



***R-Bay***  
***R-Bay; Creating an eMarketplace for the transfer of imaging related eHealth services in Europe.***

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## Executive summary

The purpose of this evaluation is to assess the use of the services and the user's perception of the services. We will also focus on organizational context in shaping the use of the services. Both quantitative and qualitative data will be used in the evaluation process. Frequencies will tell us which actors and when the actors use the services. To answer the questions about how the actors perceive the system and why they use it or not, one needs to put the questions to the actors. In this project we will use questionnaires and interviews. Questionnaires can be used to gather information from actors from all the hospitals in the project while interviews, because it is expensive, will be used to gather information from key actors. The actors will be end users, referring physicians, radiologists, technicians and management representing the hospital. The questionnaire and the interviews will be used to answer different questions. Main questions are 1) do the actors accept the system, 2) are the actors satisfied with use of the system and, 3) how is the work done (workflow), 4) does the system fit into the organization and the work process, 5) are the actors satisfied with the clinical process (diagnostic accuracy, speed, communication), 6) what values does the system bring to the individual actors and the organization and 7) what are the facilitators and obstacles to the use of the system. The use of the system is dependent on decisions and actions taken by the requesting and the service providing organizations, so it is necessary to gather information from the requesting and the service providing hospitals.

## Background information

R-Bay aims to create a virtual and secure exchange for the provision and consumption of radiology services. Health professionals will be using interoperable, secure and trusted Internet technologies to transfer media and data types. The objective of the project is to validate the business case for new way of delivering image related services. These services include eInterpretation, eProcessing, eArchiving and eTraining. R-Bay modifies healthcare working environments in Europe by making available specialist capacity and generating new business models and business streams. The healthcare professionals will have a tool that not only that eases their work and makes them more flexible but also improves the clinical outcome as they have access to consultation and second opinion.

The expected outcome of the project will be to market validate four services offered together through the R-Bay Portal. The project will help to accurately identify the demand of the service and what value the different elements of the service would have.

## Evaluating R-Bay: The purpose of the evaluation and evaluation criteria

The purpose of the evaluation is to assess the use of the services and the users or the potential users. By users we mean both hospitals and end users.

The evaluation project will identify and describe the use of the services. Who use the services and how often? How do they use the services? The goal is to evaluate benefits of the system and the facilitators and obstacles to the use of the services based on the actors experience with and reaction to the new services.

The evaluation is based on the following criteria:

- Safety/security: Is the R-Bay services safe and secure?
- Acceptability: Is the R-bay service acceptable to the end users as well as the hospital management?
- Scalability of technology: Is it possible to scale up the services? What are facilitators and obstacles to up-scaling of the services?
- The quality of the services (compared with on-site radiology)
- Efficiency including financial efficiency and effectiveness: Is the services effective in

meeting objectives? Are the R-Bay services financially efficient?

The evaluation of the clinical services which the final Report of Clinical services provides can give valuable input to consider the self-sustainability of the eServices beyond the project phase. The gathered results and findings can give the answer to whether or not the field trial should be implemented as a fully-fledged clinical service and if so, whether any modifications are required before this can happen.

### **Formative and summative evaluation**

There are two main categories of evaluations, summative and formative. A summative evaluation looks at the outcome of implementation and the services worth or merit. Often the evaluation uses numbers as data and the objective is to quantify the effect of using this new technology. One of the major pros of summative evaluation is the ability to generalize. A formative evaluation will focus on process. What a summative evaluation is missing is an understanding of how the outcome is produced. A formative study can give insight to how and why this particular outcome is produced. Focusing on process means that one has to study a few cases because there are a lot of potential factors that could have contributed to the result. It will normally not be easy to anticipate what kind of factors that are the most important and the use of case studies will make it possible to be more flexible in the evaluation process. The limitation of formative studies is that you can not generalize. But you can argue that you can to some degree generalize if you have strategically chosen samples. For example, if you have a good organizational setting and highly motivated team members and the technology are not used, you could argue that the technology will not work in other organizational settings. Or you have bad organizational setting and the technology is accepted and functions well, you could argue that the technology will be suitable in other organizations.

