

# ICT Service Chains: Its Structure And Its Optimization In Eight Large Dutch Organizations.

## **Abstract.**

*The speeding up of the adjustment of products and services often requires a faster change of the information and communication technology (ICT) that is needed for delivering a product or a service. The research focuses on the governance of the chain of processes that is needed for adjusting ICT applications, as well as on their optimization.*

*The definition of the chain includes a description of the processes on both the demand as well as the supply side. For this, best practice methods are used. This way, an ICT service chain is described. This chain includes processes that formulate the demand for ICT, that realize this demand, that take the new ICT provisions into production and that realize their exploitation*

*After definition of the research questions, the model for the chain and the optimization of this chain are presented. Using this model, the set-up of the ICT chain and how this is optimized are investigated in eight large organizations.*

## **1. ICT service chains and their optimization.**

The provision of ICT products and services in large organisations often takes place via many steps. This happens for a good reason. After all, major changes to ICT systems have to fit in with the strategy, require business cases, are realized somewhere and next implemented. [1] This process involves several parts of the organization. [2,3,4]. The work involved in the ICT provision to be delivered moves across the organization as it were. This work takes place in a chain of linked processes. This article focuses on this ICT service chain. It defines an ICT service chain as follows:

*“an ICT service chain focuses on the supply of*

*support for ICT. To this purpose, the chain includes processes that formulate the demand for ICT, that realize this demand, that take the new ICT provisions into production and that realize their exploitation.”*

This study investigates how this chain is set up in eight large Dutch organizations and how this chain is optimized by these organizations. The article consists of two parts. The first part describes the theory behind ICT service chains and their optimization. The second part describes the results of the study into the set-up and optimization of ICT service chains. The basic questions in this research are:

- a. how is the defined ICT service chain recognized?
  - Are the processes in the chain described? And does one measure on these processes?
- b. how is the researched ICT service chain optimized? Does this happen at the level of each individual process? Does this happen by making use of defined interfaces between processes and/or does this happen at chain level?
- c. And what are the challenges involved in governing the ICT service chain?

## **2. ICT service chains and their optimization in theory.**

### **2.1. The construction of chains.**

The study used the theory as developed by Looijen [2] and its definitions [8, 9 and 6]. Looijen [2] states that for the organization of information provision and ICT, three types of organizations can be distinguished. He distinguishes between: an organization set up for coordinating the demands of the clients for ICT and for supplying direct support when ICT is used. This is the ICT demand organization. On the supply side, Looijen [2] defines two other types of organization that are involved in the supply of ICT. These are on the one hand, the ICT development and maintenance organization and

on the other hand, the ICT exploitation organization. Looijen [2] calls his model of ICT organizations, the threefold model of ICT management.

The definition of the processes in the ICT demand organization is given in the Business Information System Library (BiSL) [8]. The definition of the processes in the organization of the ICT development and maintenance organization is subject of the Application Systems Library (ASL) [9]. The organization of the exploitation organization is explained in the IT Infrastructure Library (ITIL) method [6].

ICT service chains take care of the delivery of ICT . In this delivery, the requirements and possibilities need to be geared to each other; the defined ICT requirements are used in design and development of the new ICT application; this application is transferred to a production environment and started up. This way, changes to ICT go through an entire chain of consecutive processes in the organizations for demand and supply [5]. In ICT service chains, demand and supply processes collaborate. For this to be done optimally, the individual processes need to be detailed, their interfaces have to be clear-cut and governance needs to cover the chain as a whole. [11,7].

Next, we will start by discussing the processes in the threefold ICT management model. After this, the ICT service chain composed of processes is discussed and finally, the optimization of this chain is examined further.

### **2.1.1. The threefold model for ICT management and its interpretation.**

The BiSL method can provide an interpretation for the processes of the ICT demand organization [8]. BiSL distinguishes processes at three levels; namely, at strategic, tactical and operational level. The operational processes can be seen in figure 1. As soon as a request for change in ICT is stated, these processes are gone through. This takes place as follows:

1. The demand organization specifies its requirements.
2. Parallel to the realization of these requirements by the supply organization, the demand organization actively adjusts the necessary procedures and

prepares the implementation of the new ICT.

3. At delivery, the demand organization performs a user test and if the result of this test is positive, it orders the ICT to be taken into production and mutates the register for changes.
4. During the exploitation of the ICT, the users get support, authorisations are issued and the operational control of the supply organization is taken care of.

