Case Study: Replacement Cost Based Approach to Risk Management of Knowledge Assets

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Abstract

In response to an identification of IT risks, driven by dependency on key knowledge bearers, we designed an approach to knowledge asset management based on an idea of knowledge quantification using a concept of replacement cost. The implementation case complementing our knowledge transfer initiatives, delivered substantial business value to the company in terms of a sustainable mitigation of the identified IT Risks. We have learned that for knowledge management to be successful, it must cover a broad spectrum of disciplines that are well aligned with the organizational architecture in place and designed for the approach accordingly. Analysis of the results, achieved from the application of the approach, indicate that, on average, knowledge transfer on its own accounts for less than 30% of changes in knowledge asset size and distribution. The major sources of influence to knowledge assets are employee turnover, evolution of the knowledge subject itself, and task assignment policy at the operational level.

1. Introduction

Firm specific knowledge becomes an increasingly important asset for companies running their businesses that depend on IT applications, such as banks, financial intermediaries, telecommunication, or insurance companies. This is due to the fact that it is only software engineers who have a detailed understanding of the specific business in its complexity, which is a crucial enabling driver when adopting the business in response to its changing environment. Lack of knowledge or having limited availability of knowledge bearers makes the response to this task slow, costly, risky, or even impossible.

This paper presents an approach to management of the above-mentioned knowledge assets. First, the respective theoretical foundation (later referred to as framework) is laid down, followed by a description of an implementation case promoting the use of the framework, including a cost/benefit analysis. A note on the alternative approaches and a graphical overview of the framework are also included (5, 6).

2. The framework

2.1 Background

Early in 2008, PostFinance went through numerous knowledge transfer initiatives that were conducted using a method for knowledge transfer developed in cooperation with the Information Management Research Group at the University of Zürich ([1]). The method proved to be a successful way of running knowledge transfer initiatives; however, it only partially covered knowledge management in a broad sense. Of importance was that it included only limited guidance supporting decision-making for investment opportunities in knowledge assets. It also failed to address embedding the knowledge asset management within the company’s organizational architecture ([2]).

These issues came to the surface as one of the PostFinance departments wound up a broad mid-term knowledge management taskforce. The task force intended to tackle the management challenge concerning dependencies on external contractors and the general availability of the key knowledge bearers. Recognizing these issues as the key to achieving sustainable results within the task force, PostFinance extended the knowledge transfer method ([1]) by designing the framework described in what follows.

2.2 Theoretical foundation

At the heart of the framework is the idea of replacement cost as the way of quantifying knowledge assets. The replacement cost within this context is defined as an estimate of the total effort needed for transferring the respective knowledge to a person of a given target skill profile. The target skill profile matches the skills that are available on the
labor market at the time of quantification. The effort is expressed in man months (MM) and is clearly dependent on the level of documentation of the knowledge and the individual knowledge bearers, in the sense of their willingness and ability to teach the trainees.

The chosen approach of knowledge asset quantification has the following key benefits:

- The quantities (effort) provide an excellent monetary input for decision making on the investments in knowledge transfer initiatives.
- The framework implements a self-correcting mechanism for the estimated quantities, since the data on effort spent in conducted knowledge transfers provide an excellent and unbiased source for adjustments of the estimates.

Quantification is being done at the level of the so-called knowledge unit. The knowledge unit is defined as the smallest portion of knowledge that needs to be identified in order to gain enough insights for knowledge asset management. For each knowledge unit, the respective knowledge bearers need to be identified, including the respective fraction they cover, as well as the fraction of knowledge that is being borne by at least two knowledge bearers (so-called knowledge redundancy level). Clearly, the higher the knowledge redundancy level, the better are the respective knowledge assets protected from employee turnover.

To be noted is that knowledge units can be quantified along various characteristics. The following set of characteristics has been adopted by PostFinance:

- knowledge residing in the heads of internal staff (referred to later as internal knowledge);
- knowledge residing solely in the heads of external contractors (referred to as external knowledge);
- knowledge residing solely within the respective subject itself, due to the past employee turnover (referred to as lost knowledge). For the PostFinance purpose, the subject was the software code and/or software specification artifacts.