In this evaluation we will include both outcome and questions about how the actors use the services. Which services has been used, number of cases, the case mix, quality of the services, diagnostic accuracy, effectiveness and efficiency are outcome-based assessments. The formative evaluation will focus on how the work is done, the fit between the services and the daily work flow at the department and which language the actors use when reporting.

## **The Actors: who are the informants and the respondents?**

The actors in this evaluation will be both organization and people. The organizations are the individual hospitals in different countries. These hospitals can be categorized as two different actors. There are those hospitals which are provider of the services and those who are customers of the services. The customers and providers have different jobs in the making of the radiology services. One key question is; do the two types of actors have the same experiences, positive or negative, with the services. Further more, it will be interesting to know if the same kind of organizations has different experiences. The hospitals in this project are situated in different countries. So therefore there could be an opportunity to account for the meaning of different languages and cultural settings.

But hospitals are made of different actors: health care professions, technicians, administrators etc. These are the actors who really can tell us about the system and how it functions in their organization. Actors in the same organizations can have different experiences and opinions about the same system and incentives and motivation to use the system.

Respondents/interviewees and topics:

- 1) Referring physicians and radiologists: the services and the diagnostic process
- 2) Consulting radiologist: the technology, the services and the diagnostic process
- 3) Technicians: the technology and the services
- 4) Management representing the organization: organization and the value of the services

## **Data collection**

The case study is a method that is used more and more by social scientists. It has evolved from medical, psychological and legal reports and is today used by social scientists for studying social events in a holistic perspective to get a more complete picture of those events (Franken, et al., 1996). A case study will focus on both the event and its context. The R-Bay can be seen as an experiment, it's planned: the number of cases and diagnostic cases are predefined. The context is cross-border communication. The context is also the individual hospital (organization, workload, roles, communication channels etc.) where the personnel normally use their native language. This is an event where case study methodology is suitable. Case study can tell us how and why certain events occurred. A collective case study (using several cases) has the advantage of comparison and simultaneous analysis of individual cases to develop a better understanding of the

phenomenon.

In case study it is normal to use more than one method of data collection. This evaluation uses triangulation in the data collection process. Triangulation means using of different methods to research the same issue within the same units. In this evaluation we will use quantitative data, interviews and questionnaires.

#### *Frequencies:*

The use of the services is one of the main criteria for measuring the success of the services. Statistics should be made to figure out how many times the services have been used? And what kind of clinical cases has been uploaded and reported?

To some degree we could say that the use of the services is dependent of actions taken by the requester. If the hospitals do not request any services form the provider there will be no activities. The hypothesis will be that the frequencies are a result of the interpretation of the member of the customer organization. But the decision to use the services or not, is based on the interpretation of the need and the type of services provided. If we want to know more about why the hospitals make a request or not, we must employ research methods that can us tell us more about the decision making process.

#### *Interview:*

Interview is a proper method to use whenever little is known about the subject that is studied or you want know more about how and why people make decisions. Semi structured interviews are known to be one of the more promising methods. In semi structured interviews some questions are formulated before the interview starts, while other questions are defined as the interview goes on, some based on themes defined by the interviewer and others based on themes brought up by the interviewed. The pro of semi structured interviews is the flexibility. The interviewed will be able to bring in new themes into the discussion. The questions that are defined by the interviewer can be used in every interview. These questions will make it possible to compare answers from different actors.

The use of interview is resource demanding. The solution is to interview a carefully selected sample of the actors in this project. These actors could be the key actors. They can be called key actors either because they are very influential actors or because they have a lot of information about process. Face-to-face interviews are expensive because you have travel to the locations. Interviews can be conducted via telephone or videoconference.

### *Questionnaires:*

A less resource demanding method is to use questionnaires. In questionnaires most of the answers are coded by the researcher so the respondent only has to mark the answer to each question. There is a possibility to construct open questions, questions that the respondent has to answer in his or her own words. As the use of questionnaires is less resource demanding the researcher is able to invite more respondents to participate in the evaluation. What you gain in numbers you lose in flexibility compared to interviews.

Questionnaires can be used to gather information from end users, referring physicians, radiologist and technicians, and hospital management. Because it is less expensive to administer we can include all the hospitals in the project.