The ASL method defines the processes in the maintenance and development organization [9]. ASL also distinguishes processes at strategic, tactical and operational level. Figure 1 includes the operational ASL processes, which are gone through in case of a change to the ICT. These are:

1. The alignment with the demand organization by performing an impact analysis.
2. In the design and development of this request, the design, realization and test processes are carried out.
3. During the transition into the production stage, this is followed by an update of the list of requests (change management), the implementation of the new ICT and the software control&distribution process.
4. During exploitation of the ICT, there is support in case of incidents, the configuration is kept up to date and capacity management takes place, whilst continuity and availability are ensured.

ITIL shows the processes that concern the exploitation of ICT [6]. Cater Steel et al. [12] researched the critical success factors when working according to ITIL. In this research, the ICT processes are used for putting together an ICT service chain. ITIL version 3 teaches us that the following processes (see figure 1) may be gone through in ICT service chains when realizing IT requests:

1. In the specification of the requests, the service levels are reviewed and the implications for the service catalogue determined.
2. In the design and development of the desired ICT, steps are taken for enabling the right availability, capacity and continuity of the ICT, once this is taken into production. This is accompanied by measures for enabling this in the field of security.
3. In the transition towards exploitation, this transition

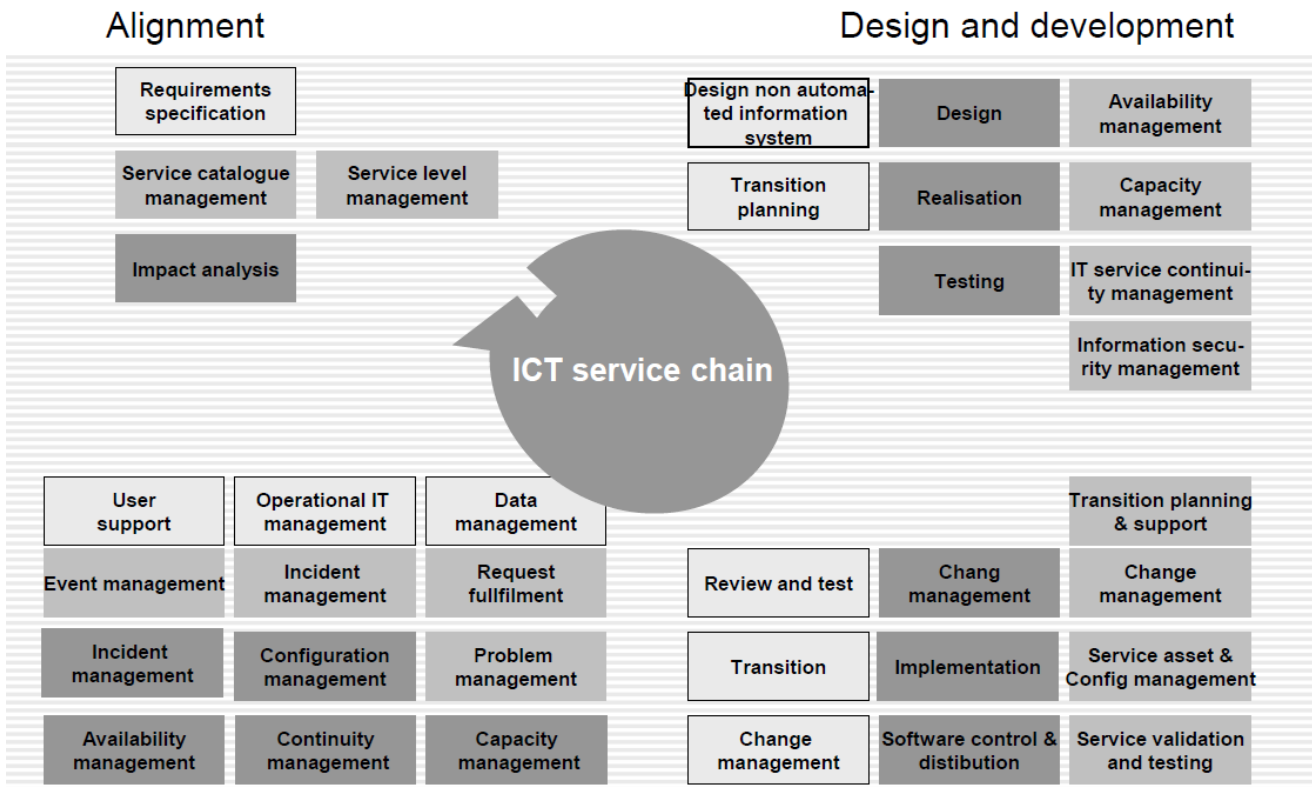


Figure 1 : ICT service chains at operational level.