As to the knowledge redundancy level, PostFinance has chosen to measure this variable only within the knowledge residing solely in the heads of internal staff, since the external contractors have no incentives to back each other up in this sense.

Each knowledge unit is assigned a criticality level. The number of levels, as well as their meaning, is a subject of tailoring for the particular business. Based on this information, the relative importance of the particular knowledge unit can be taken into account within the decision making process. For an example of knowledge unit attributes, please refer to Table 1.

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criticality level</td>
<td>A</td>
</tr>
<tr>
<td>Internal knowledge [MM]</td>
<td>4.5</td>
</tr>
<tr>
<td>External knowledge [MM]</td>
<td>1.0</td>
</tr>
<tr>
<td>Lost knowledge [MM]</td>
<td>0.5</td>
</tr>
<tr>
<td>Internal knowledge redundancy level [%]</td>
<td>40</td>
</tr>
<tr>
<td>Knowledge distribution:</td>
<td></td>
</tr>
<tr>
<td>Employee A [%]</td>
<td>90</td>
</tr>
<tr>
<td>Employee B [%]</td>
<td>50</td>
</tr>
<tr>
<td>External contractor X [%]</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 1 Knowledge unit attributes

The summary of all knowledge units under consideration, including the respective quantification and distribution among the knowledge bearers, is called a knowledge map. Knowledge units can, of course, be aggregated into higher level structures providing a different management overview and improved maintenance of the knowledge map. PostFinance decided to consolidate along software applications as the subject of knowledge in focus.

Noteworthy is that a knowledge map reflects – by design – only a point in time, and thus needs to be revisited and updated in a periodic manner. This concept borrows from the theory of financial accounting (balance sheet).

In order to provide a source of changes to the knowledge map between two subsequent updates, the framework defines a so-called knowledge flow log, which needs to be maintained. This concept is an analogy of a cash flow statement as used within financial accounting. The knowledge flow log records every knowledge flow that occurs along the respective period of time and along different sources of adjustments within the knowledge map. Thus, each record within the knowledge flow log is classified by the following events:

- knowledge transfer initiative,
- change in the complexity level of the underlying subject of knowledge,
- adjustment of the quantification estimate,
- employee turnover, and
- task assignment within the operations.

The above classification is a must in order to evaluate the results of the overall knowledge management effort in an unbiased way; e.g., the knowledge distribution can get enhanced over time due to the accidental changes to the underlying...
knowledge subject alone since knowledge subjects grow or decline in their complexity with time. Given that these changes would be attributed to a knowledge transfer, it would bias the achievements of the knowledge transfer dramatically.

Given the above explanations, it should be clear that the framework consists both of compulsory concepts and concepts that are left for tailoring by the target organization based on its specific needs. In what follows, the tailoring options are listed:

- target skill profile,
- scope of the knowledge under consideration,
- art of the knowledge under consideration (by default the framework suggests concentrating on firm specific knowledge only),
- aggregation levels of knowledge units,
- characteristics driving the knowledge units quantification,
- cost of manpower expressed in local currency in order to turn the effort into monetary terms,
- scope of the knowledge redundancy level, and
- definition of criticality levels (one of the knowledge unit attributes).

As pointed out in the above sections, the replacement cost approach allows for better decision making on the investments in knowledge transfer initiatives. Having covered the cornerstones of the framework, we are ready to manifest the way in which the investment decision making is supported. The analysis is based on the following key performance indicators (KPI’s) described below:

- external-Internal knowledge distribution ratio,
- magnitude of the knowledge lost,
- knowledge redundancy level, and
- knowledge asset exposure.

Of importance is that the above KPI’s partially depend on the particular framework tailoring decisions.

External-Internal knowledge distribution ratio is expressed in percent and derived as follows:

\[
(a) \quad \text{external knowledge} / (\text{internal knowledge} + \text{external knowledge})
\]

As implied by the formula (a), the higher the ratio, the higher the dependency of the respective organization on external contractors.