## **Research topics and questions**

Based on the purpose of the evaluation we have identified research topics: technology, the clinical process, user experiences, acceptance, value of the services, efficiency, organization and normalization of the services. These are topics that can be evaluated by the use of interview and questionnaires. The limitation in this evaluation project is that the services is a new tool and the users will only have used the services for a short period when the data collection phase starts.

### **1) Technology**

#### *Reliability:*

Reliability is important because time is valuable, and reliability problems can consume a lot of the user's time. Unreliable services will negatively affect user satisfaction. Reliability is important in acute situations. Is the R-Bay services reliable? How often is the system down?

#### *Usability:*

Usability is the ease with which people can use a technology. The ease of which the technology can be used is a product of the technology it self, the work to be done and training. Is the technology complicated to handle? How much training is necessary? Can users accomplish to handle the application and complete their tasks at their intended speed?

#### *User satisfaction:*

Questions about user satisfaction can be based on the actual use of the system. How satisfied are health care workers with the use of the services. What do they like and what do they dislike about the services? If there are not satisfied with the services, has it something to do with the quality of the services, the technology or the organization of the work process? And do members of the requesting organization, the referring physicians and radiologists, and the service providing organization, the radiologists, have different opinion?

## 2) The clinical process

The RBay-services involve a variety of actors, technologies and work processes in different organizations:

- 1) A clinician makes consultation request using the eInterpretation solution.
- 2) The request addressees receive an automatic notification of incoming request.
- 3) When the radiologist logs into the system, the consultation request is displayed and any attached images can be viewed.
- 4) When the consultation has been completed, a notification is automatically sent to the consultation requestor.
- 5) The report can be retrieved can be retrieved from the consultation portal.
- 6) The system allows the requestor to give feedback to the radiologist on the report.

There are several questions concerning the clinical process:

Image quality:

In study at the Radiology Department at the University of Arizona the radiologists rated the image quality as generally good to excellent, but still the most common reason for radiologists not being able to read teleradiology images was poor image quality (Kuprinski et. al., 1999). Image quality is essential to reading of radiology images in the R-Bay-project. A good deal is known about resolution and quality of images, but it's the human and organizational dimensions that make the practice of teleradiology possible (Franken et al., 1996).

Clinical history:

The same study concludes that lack of clinical history was the second most common reason for not being able to read the images. A radiology images is interpreted against the background of clinical history (Nyce, 2006). This is not a question about how the technology functions, but about decisions made by human beings. In the R-Bay-project it can also be questions about specific

institutional cultures (“this is the way we do it in our organization”) or about different professional cultures in different countries.

Enough images:

The Kuprinski-study (1999) reported that not enough images were the third most common reason for not being able to read the images. Again it is question about human beings making decision on how many and which images to upload.

The procedure:

If the radiologists are not able to read the images, are there standard operating procedures for handling of those cases. What are the standard operating procedures? Are the actors satisfied with the procedures? Do they prefer to communicate via telephone communication or written communication?

Written communication:

In the R-Bay-project communication will take place between healthcare professionals normally using their native language in daily care. Clinical information and the report are vital documents in a teleradiology services. Which language will be used in the communication? English or the language of the customer? It is important that the actors have the language knowledge necessary to communicate across borders. The importance of idiomatic language has also been stressed (Jarvis and Stanberry, 2005). This is questions about the readability of the text.

Diagnostic accuracy of the report:

A principal dimension in an evaluation of teleradiology is the interpretative accuracy (Franken et al., 1996). Physicians will be asked to evaluate the accuracy of the report from the radiologists. Did the report answer the clinical question that the physician had? The accuracy of the report can be compared with the accuracy of reports from the on-site radiology department. The radiologists can be asked if they are confident in their interpretation. In this way we are able to compare the answers from the physicians and the radiologists.

Relevance to patient care:

The relevance of the report to patient care is a principal dimension in an evaluation of teleradiology. The physicians will be asked about the relevance of the report to patient care.

Organization of the report:

Is the report well organized? The physicians will be able to compare the teleradiology report with on-site radiology report.