| Organization                 | Equens        | Amphia  | Ministry of Defence | Ministry of ELI, division Agriculture | Kadaster | Philips      | ASR        | Police            |
|------------------------------|---------------|---------|---------------------|---------------------------------------|----------|--------------|------------|-------------------|
| <b>Demand organization:</b>  |               |         |                     |                                       |          |              |            |                   |
| - size                       | ?, spread     | 15fte   | 400fte              | 100-200fte                            | 60fte    | 400-200fte   | 300-200fte | 200fte            |
| - method                     | no explicit   | to BiSL | to BiSL             | BiSL                                  | to BiSL  | to BiSL      | BiSL       | BiSL              |
| <b>Total supply:</b>         |               |         |                     |                                       |          |              |            |                   |
| -development and maintenance | 130fte        | 50fte   | 1400fte             | 280fte                                | 264fte   | 900-2375fte  | 900fte     | 2050fte           |
| - method                     | 110fte        | 14fte   | 300fte              | 120 fte                               | 100fte   | 1200-1500fte | 600fte     | 250fte            |
| - exploitation               | no explicit   | to ASL  | ASL                 | ASL                                   | to ASL   | own method   | ASL        | ASL               |
| - method                     | 15fte         | 26fte   | 1000fte             | 100fte                                | 164fte   | 400-500 fte  | 300fte     | 1800fte           |
| - method                     | ITIL and ITUP | ITIL    | ITIL version 3      | ITIL                                  | to ITIL  | outsourced   | outsourced | ITIL version 2/3. |

Table 1 : Qualities of the investigated Information provision and ICT organizations.

is planned and supported. An exploitation test is performed, the register including the requested changes is amended and the configuration is updated.

4. During exploitation, the ICT is kept in production and incidents and problems are solved.

### 2.1.2. The building of ICT service chains.

A request to change ICT does, sometimes iteratively, go through four stages [5]. These include the alignment of the request for new ICT and the possibilities to realize this; the design and development of the new ICT; the transition to production and the exploitation of the new ICT. In each of these four stages, people from the three individual organizations collaborate. These people perform the tasks that are (part of) specific BiSL, ASL and ITIL processes. The output of each of these processes goes to another process in the chain that links the request for and the actual working with the realized ICT. Figure 1 demonstrates that clusters of collaborating BiSL, ASL and ITIL processes can be identified in each of the four phases.

### 2.2. Optimization of ICT service chains.

Optimization of chains starts by describing the individual processes of a chain and their interfaces with the processes that precede and follow these [11,14]. After description of the processes and their interfaces, it is possible to lay down standards that these processes have to meet and measure to what degree these standards are met. Subsequently, a chain of processes can be optimized in three different ways. Namely, the optimization of each process individually, the optimization of the interface between processes and the optimization of the chain as a whole. [10]

At process level, after description and after assigning a service level for a process, it often turns out that one has to have the right expectations regarding the process. [11] In some types of processes, such as the service desk process where many queries arrive and the arrival of queries is often of a statistic nature, one is able to calculate which achievement can be accomplished with the given effort. [10,15].

At the level of the interfaces between processes, optimization entails coming to agreements on the

standards to be used, thus ensuring that the output of the supplying process can be processed optimally by the receiving processes and avoid various differing interpretations.

As regards chains of processes, Goldrath [7] teaches us that, by always improving the weakest performing process, a chain of processes will develop another weak process. By improving this in turn and by continuing to improve the next weakest process, the chain as a whole is optimized. In ICT service chains, the Goldrath theory means that the progress of a request for ICT needs to be governed chain wide. This enables real time and in time recognition of possible weak process in a chain, meaning that this process does not lead to delays. On the other hand, it allows for ascertaining situations in which, in spite of the fact that all requests for ICT are dealt with, there is still room left in some of the chain processes. In that case, this room can be eliminated.

The chain wide governance of a large number of requests regarding ICT that are to be realized in parallel can be supported by technology [13]. In real time, this explains where there is undercapacity and where there is overcapacity in a chain. Based on this information, one may decide to make adjustments.