Magnitude of the knowledge lost can be directly derived from the knowledge map as a sum over the knowledge units of the particular aggregate, expressed in man months. This KPI is a key work force efficiency driver to the organization, since knowledge harvesting is known to be a very difficult and time consuming task. Thus, especially for critical knowledge units, this magnitude must be maintained at the lowest possible level. For the PostFinance the respective knowledge units are those that are inevitable for maintenance of the software supporting business critical functions. Thus, instant human reactions as part of software maintenance in response to eventual malfunctions are a must, and there is no time for any knowledge harvesting along the problem analysis.

Knowledge redundancy level is derived as an average over the knowledge redundancy levels of the knowledge units within the given aggregate, expressed as a percentage. This KPI is directly related to an employee turnover rate. The higher the turnover, the higher the redundancy level that is required. The reasoning is simple: If an employee leaves the organization and is the only knowledge bearer at that time (redundancy level of zero), the magnitude of the knowledge lost goes up, having negative impact, as explained above.

Knowledge asset exposure is the final of the presented KPI’s, and is driven by the knowledge redundancy level and employee turnover projection: Let

\[
(b) \quad \text{Expected portion of the lost knowledge} = \text{Current portion of the lost knowledge} + ((1 - \text{Knowledge redundancy level}) \times \text{expected employee turnover rate})
\]

then

\[
(c) \quad \text{Probability of total operational failure due to lost knowledge} = \text{Expected portion of the lost knowledge}
\]

then

\[
(d) \quad \text{Knowledge asset exposure} = \text{Cost of total operational failure} \times \text{Probability of total operational failure due to lost knowledge}
\]

The basic idea behind the KPI (d) is to assess the expected cost of total operational failure, attributed to the quality of the underlying knowledge assets. The quality is being defined as the probability that fixing operational failure will require lost knowledge, as calculated by (c). This probability is dependent on the expected portion of lost knowledge based on employee turnover projection, as calculated by (b). Putting (b) into words: Holding all the knowledge management influence factors and measures in addition to employee turnover fix, the expected portion of the lost knowledge will be the current portion, plus the knowledge that is currently not redundant, and thus expected to get lost due to employee turnover. As one might guess, the goal is to hold the knowledge asset exposure as low as
possible. There is a way of calculating the investment required to retain the knowledge and thus totally mitigate the knowledge asset exposure:

\[(e) \quad \text{Cost of knowledge asset exposure hedge} = \frac{\text{Expected portion of the lost knowledge}}{\text{Total knowledge}}\]

Putting (e) into words, in order to mitigate knowledge exposure, it is necessary to back up knowledge. Phrasing it differently, this is the yearly investment volume to be done in order to recover the lost knowledge and to avoid additional knowledge getting lost. Noted is that the employee turnover is typically quite different for internal staff than for external contractors, and that the lost knowledge has – by definition – a redundancy level of zero and projected employee turnover of 100%. This cost can also be referred to as a cost of knowledge asset exposure hedge. Finally, one needs to be aware of the fact that this is just an investment volume. The question of how to direct the investment is still left without an answer.

As one can see, the level of investment is a function of two variables: expected employee turnover and knowledge redundancy level. Thus, given there is a low projection on employee turnover, there is no special need to invest into the knowledge management aiming at the redundancy level, and vice versa. There is also a strong analogy to a concept of so-called foreign exchange exposure ([3]). The idea has been adopted from the FX market theory, by substituting:

- the expected foreign exchange rate by projected employee turnover, and
- hedging instruments by knowledge management initiative backed by the respective investment.

The presented KPI’s represent just a small set of possible indicators that can be applied. The particular KPI set is, in fact, very much dependent on the goals of the organization implementing the framework. Additional KPI’s might be:

- knowledge volume to the complexity of the subject (e.g., measured in function points in the case of software as a subject), and
- knowledge volume to the total cost of ownership of the subject.

Having covered the theoretical foundation of the framework, we are ready to show how it addresses the requirements as formulated by PostFinance:

- guidance for decision-making upon investment opportunities in knowledge assets, and
- guidance for embedding the knowledge asset management within the company’s organizational architecture.