Timely manner:

Speed is also a principal dimension. Did the report arrive in timely manner? The physicians will be able to compare the R-Bay-services with the on-site radiology services. Are there any differences? If there differences, what does this mean for patient care?

Contact between radiologists and physicians:

Reports are not the only interface between radiologists and physicians. Informal communication is an example. Consultation with attending specialist is of significance. It has been documented that meetings of clinicians with radiologists can change the clinical diagnosis in 20% of cases (Leung and Dixon, 1992). Aas (2006) says that with teleradiology, the close contact between radiologist and clinician may disappear, resulting in reduced quality diagnostics. The R-Bay system allows the physician to give feedback to the radiologists on the report. Both the radiologists and physicians will be asked if the lack of traditional communications channels make any difference and the satisfaction with the feedback solution.

### **3. User experiences**

Evaluation of the user experiences aims to understand the whole situation of the users. This is a broader concept than usability and user satisfaction. The focus is on people using technology in every day and not so every day life situations. These situations are a part of a broader context of work practices and relations to other actors.

### **4 Efficiency**

Efficiency is about the extent to which the application can be used without more than necessary tasks and the time it takes to complete the tasks. Normally the respondents also will compare the new technology with traditional ways of doing things.

### **5 Acceptance**

A widely used criterion to evaluate the acceptance of the technology is the actual use of the system. The use of this system is dependent upon decisions made by more than one actor. One of the actors could accept the system but not the other. If the customer organization does not request a service, there will be no use. In this study the number of cases are predefined and agreed upon. To measure acceptance we will gather information from the actors, both from management

representing the hospital and the end users, the referring physicians and the radiologists. Acceptance is related to the previous mentioned factors.

### **6) Value of the services**

What are the benefits of using the services? The key question is about how the actors perceive the utility of services. Do the services add value to their work or organization? Does the system support the health care personnel in their tasks in their department and does this work help to achieve the objectives of the hospital?

### **7) Organization**

The new services will be implemented in ongoing organization with a structure, time schedule, work processes and personnel. Does the new service fit into the organization and the ongoing work processes? Are there differences between the providing organizations and requesting organizations? Do they need to change the organization and the work process to make a better fit between the technology and the human factors?

### **8) Sustainability and upscaling of the services**

Is it possible to make a sustainable service and which actions have to be done to scale up service? Will the services become a normal way of doing radiology? Based on the information from the interviewed and the respondents, this evaluation can report how the actors consider the main facilitators and obstacles to the implementation of a sustainable service.

## **Evaluation plan and timeline**

### 1) Identify end users and hospital management:

End users are the clinical personnel/healthcare professionals from both the clinical customers and providers' sites that will be involved in the project and the cases. The personnel are e.g. doctors, radiologists, nurses and technicians. eTraining users are the group of professionals that will be using the eTraining service for merely training purposes.

Hospital management is the persons who can evaluate the services' contribution and value added to the hospital. The management speaks on behalf of the organization.

### 2) Distribute the questionnaires to the identified actors.

### 3) Interview with identified actors via telephone. The interviews will be recorded and transcribed.

### 4) Analyzing the data.

5) A report will be written.

Table 1: timeline of evaluation

Identify informants	September 2008
Distribute questionnaires	September 2008
Interviews	October 2008
Analysis	October 2008
Report	October -December 2008

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## Appendix

1-2 Questionnaires  
3-6 Interview guides

### 1 Consulting radiologist questionnaire (provider)

Rate your degree or disagree with each statement: 1= strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly disagree

The image quality was:

- 1) Very Bad
- 2) Bad
- 3) Acceptable
- 4) Good
- 5) Excellent

Comments:

2) There were enough images to read the images:

Comments:

3) There was enough clinical information:

Comments:

4) Written communication was clear:

Comments:

5) The report arrived in timely manner:

Comments:

6) The reports answered the clinical questions:

Comments:

The reports were accurate:

Comments:

8) The reports were well organized:

Comments:

7) I found the R-Bay easy to use:

Comments:

8) Overall, how satisfied are you with the R-Bay services:

- 1) Very dissatisfied
- 2) Somewhat dissatisfied
- 3) Neutral
- 4) Somewhat satisfied
- 5) Very satisfied