### 3. Set-up of the empirical study.

The study into the set-up and governance of ICT service chains is part of the research programme in the field of IT governance. The study was carried out in cooperation with the ASL-BiSL foundation. This foundation is the driving force behind the realization of NEN3434, a standard for the set-up of the organization of ICT development and maintenance. All points regarding the theory of the set-up and optimization of ICT service chains were listed by a knowledge circle of the lectureship. This knowledge circle included lecturers of the university, two members of the architecture board of the ASL-BiSL foundation and employees of two external companies.

The empirical research was carried out by four groups of three students of this University of Applied Sciences. This research consisted of in-depth interviews with participants in ICT service chains in

eight large Dutch organizations that each employ over 2000 people. Organizations taking part in the study were Philips, the Amphia hospital, insurance company ASR, the interbank organization Equens, the Police force, the Ministry of Defence, the Ministry of Economy, Agriculture and Innovation (ELI) and the Kadaster. The students were trained for holding these interviews by means of lectures and by means of two trial interviews.

#### **4. ICT service chains in practice.**

##### **4.1. Qualities investigated organizations.**

Table 1 shows the qualities of the investigated organizations. The table reveals that all investigated organizations have set up ICT demand and supply organizations, unless these are outsourced. Furthermore, it becomes clear that almost every organization that took part in the study has set up its information provision and ICT organization according to the BiSL, ASL or ITIL methods or uses a set-up based on these methods.

##### **4.2. ICT service chains at operational level.**

The first part of the research question concerns recognition of the different processes; the description of these processes and measuring on the progress of these processes. Table 2 shows that virtually every process is present in each of the eight investigated organizations. Exceptions to this are processes to do with the alignment of the requests and processes regarding the transition. Furthermore, it emerges that all processes are described, with the exception of processes regarding transition and those regarding exploitation. Finally, any time spent on these processes is recorded for each application in virtually all processes. The information resulting from this does not lead to a majority of the organizations having indicators at their disposal. Indicators which might be helpful for planning large parts of ICT realisation trajectories. Indicators are used in only two out of eight organizations for planning the design of ICT provisions. Besides, these are used for testing already concluded service agreements.

##### **4.3. Challenges when working in chains.**

The second part of the first research question concerns the challenges as experienced by organizations when working in the ICT chain. Table 3 shows that most (75%) of the eight investigated organizations monitor their projects chain wide. However, it does not follow that the documents produced by the processes in the ICT service chain are managed in a central location for the entire chain. Neither do all organizations keep up with the progress of an ICT request at chain level or is the received data regarding this progress evaluated.

When asked about the accumulation of work in the chain, 25% of the organizations remark that they do not have any data on possible accumulations in this field. The others point at the interfaces between the three different organizations as being the location where accumulations often, if at all, do occur. Only one single organization (Philips) states that the progress of projects is monitored weekly and that in time action is taken when progress lags behind.

##### **4.4. Optimization of chains at operational level.**

The second research question concerns the optimization of the ICT service chain. Table 4 reveals that, when looking at process level, not all organizations have described their processes, nor have they set standards for the execution of a process. However, the processes are evaluated on a regular basis.

The interfaces between processes are often described and 75% has set requirements for the documents that are passed on from one process to the next. In more than 50% of the organizations, there are audits on whether they stand by the agreements.

At chain level, a majority of the researched organizations does have chain owners of a chain. Methodical improvement of a chain does take place but audits at chain level are only performed in 37.5% of the researched organizations.

#### **5. Discussion.**

In modelling the chain from the request for ICT to realization of ICT in the eight investigated large

organizations, each of which have entirely or partly in-house information provision and ICT organizations, best practice methods were used. In this case, the ITIL [12,16] method is used internationally. For the ASL method, there is a NEN3434 [10] standard in place and an ISO standard is being prepared. In the Netherlands, the BiSL set-up method is mainly used for setting up demand organizations [10].

These methods are used to set up the chain. It is possible to distinguish four clusters of processes in this: arriving at alignment, the development and maintenance of ICT, the transition and the exploitation of ICT. Use of other methods would probably have resulted in the same kind of processes and a comparable ICT service chain.