Looking at the monetary character of the framework driven by the knowledge quantification approach followed and taking into account the set of KPI’s suggested, it should be clear that the framework provides an excellent investment decision means, especially when it comes down to talking in numbers, which is the language of executives holding the budgets. Another important means offered by the framework comes from the fact that the knowledge map provides a comprehensive view not only regarding the quantity of the knowledge, but also from the knowledge concentration and distribution. This is the way that the hot areas of the knowledge asset related business risk gets disclosed, thus making the knowledge management investment opportunities visible.

One of the major parts of the organization’s architecture is performance measurement, evaluation, and reward system ([2]). Such a system, as the naming suggests, heavily relies on measurable targets, following the “you can only manage what you can measure” principle. The framework supports this requirement by the knowledge quantification means as explained in the above sections. This allows integration of knowledge management within the organization’s architecture by providing line managers with measurable knowledge management targets accompanied by the respective incentives to actively manage their knowledge asset portfolio.

3. **Case**

The purpose of this section is to describe the first framework implementation case pointing to the key insights gained by practitioners.

3.1 **Environment**

The implementation case was conducted within a software engineering department, developing and maintaining banking software applications of high business criticality and strategic importance. The applications have evolved over more than 10 years and are supposed to fulfill a service level of 7x24, which requires instant reaction times in case of any software failure that might come up.

The respective software size and complexity expressed in terms of total yearly maintenance cost totals CHF 16m. The part corresponding to the man power from within the department totals CHF
2.260m (CHF 1.740m incurred by the internal staff and CHF 0.520m by external contractors).

At the beginning of the framework implementation, 32 fulltime software engineers and 8 external contractors from several different companies worked at the department, and the projected employee turnover rate equaled 8%.

It is clear that the main software maintenance cost drivers are:

- software size and complexity, and
- software maintenance crew in the sense of both level and availability of expertise.

As the software size and complexity go beyond the scope of the knowledge management discipline, the rest of the case focuses on the second of the cost drivers, and how the framework helped to tackle this challenge.

Prior to the framework implementation, the department was able to fulfill the committed service level, but relied heavily on willingness and availability of several key people. This situation was not satisfactory at all, since:

- Among the key people there were also contractors with premium remunerations.
- Any (even a temporary absence) of the key people were putting the company on serious business risk.
- It was not entirely clear how much and where to invest in order to tackle the above problems in a sustainable manner.

Also important is the fact that the department was headed by the framework inventor himself.

3.2 Process

This section describes the implementation case of the process the department went through, highlighting especially important insights gained. The framework as it is described (2.2) is the version that evolved from the insights gained during the case. The rationale of the framework’s genesis of the insights, including the respective consequences for the framework design, is described below.

The first phase was dedicated to managerial analysis of the problem and designing the initial version of the framework.

The second phase started by a kick-off meeting conducted by the head of the department. This meeting was attended by the whole department, including all subordinated line managers. The goals were to:

- establish the awareness for the situation that the department was in,
- show the urgency of the necessary respective changes,
- explain the way to get there in terms of actions to take, basically providing the overview on the framework, and
- ensure that the barriers, in fact cultural change, were being addressed, and that the incentives were right.

The kick-off was followed by a short training session for the line management and application lead developers held by the department head. The rest of the phase was dedicated to the initial setup of the knowledge map. We decided to adopt applications as the knowledge unit aggregate, and asked the respective application lead developers to list the inventory of the knowledge units of each. Early on, we had learned that there was a need to better specify the art of knowledge in scope, in order to avoid useless knowledge unit inventories. We did this by declaring the purpose of the knowledge: The knowledge in scope is the knowledge needed to maintain the software, in the sense of the root cause analysis in the case of malfunctions, as well as for implementing the corrective actions to fix the problems identified. The inventory of the knowledge units took just a short time to complete, since the software itself is a very well structured information asset.

The next step to take was the quantification of the knowledge units. This was the point where we struggled a lot. Due to the absence of a common understanding of the quantification method within the department, the quantification took us several iterations to complete. Even the line managers needed to re-visit the theoretical foundations of the framework several times in order to gain a proper understanding. Interestingly, once the concept was clear to all, it was no longer a problem to establish the estimates. This can be attributed to the fact that the software engineers were used to doing estimates on a regular basis as part of their daily business.