9) Please rank on a scale from 1 to 5 your overall satisfaction with R-Bay compared with on-site radiology (1=lower than the on-site radiology, 3=the same and 5=higher than on-site radiology)

Comments:

11) The workflow of the services fitted well into my normal work:

Comments:

13) The services lack some vital capabilities:

Technical:

Organizational:

12) General comments about the R-Bay services

## 2) Referring physician and radiologists (customer):

Rate your degree or disagree with each statement: 1= strongly disagree; 2=disagree; 3=neutral; 4=agree; 5=strongly disagree

1) Written communication was clear:

- a) on-site radiology
- b) R-Bay services

Comments:

2) The report arrived in timely manner:

- a) on-site radiology
- b) R-Bay services

Comments:

3) The reports answered the clinical questions:

- a) on-site radiology
- b) R-Bay services

Comments:

4) The reports were accurate:

- a) on-site radiology
- b) R-Bay services

Comments:

5) The reports were well organized:

- a) on-site radiology
- b) R-Bay services

6) It was simple to make arrangement for feedback on the report:

Comments:

7) I received feedback in a timely manner:

Comments:

8) I found the R-Bay easy to use:

Comments:

9) Overall, how satisfied are you with the R-Bay services:

- 1) Very dissatisfied
- 2) Somewhat dissatisfied
- 3) Neutral
- 4) Somewhat satisfied
- 5) Very satisfied

10) Please rank on a scale from 1 to 5 your overall satisfaction with R-Bay compared with on-site radiology (1= lower than on-site radiology, 3=the same and 5=higher than on-site radiology):

Comments:

11) The workflow of the services fitted well into my normal work:

Comments:

12) The services lack some vital capabilities:

What:

Technical:

Organizational:

13) I prefer to communicate with the radiologists via:

- a) Written communication
- b) Telephone
- c) Face-to-face

14) Please rank on a scale from 1 to 5 your satisfaction with communication in R-Bay compared with on-site radiology (1=lower than on-site radiology, 3=the same and 5=higher than on-site radiology)

Comments:

**3) Interview with consulting radiologists (provider):**

- 1) How many reports have you made?
- 2) How often do you have to give feedback to the customer on a report?
- 3) How do you consider the usability of the system?
- 4) How satisfied are you with system?
- 5) How do you consider the efficiency of the system?
- 6) Do you get enough images and clinical information to make a report?
- 7) How do you consider the communication with the customer?
- 8) How easy is it to integrate the services into your daily work processes?
- 9) What is your general impression of the system?
- 10) What are the barriers and facilitators to the use of the system?

**4) Interview with referring physicians and radiologists (customer):**

- 1) How many requests have you made? How many reports have you received?
- 2) How often do you need to have feedback on a report?
- 3) How do you consider the communication with the provider?
- 4) Did the report answer your clinical question?
- 5) How was: a) written language; b) organization of the report; c) diagnostic accuracy?
- 6) How satisfied are you with services?
- 7) How do you consider the efficiency of the system?
- 8) How easy is it to integrate the services into your daily work processes?
- 9) What is your general impression of the services?
- 10) What are the barriers and facilitators to the use of the system?

**5) Interview with technician (customer and provider):**

- 1) How often have you used system?
- 2) How do you use the system (the work process)?
- 3) How satisfied are you with the system?
- 4) How do you consider the efficiency of the system?
- 5) How often do you to communicate with other actors? With whom and what are the purposes?
- 6) Are there barriers to the use of the system?
- 7) What can be done to optimize the use of the system?

**6) Interview with hospital management (customer and provider):**

- 1) What is the situation of the radiology in your organization?
- 2) Overall, how satisfied are you with R-Bay system in your organization?
- 3) What is the value that the system brings to your organization?
  - a. Work flow and use of resources
  - b. Patient waiting times
  - c. Access to specialized healthcare in timely manner
  - d. Lower production costs
- 4) Are the services in accordance the organizational policy?
- 5) What are main facilitators and obstacles to the use of the system?
- 6) What are the main obstacles regarding routinization or normalization of the services?
- 7) What can be done to optimize the use of the system?