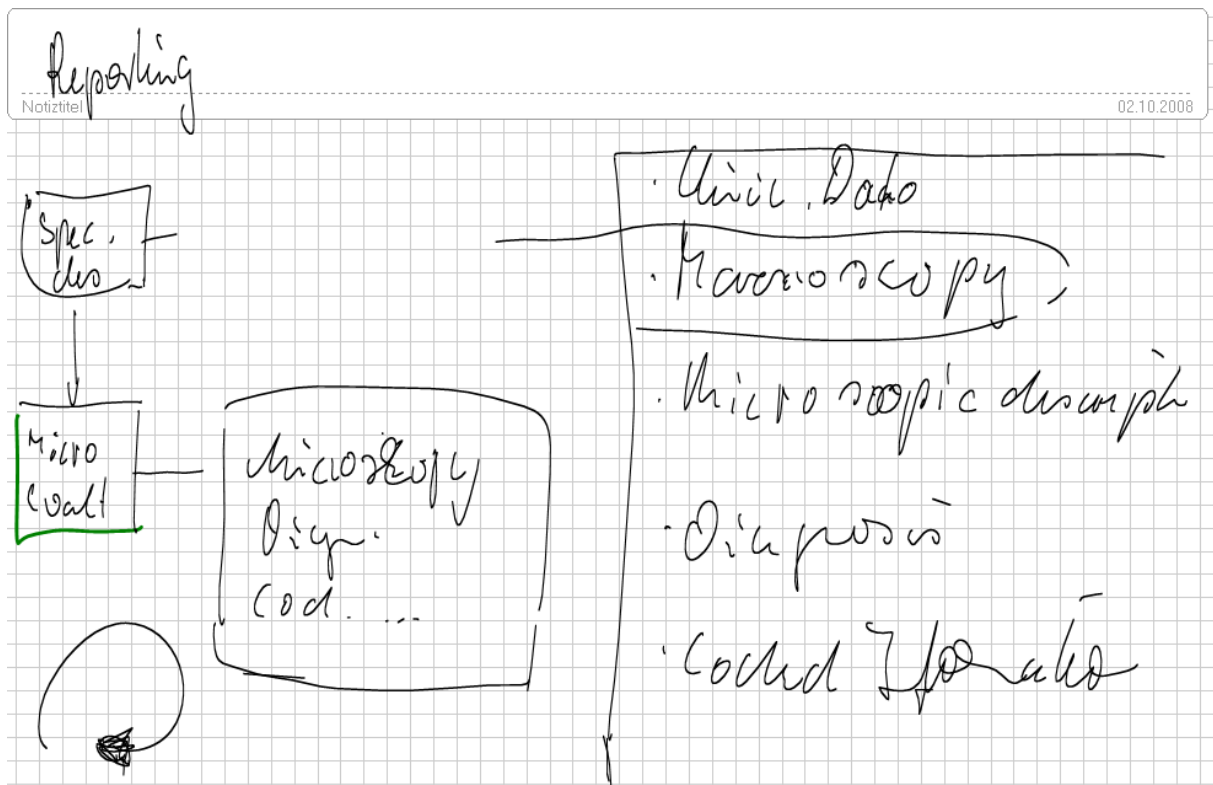
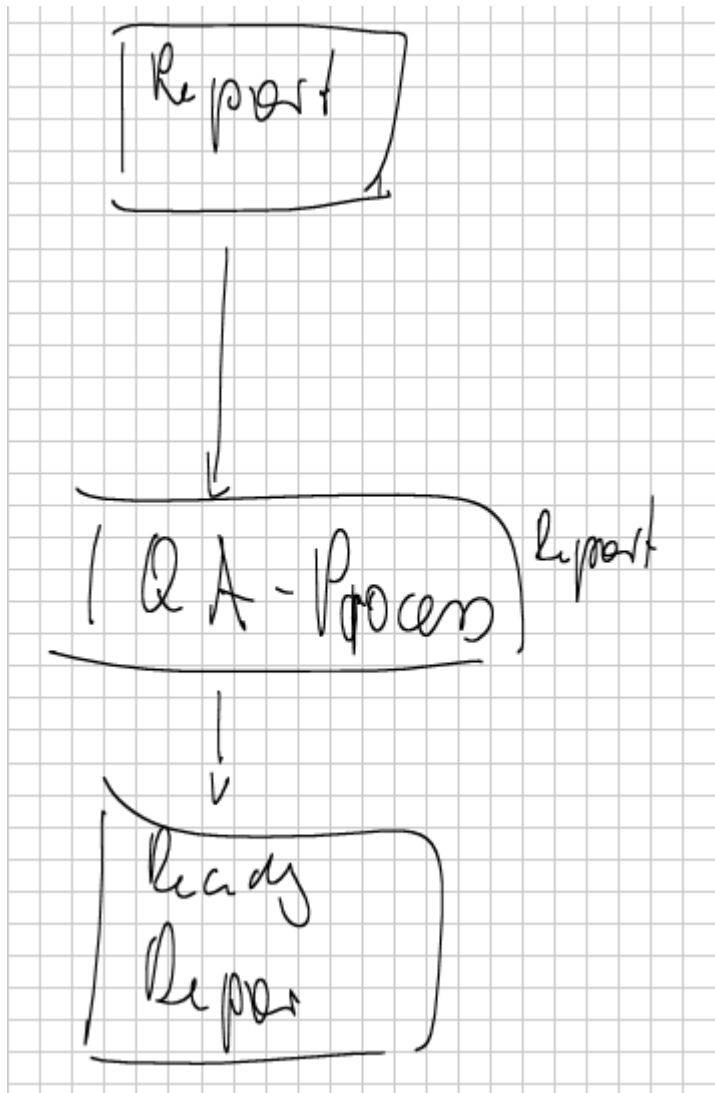