After the quantification was finished, the knowledge units were assigned the respective knowledge bearers as well as the knowledge redundancy level. For some reason, there was a need to explain the meaning of the knowledge redundancy level. For some reason, there was a need to explain the meaning of the knowledge redundancy level. For some reason, there was a need to explain the meaning of the knowledge redundancy level. In addition, it became clear that this attribute was only important/useful for internal knowledge, since there was no point in maintaining knowledge redundancy among the external contractors, as these were not supposed to back each other up (actually the opposite is the case, from the perspective of a single contractor).
Further on, the “portion of the knowledge attributed to the projection employee turnover” was assigned to each of the knowledge units. This attribute definitely turned out to be useless. The purpose was to estimate how much more expensive the respective knowledge transfer effort would be, given the employee turnover projection would hold (i.e., come to reality). Asking the employees to fill in the attribute at the level of the single knowledge unit was actually asking them for their subjective opinion on how likely their colleagues (peers) were going to leave the company at midterm. This was, of course, an unfair question, strongly violating the corporate culture.

The third phase aimed at analysis of the completed knowledge map. This was done by the line management, together with the department head. Not surprisingly, during this phase the key performance indicators played a major role. At that time we employed only the following KPI’s:

- lost knowledge,
- external-Internal knowledge distribution ratio, and
- knowledge redundancy level.

As can be seen, these KPI’s did not cover the full set of recommended KPI’s according to the current version of the framework (2.2). We derived the action plan in terms of an investment project definition. The investment opportunity relied on the results of the knowledge map analysis: dependency on external contractors and their premium remuneration as well as the risk faced due to the magnitude of the lost knowledge. The project was accepted by the respective committee (chaired by the CIO).

The department head appointed one of the line managers from within the department as project leader. Learning by teaching was used as the knowledge transfer method. The method relies on the principle that the trainees explain what they have learned from their peers, including the knowledge bearer. This approach turned out to be very successful. However, the project was not put under tight control. This became a source of pain since the daily business always came first, and so the project did not progress at the desired pace. In response, the department head took the project leadership away from the line manager and took over the position. From there on, things changed, since the agency problem (alignment of incentives along a different hierarchy levels as described in [2]) that stemmed from the former setup was eliminated.

An important insight that led us to making the knowledge transfer visible was introducing the following policy: Every activity focusing on knowledge transfer must be conducted as a project with a clear time line, goals, and budget. In order to achieve this and make the knowledge initiatives visible, the new reward system provided incentives for employees who confessed their knowledge gaps, instead of acquiring the missing knowledge on their own with no management visibility and without a chance to be rewarded for the effort.

As the knowledge transfer advanced, it was a challenge to stay focused on the goals. We experienced that the employees involved did not recognize the importance of the knowledge map, in the sense of how seriously it might influence their carriers. In response, the knowledge map became a part of the department’s performance measurement, evaluation and reward system. Quantified knowledge units allowed the department head, as well as the line managers, to state measurable targets and track the respective progress.

With the completion of the first part of the knowledge transfer project, it was time for a cost/benefit analysis. We followed a simple plan: updating the knowledge map and assessing the progress based on the KPI’s. This intention turned out to be rather short sighted. In order to evaluate the project achievements properly, there was a need to look at the broader picture. The key point was the insight that the project had only partial influence on the knowledge map.

In reality, there are many more sources of influence to take into account. The first and most obvious one is the knowledge transfer initiative itself. However, there is much more going on within the daily business shaping the quantity and distribution of the knowledge assets in place. An employee leaving the organization is another obvious source of influence. Less obvious is a task assignment within daily business, driven by temporary absences or other reasons the line management might have.

For clarification, we can imagine that there is a project that re-implements a major part of software functionality. We can suppose that an employee that would otherwise have been involved in the project, would enjoy vacations during the project and then be assigned another task. This employee would miss out on the opportunity to acquire the respective knowledge on the job, and would consequently not accumulate as much knowledge as before.

The next source of influence is a little more subtle, but still of major importance to track and to control, as experience suggests. It is the size and the complexity of the subject of the knowledge. In this case, the subject is software applications. The reasoning is quite intuitive: It is much harder to
understand and retain knowledge about the software application of a complex architecture, and/or fussy undocumented source code, than about a well-designed and well documented software application. It is also easier to grasp a small application than a huge one. This is where the software architecture and documentation efforts (triggered by the knowledge management discipline) come in.

