Learning an organization
new working methods:
The system based contract
control method at Rijkswaterstaat
as example

Graduation thesis
By Sam de Bree
Learning an organization new working methods: The system based contract control method at Rijkswaterstaat as example
Project details

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In a coffee chat during first days of research, an anonymous employee mentioned the following: “Oh no more SCB terms; isn’t that old fashioned by now? At least we don’t hear much about it anymore...”. This expression of thoughts might be an example how employees of Rijkswaterstaat are coping with organizational changes. Nevertheless, during the research period for this thesis, others were full enthusiasm of the new role and working methods Rijkswaterstaat adopted. This encouraged me to get a grip on the (for an outsider) complicated and complex structure of the organization and the practical environment of the research topic.

Although, this thesis contains critique on the process of the implementation of the SCB method, the theoretical view this thesis applies might oversimplify the organizations ‘struggle’ to adapt to its changing environment. Performing this research proved to me that reality is more complicated and complex as theory suggests. In fact, Rijkswaterstaat is performing a difficult job in adapting almost every task the last decades. While at the same time, there is constant pressure to perform it public tasks. In that context, the organizational changes the organization is subjected to are similar to the maintenance of public works; the road remains accessible during the construction of extra lanes. It might be true that Rijkswaterstaat in retro perspective and in comparison with other organizations is quite successful in adapting its organizational behavior.

This thesis includes an abstract and a Dutch executive summary. Furthermore, the appendix includes a scientific article that presents the thesis in a format suitable for publication in a journal.

This research is a graduation project for the Master Systems Engineering, Policy Analysis and Management (SEPAM) program at the Delft University of Technology. During this study, I developed knowledge and skills that helped me to execute the research for and write this thesis.

Furthermore, I would like to thank all Rijkswaterstaat employees involved in this research (from the Information and Administration section BBD and the Contract managers from the cases). Their support, information and experience with the practice of the research topic were essential in finishing this thesis.

Last, special thanks for my brother, Rob who was willing to provide the graphic design for this thesis.

Delft, April 2010

Sam de Bree
Abstract

This thesis reflects on how Rijkswaterstaat is learning the system based contract control (SCB) method, a new working method. The principal for the research of this thesis is Rijkswaterstaat; this is the Dutch public organization responsible for construction and maintenance of Public Works on the national highways and waterways. The new working method describes how project teams at Rijkswaterstaat control and ensures the quality of the works constructed by contractors. This method is conflicting with former methods used in the organization. Whereas in old methods Rijkswaterstaat used its own quality management system to ensure the quality of the work of their contractors, the fundamental premise of the new method is that by testing the quality management system of the contractor the quality of the process that constructs the product and the product itself can be controlled. Therefore, this method is called ‘system based contract control method’ (in Dutch; ‘systeem gerichte contractbeheersing’ (SCB)). The method prescribes testing of the system during the contract period based on the risks of a project that could affect Rijkswaterstaat’s interests. These risks also result in testing the process and products of the contractor.

The implementation of the SCB method is not finished, and perceived not (yet) successful by the Senior Management of Rijkswaterstaat. Multiple developments influence the application of the SCB method in the project at the regional services of Rijkswaterstaat. The problem addressed in this thesis is that the effect of learning that supports the implementation of the method is not optimal. The main question to this research is:

How is Rijkswaterstaat learning the system based contract control method and how could this learning be improved?

This thesis describes a structured method that helps to identify improvements for learning the system based contracting method at Rijkswaterstaat. The presented theoretical model enables analysis in the learning in an organization. Three aspects define learning in an organization. First, the individual in the organization that take actions should detect an error in the application’s success of the method. Second, this error should be corrected and by that, it should improve the success of the method in projects. Third, the individuals in the organization should share the knowledge within the organization on these actions. This theoretical learning enables testing how Rijkswaterstaat states it is learning a new method to ensure the quality in their contracts. Furthermore, this thesis compares this expected learning with the actual learning. Case studies on four projects at the regional department South Holland of Rijkswaterstaat represent this actual learning. Table a.1 summarizes the cases and their characteristics.
There are differences between the three views on learning. The existence of differences itself does not prevent learning in the organization. These differences are evaluated on the criterion of preventing optimal learning based on the theoretical learning. The aspects in the differences that prevent learning are called deficiencies.