FIGURE 17: BASIC ELEMENTS OF PATHOLOGY REPORT

The report can have the following content elements (Figure 17):

1. Patient data
2. Clinical information – request, clinical question, general clinical situation
3. Macroscopic description
4. Microscopic description
5. Diagnosis
6. Coded data
7. Laboratory data (e.g. IHC report)



**FIGURE 18: MINIMAL CONSENT ABOUT REPORTING**

The minimal common sense about the reporting process is expressed in Figure 18. The reporting process starts during the first interaction of the pathologist with the operation material during the macroscopic description and will be continued during the microscopic evaluation. The result of the personal diagnostic process of the pathologist is preliminary report and this report is the input for a quality assurance process. Many different types of quality assurance processes are possible and at the moment it cannot be unified at the moment.

The result of the quality assurance process is the approved report as final report is send to the clinician.

As a requirement to the standardization process in IHE a very flexible architecture model for the actors report generator, report manager and evidence creator is essential. Especially the report manager should manage many different status levels for the reports concerning the different possibility due to the diagnostic process and the quality assurance process of the report (Figure 19).

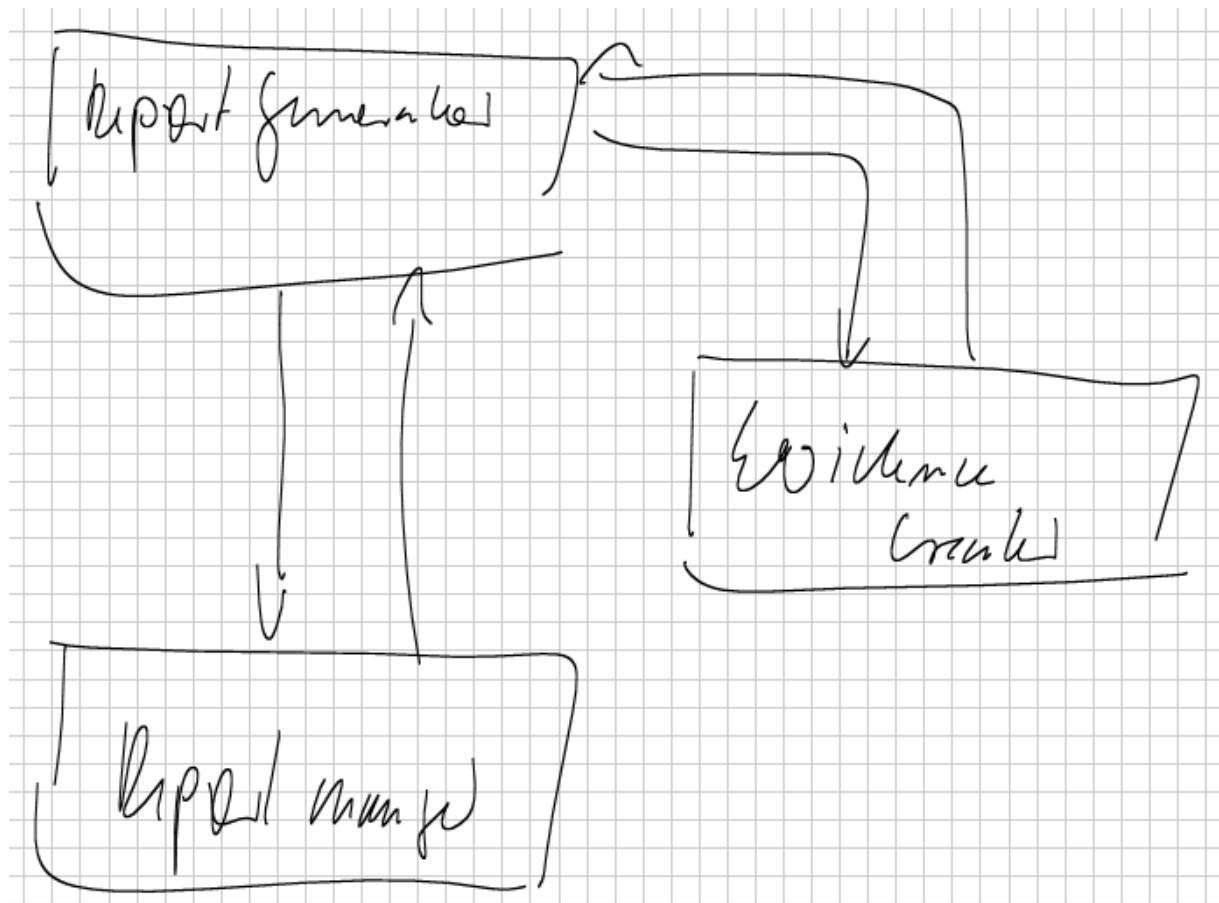


FIGURE 19: ESSENTIAL ACTORS OF IHE AND THEIR RELATION

FORMAL DESCRIPTION OF THE REPORTING PROCESS

EXTENSION OF THE BASIC BUSINESS PROCESS: IMMUNOCHEMISTRY

REASONS FOR EXTENSION

As a result of the meeting in Warsaw November 2008 the immunochemistry needs more efforts for standardization. Strong requirements for standardization exist due to the clinical and therapeutic relevance of this method (Figure 20). But many different conditions influence the results in immunochemistry and the quantization of the results. At least there are at least four different areas of standardization (figure 21).

To handle the very difficult problem the divide & conceour- Strategy is proposed. The means the IHC is an own business case with different entry points and the IHC report as an output (Figure 22).

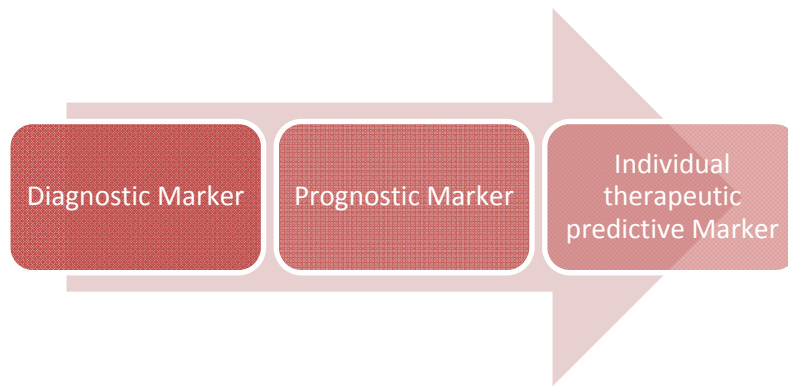


FIGURE 20: CHANGE OF PARADIGM IN IMMUNOCHEMISTRY - DIRECT INFLUENCE OF THE THERAPEUTIC DECISION DUE TO THE THERAPEUTIC PREDICTIVE MARKERS