The chains and their optimization were investigated in eight large to very large Dutch organizations. The sample of eight organizations is small, all the more because at least one organization, the hospital, has not set up chain wide ICT governance and its set-up of information provision and ICT organization consists of processes that have been designed "in the spirit of" the method. Furthermore, the research took place in collaboration with the ASL/BiSL organization, which obviously means that the investigated organizations are predominantly users of the BiSL and ASL methods.

## 6. Conclusions.

The study started with the following three research questions:

- a. how is the defined ICT service chain recognized? Are the processes in the chain described? And does one measure on these processes?
- b. how is the researched ICT service chain optimized? Does this happen at the level of each individual process? Does this happen by making use of defined interfaces between processes and/or does this happen at chain level?
- c. And what are the challenges involved in governing the ICT service chain?

Considering the question (a) the study shows that the ICT service chain in the eight investigated

organizations are recognized and that virtually each recognized process is present. These processes are usually described and time registration is performed when the processes are executed. The information resulting from this does not lead to indicators.

Concerning question (b): When the processes are viewed as the links in a chain, it turns out that there is not always chain wide monitoring of processes or management of documents. This may result in less or no insight at all into accumulations of work in a chain.

In 62.5 % of all cases, chain wide process owners have been appointed. Chain wide performance of audits seems to be a point of particular attention.

Concerning question (c) the study shows, that not a;; organizations keep up with the progress of an ICT request at chain level or is the received data regarding this progress evaluated. When asked about the accumulation of work in the chain, 25% of the organizations remark that they do not have any data on possible accumulations in this field. The others point at the interfaces between the three different organizations for demand and supply as being the location where accumulations often, if at all, do occur. Only one single organization (Philips) states that the progress of projects is monitored weekly and that in time action is taken when progress lags behind.

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| Organization                   | Equens                        | Amphia                  | Ministry of Defence              | Ministry of ELI, division Agriculture | Kadaster           | Philips               | ASR                        | Police              |
|--------------------------------|-------------------------------|-------------------------|----------------------------------|---------------------------------------|--------------------|-----------------------|----------------------------|---------------------|
| <b>Alignment processes:</b>    |                               |                         |                                  |                                       |                    |                       |                            |                     |
| -processes:                    | Bisl. and ASL processes       | Bisl. and ASL processes | all                              | all                                   | all                | all                   | all                        | all                 |
| - processes described          | Yes                           | No, only ITIL           | Yes                              | Yes                                   | Yes                | No                    | Yes                        | Yes                 |
| - measured on                  | time keeping                  | time keeping            | time keeping                     | time keeping                          | progress report    | time keeping          | time keeping               | no                  |
| - indicators                   | no                            | no                      | no                               | no                                    | no                 | no                    | no                         | no                  |
| <b>Design processes:</b>       |                               |                         |                                  |                                       |                    |                       |                            |                     |
| -processes:                    | all ASL processes rest partly | all                     | all                              | all                                   | all                | all except AO making. | all present                | all present         |
| - processes described          | partly                        | only ITIL               | yes                              | yes                                   | yes                | yes                   | yes                        | yes                 |
| - measured on                  | time keeping                  | time keeping            | on time and money                | on time and money                     | time keeping       | time keeping          | on time and money          | on time and money   |
| - indicators                   | yes but could be improved.    | no                      | no                               | no                                    | no                 | no                    | yes but could be improved. | no                  |
| <b>Transition processes:</b>   |                               |                         |                                  |                                       |                    |                       |                            |                     |
| -processes:                    | ASL&ITIL processes            | all                     | all                              | all                                   | all                | part Bisl and ITIL    | part Bisl processes        | all                 |
| - processes described          | no, only ITIL                 | no, only ITIL           | no                               | yes                                   | all primary        | yes                   | yes                        | no                  |
| - measured on                  | time keeping                  | time keeping            | yes, per trajectory              | overall                               | planning hrs meas. | yes, per traject.     | yes                        | yes, per trajectory |
| - indicators                   | no                            | no                      | no                               | no                                    | no                 | no                    | no                         | no                  |
| <b>Exploitation processes:</b> |                               |                         |                                  |                                       |                    |                       |                            |                     |
| -processes:                    | most available                | all                     | all                              | all                                   | all                | most available        | most available             | all except 2 Bisl   |
| - processes described          | no                            | yes                     | yes                              | yes                                   | yes                | no                    | yes                        | no                  |
| - measured on                  | management                    | yes                     | yes                              | yes                                   | yes, SLA           | yes, SLA              | yes, SLA                   | Yes                 |
| - indicators                   | only indicators incidents     | no                      | indicators by means of execution | checking using SLA                    | checking using SLA | checking using SLA    | checking using SLA         | no                  |