As the case showed, the knowledge transfer alone drives, on average, roughly only 30% of the total changes of knowledge map. This means that the task assignment, employee turnover, as well as the knowledge subject itself account for a major part of the success (or failure) of knowledge management initiatives. Last but not least, the knowledge map can evolve through adjustments of the estimates done along the quantification of the knowledge units, but again, these must be perceived separately in order to take the respective bias out of the analysis.

As an instrument to track the above mentioned sources of influence, we designed the so-called “knowledge flow log.” Experience shows that a knowledge flow log needs to be maintained on a periodic basis. In our case, the periods were determined by the milestones of major software development projects shaping the subject of the knowledge – the software.

The evaluation of the knowledge management achievements had been an analysis of historical data thus far. We felt like someone driving a car and watching the road behind in the rear view mirror. The missing part was clearly the projection of future evolvements of the knowledge assets in scope. Recognizing an employee turnover rate projection to be a seemingly reliable indicator shaping the future state of the knowledge map, we derived a way of measuring the expected volume of investment needed to retain the knowledge assets exposed to employee turnover and the respective knowledge drain. For the calculation formula, refer to (e). With this formula, it is possible for the department to estimate the budget for knowledge management upfront in a well-defined way, using a projected employee turnover rate as input.

### 3.3 Knowledge map

This section provides an overview of the results achieved within the department since the framework was put in place. This is done by means of a comparative view of the knowledge map. Figure 1 shows the evolution of the knowledge map in terms of the three key performance indicators.

![Figure 1 Comparative view of knowledge map KPI's](image_url)
As can be seen from Figure 2, the knowledge transfer contributes less than half to the overall change of External-Internal knowledge distribution ratio. According to the respective knowledge flow log, the other half is attributed to the operational task assignment policy at the employee level that is well aligned with the knowledge management goals. The analysis of the knowledge redundancy level discloses a strange picture at first sight: Knowledge transfer took care of a considerable increase of the knowledge redundancy level; however, the level increased in much lower magnitude in total. Again, after a closer look at the knowledge flow log, the answer is obvious: At the same time that the knowledge transfer was conducted, employee turnover and a rather unlucky task assignment took place leading to the reduction of the knowledge redundancy level that reduced the achievements of the knowledge transfer at the bottom line. Figure 3 shows a very similar picture, but this time addressing a lost knowledge. Again, the knowledge transfer made a great contribution, which was completely offset by the employee turnover that happened in the meantime.

4. Cost/Benefit analysis

This section provides an overview of the total cost of implementation of the framework as well as the related benefits. All financials presented in this section are historical data collected from the implementation project (3). Thus, given that the framework will be implemented in a different scale from the one discussed in the case, the cost as well as benefits must be adjusted accordingly. Table 2 provides the summary of the costs (in thousands of Swiss Francs) for the phases that the knowledge management went through.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cost [kCHF]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial training</td>
<td>7</td>
</tr>
<tr>
<td>Initial setup of knowledge map</td>
<td>37</td>
</tr>
<tr>
<td>Knowledge transfer</td>
<td>581</td>
</tr>
<tr>
<td>Update of knowledge map</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>638</td>
</tr>
</tbody>
</table>

Table 2 Cost overview

Table 3 summarizes the benefits gained from the knowledge management activities.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Saving [kCHF]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct yearly savings attributed to the knowledge transfer</td>
<td>47</td>
</tr>
<tr>
<td>Indirect yearly savings attributed to the knowledge transfer</td>
<td>695</td>
</tr>
<tr>
<td>Subtotal</td>
<td>742</td>
</tr>
<tr>
<td>Total indirect yearly savings (free of estimate bias)</td>
<td>-824</td>
</tr>
</tbody>
</table>

Table 3 Benefits overview

It is noteworthy that the direct savings come from the difference in pay between internal staff and external contractors. If the internal staff acquires the knowledge needed to cover the tasks done by external contractors, one can replace the contractors by internal staff gaining benefit from lower pay required for the same effort.