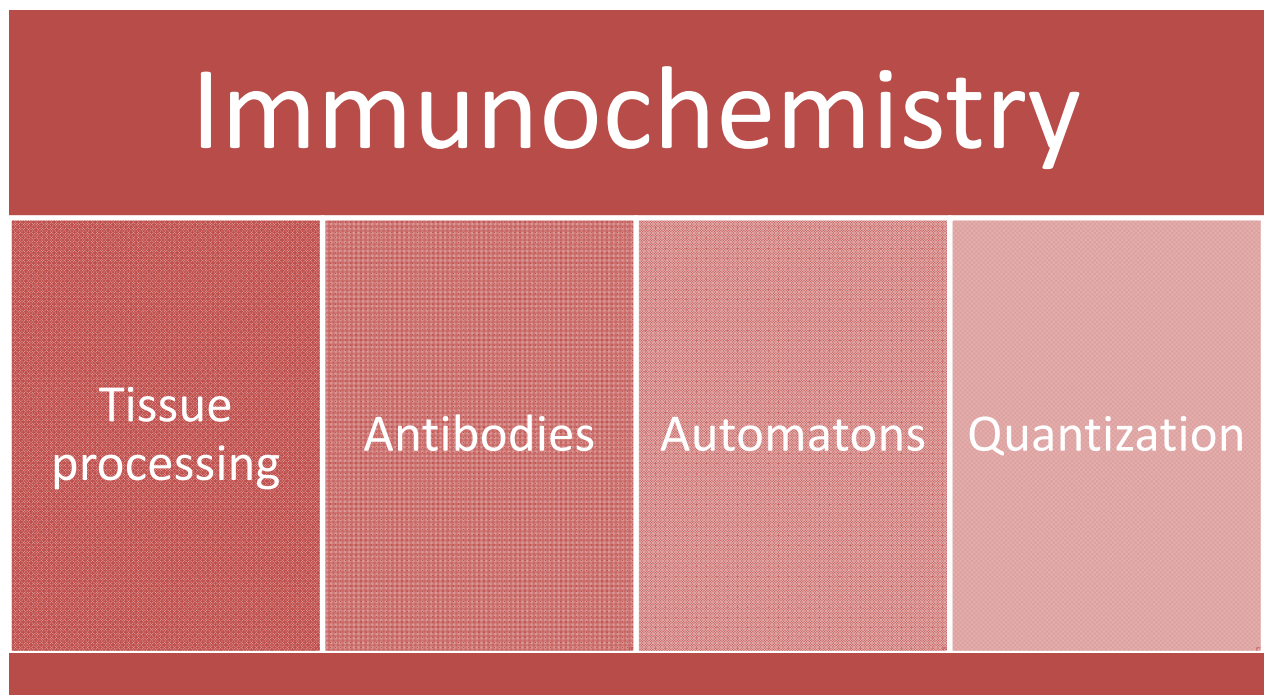
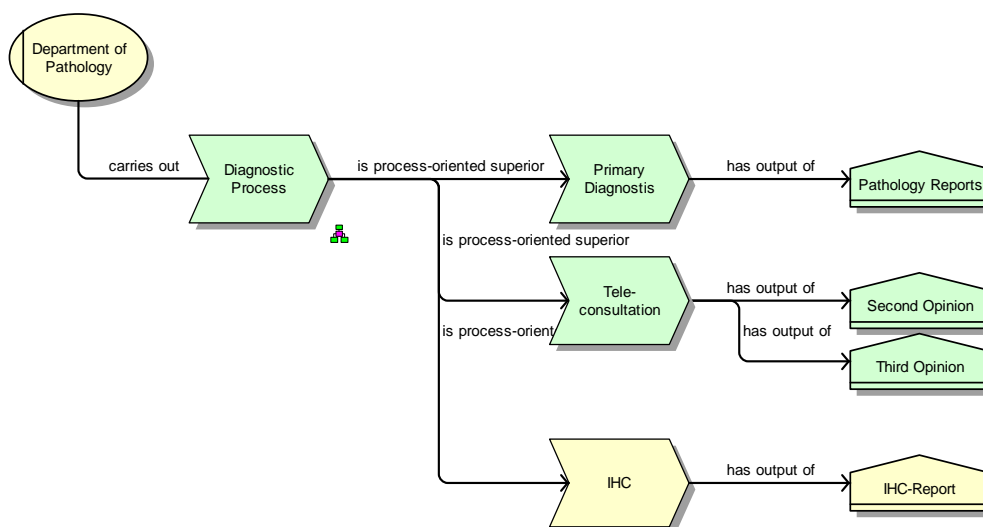