**Table 2:** Qualities of the processes in the investigated organizations

| Organization  | Equens  | Amphia                                     | Ministry of Defence   | Ministry of Economy, Innovation and Agriculture, division Agriculture | Kadaster  | Philips  | ASR   |
|---|---|--|---|---|---|--|---|
| <b>Alignment at chain level:</b>                            |   |  |   |   |   |  |   |
| <b>1. Course change through the operational chain:</b>      | Some chains run smoothly, others less                             | Only chain wide alignment in exploitation. | In major changes one goes through all four chain sections.      | Projects are in the project register and are monitored chain wide.    | Chain wide progress projects as well as change management. Chain is described as a chain. | Chain wide monitoring of projects on a weekly basis.                   | Chain wide monitoring of projects by means of progress reports. |
| <b>2. Delivery of products and services at chain level:</b> | Not all chains described.   | No chains described.                       | Monitoring of projects chain wide.                              | Monitoring of changes chain wide.                                     | Monitoring and management of documents takes place chain wide                             | Monitoring and management of documents takes place chain wide          | Chain wide monitoring via progress report.                      |
| <b>3. Measuring and assessing at chain level:</b>           | No chain wide measurement.  | Chain wide measured in time and money.     | Chain wide measurement on time and costs.                       | Chain wide measurement on agreements.                                 | Measuring chain wide.   | There is chain wide time keeping and there are chain wide indicators.  | No, but involved in key performance indicators.                 |
| <b>4. Accumulation of work the chain</b>                    | If these are present, then they occur in development and testing. | Accumulations mainly when testing.         | Accumulations in all disconnections of the four chain sections. | In the exploitation there are delays in the handling of calls.        | Especially in transition from BSL to ASL and from ASL to ITIL processes.                  | For each project the status is checked weekly and problems are solved. | Not discussed.  |

**Table 3 :** Challenges when working with ICT service chains.

| Organization                            | Equens          | Amphia                   | Ministry of De-fence  | Ministry of EL, division Agriculture | Kadaaster                         | Philips         | ASR    |
|---|-----------------|--------------------------|-----------------------|--------------------------------------|-----------------------------------|-----------------|--------|
| <b>Optimization:</b>                    |                 |                          |                       |                                      |                                   |                 |        |
| <b>a. at process level:</b>             |                 |                          |                       |                                      |                                   |                 |        |
| - described processes:                  | seven chains    | ITIL processes           | yes                   | yes                                  | yes                               | yes             | partly |
| - standards per process                 | yes             | no                       | yes                   | no                                   | partly                            | yes             | no     |
| - evaluation standards?                 | incident driven | only in ITIL proc.       | Yes, at ext. standard | permanently                          | yes, yearly prim.proc             | yes             | no     |
| - indicators used?                      | in the making   | no                       | no                    | no                                   | yes, e.g. service desk            | yes, chain wide | no     |
| - evaluation process?                   | at least 1x yr  | monthly consultation     | yes, self evaluations | partly                               | yes                               | yes             | no     |
| <b>b. the interfaces</b>                |                 |                          |                       |                                      |                                   |                 |        |
| - interfaces described                  | partly          | no                       | yes                   | yes                                  | yes                               | yes             | yes    |
| - standards documents                   | partly          | no                       | yes                   | yes                                  | yes                               | yes             | yes    |
| - international standards?              | no              | no                       | unknown               | no                                   | no                                | no              | no     |
| - waiting times between proc.           | yes             | no                       | yes                   | partly                               | yes                               | yes             | yes    |
| - audit on compliance?                  | yes             | no                       | yes                   | partly                               | sometimes                         | yes             | yes    |
| <b>c. at chain level:</b>               |                 |                          |                       |                                      |                                   |                 |        |
| - chains recognized and owners present? | yes             | recognized but no owners | yes                   | yes                                  | not all but chains do know owner. | yes             | yes    |
| - methodically improved?                | no              | no                       | reactive              | ad hoc                               | yes                               | yes             | yes    |
| - audit at chain level?                 | no              | no                       | yes                   | partly                               | yes                               | no              | yes    |
| - quality plans/chain?                  | no              | no                       | no                    | no                                   | yes                               | no              | no     |

**Table 4 :** Optimization of ICT service chains.