The meaning of an indirect savings is closely related to the concept of knowledge asset exposure (d). The saving is the difference between the cost of knowledge asset exposure hedge (e) that is prior to, and after, the period under consideration. The total

![Figure 2 KPI's contribution I](image1.png)

![Figure 3 KPI's contribution II](image2.png)
indirect savings attributed to the knowledge transfer do not account for the correction of estimates, and thus are without bias.

Analyzing the benefits against the costs, we can make the following statements:

- Round CHF 50k totaled the initial cost of introducing the framework within the department.
- The reoccurring maintenance cost of knowledge map totals CHF 13k, which is a minor amount compared to the benefits delivered (Knowledge map is a prerequisite for well-designed knowledge transfer).
- Summing up the direct and indirect yearly savings, the knowledge transfer achieved a return on investment of 1 year.
- Savings attributed to the knowledge transfer are very much different from the total savings. This difference is striking: yearly savings of CHF 742k compared to yearly additional cost (expressed as a negative saving) of CHF 824k!

5. Framework Overview

Figure 4 offers an abstract conceptual overview of the framework – change of the knowledge map over a single time period documented within the knowledge flow log. Each change within the knowledge flow log (e.g. change of amount of the internal knowledge) is different for each of the five drivers, depicted by arrows. For example, knowledge transfer initiative might have increased the redundancy level, offsetting the respective reduction of the same due to the task assignment within the operations. Thus, the absolute change of the knowledge map attributes is derived as a sum of the respective contributions along all the arrows.

6. Other approaches

After having shown how the framework works, we show how it relates to the family of major knowledge asset measurement approaches published.

First, the measurement employed within the framework is designed for an organization’s continuous performance improvement (internal perspective), as opposed to market valuation of the knowledge assets ([5]). Second, the framework, even though a monetary measurement approach does not employ book values according to the financial accounting standards, it precisely defines its own concept of a replacement cost, including the respective guidelines.

These major distinctions reduce the purpose of the framework down to risk management, but at the same time, eliminate known conceptual problems coming from other approaches.

In fact, Skandia navigator, EVA™, Tobin’s q, IC-Index approach, or IC Audit model suffer from well-founded criticism concerning the lack of proper quantification of replacement cost, replacement value or book value of knowledge-based assets, as well as absence of guidance and strong company specific nature disqualifying it for benchmarking purposes ([4]).

Summing up, the framework is a single purpose and therefore offers a better trade-off between complexity, accuracy and ease. Due to the concepts employed, it also leaves only very limited space for criticism, as it has been passed on alternative approaches.
7. Conclusion

The framework presented in this document has been designed to bridge the gap between knowledge transfer and a broader organizational context, driven by a simple but urgent business need. As the knowledge management achievements of the department prove, the framework served its purpose very well. The key success factors can be attributed to the insights that evolved along the genesis of the framework:

- As any other people business, this is again the subject of cultural change through which the organization needs to make its way.
- Knowledge management, in order to deliver a sustainable business value, must be applied across all managerial levels (strategic, tactical, as well as operational) well aligned with the organizational architecture. Specifically, it must become an integrated part of the respective performance measurement, evaluation and reward system to get the required recognition by executives as well as employees at the bottom line. This is where measurable targets supported by the framework at its core come in handy.
- Knowledge transfer is not the right approach to improve on the External-Internal knowledge distribution ratio, unless combined with appropriate task assignment policy within the operations.
- Knowledge transfer is definitely the right approach to improve the knowledge redundancy level.
- Utilization of the knowledge flow log (or a similar mean) is a must, in order make well founded decisions upon knowledge management investment projects. Otherwise, being unable to separate the effect of the various drivers of knowledge asset evolution leaves the decision making with biased and likely misleading information.
- As the case shows, the benefits exceed the cost by far, which is a strong proof of accountability of the framework if introduced in a similar business environment.

Summing up, the case presented in this paper is an example of a successful approach to management of knowledge assets. It can be assumed that the framework is going to evolve further, leveraging the best practice identified during its use by practitioners from within or outside the organization. This approach might be one of the last missing pieces that contribute to a better recognition of knowledge management in terms of its impact on business value.

8. References