FIGURE 21: ESSENTIAL DOMAINS OF STANDARDIZATION IN IHC



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 Working Group 1

FIGURE 22: EXTENSION OF THE BUSINESS CASES TO IHC



THE BUSINESS PROCESS OF IMMUNOCHEMISTRY  
Steps in Immunochemistry procedure – lab process

# APPENDIX

## LEGENDS

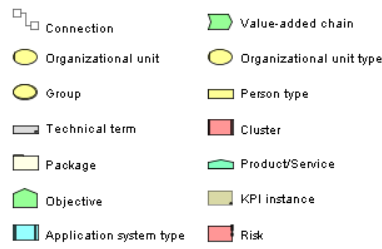


FIGURE 23: ELEMENTS OF VALUE ADDED CHAIN DIAGRAMS



FIGURE 24: ELEMENTS OF EVENT-PROCESS-CHAINS (EPC) AND PROCESS-CHAIN-DIAGRAMS (PCD)

## MINUTES OF THE WG-MEETINGS

MEETING IN EVORA, OCTOBER 2<sup>ND</sup>, 2008

The following topics were covered during the meeting of the WG1 in Evora:

# WG 1 & IHE Anatomic Pathology Planning Committee

- 13.30 - 14.00 Current status of the Business process modeling
  - Limitations
  - Necessary extensions and detailing
- 14.00 - 14.30 Extension & Detailing: Telepathology
- 14.30 - 15.00 Extension & Detailing: Reporting in Pathology
- 15.00 - 15.15 Short Break
- 15.15 - 16.00 Validation of the brief proposals & Cancer Registry Pathology Reporting (CRPR) Profile : workflow

The current business cases were analyzed and accepted. They were added after the discussion of the extension of the business process due to the teleconsultation process as a separate value of pathology action.

The general business process of diagnostic pathology was analyzed (next figure).

# Evaluation of the status

## Advantage

- Abstract overview about the processes
- Modeled as “best practice”
- Allowed to modify the processes
- Transferable to BPMN

## Disadvantage

- No relationship to IHE workflow elements expressed
- Open issues
  - ▣ Reporting & Billing
  - ▣ Image Management
  - ▣ Teleconsultation
  - ▣ Usage automations, specimen processing

FIGURE 25: RESULTS OF THE EVALUATION OF THE VERSION 1.2 OF DIAGNOSTIC PATHOLOGY BUSINESS PROCESS

In the next analysis step the actors of the IHE Technical Framework Version 1.5 were related to the business process.

# Result of Analysis

- Missing actor for order process steps
- Missing actor for report generation, management and distribution
- Missing actor for telepathology consultation

FIGURE 26: PROBLEMS OF THE ACTORS IN IHE TF PATHOLOGY AND THEIR RELATIONS TO THE BUSINESS PROCESS

The position and process of teleconsultation were discussed by the members of the COST Action. The process of business modeling started at the informal level to discover the various steps and results of every step.

The extension of the business process in diagnostic pathology with reporting was quite complicated. Various models exist and should be analyzed for common used process steps, for generalization or specialization. In the documentation a version of a suggested common opinion is presented and can be discussed by the community.