This thesis provides the following deficiencies in learning on the SCB method:

1. **No description of the method’s success**

There is no description on the successfulness of the method in the expected learning. This is necessary to enable detection of errors within projects. Theoretical learning states that an error can only be detected when aspired achievement exists. The dynamics of the method and the resistance to change within the organization cause this deficiency.

2. **No incentive for error correction**

There is no description on the successfulness of the method in the expected learning. This is necessary to enable detection of errors within projects. Theoretical learning states that an error can only be detected when aspired achievement exists. The dynamics of the method and the resistance to change within the organization cause this deficiency.

3. **Misplaced empowerment and lack of error openness**

In the organization, the detection of errors within the project team that possesses the information to take actions is subject to a conflict of interests that cause misplacement of the empowerment to detect the errors. The short-term interest to finalize the project prevails, most of the times, over the long-term interest of improving the internal quality of the project management by...

<table>
<thead>
<tr>
<th>Case</th>
<th>Project phase (as in November 2009)</th>
<th>Type of (main) works in project</th>
<th>Magnitude</th>
<th>Interviewed RWS employee</th>
</tr>
</thead>
<tbody>
<tr>
<td>A13/A16</td>
<td>Planning phase</td>
<td>Study phase of new highway connection</td>
<td>Costs unknown, construction of approx 10 km highway.</td>
<td>Contract manager and manager project management</td>
</tr>
<tr>
<td>Dordtse Biesbosch</td>
<td>Preparation of execution</td>
<td>Decontamination and restructuring of water system</td>
<td>32 million euro’s, 140 ha soil</td>
<td>Contract manager and manager project management</td>
</tr>
<tr>
<td>A12 The Hague-Gouda</td>
<td>Execution</td>
<td>Construction peak highway lanes</td>
<td>150 million euro’s, involves more than 15 km highway</td>
<td>Contract manager, test planner and manager project management</td>
</tr>
<tr>
<td>Hollandse Ijssel</td>
<td>Execution</td>
<td>Decontamination and restructuring river</td>
<td>49 million euro’s, 20 km river and objects</td>
<td>Contract manager and manager project management</td>
</tr>
</tbody>
</table>
the organization. This is the client’s decision, but the emphasis on the short-term interest also decreases the error openness within the projects.

4. Limited knowledge conversions

There is a deficiency on the knowledge sharing aspect in the difference between the expected and actual learning. Knowledge on actions that improve the method’s success is either tacit or explicit and can be shared among individuals in or between projects. The interaction between employees from different projects is limited. Furthermore, the capacity for sharing knowledge is limited within the projects.

The measures this thesis provides are capable of minimizing the deficiencies in the differences between the three views on learning, by that they improve the learning on the SCB method at Rijkswaterstaat. First measure is to start the process of defining the success of the method; this should enable the identification of the method’s success in a specific project and enables error detection on this success. Second measure is more attention from the client for the product and process of projects at Rijkswaterstaat. This will increase the attention to the long-term interest of both the client and Rijkswaterstaat in improving the production process of the projects. The third measure is to test the internal quality more often by the project teams themselves; this will create the need for the projects to improve their working processes, which also include the application of the SCB method. Fourth measure is building a knowledge management system that connects project team members with a demand for knowledge with owners of this knowledge in different project teams throughout the organization.

This thesis concludes that there is no learning on the SCB method that improves the method’s success at Rijkswaterstaat. The lack of error detection on the success of the method causes the absence of learning on the method. There is learning on the instruments of the method, but most of the time the emphasis of the project teams on the quality of the works in the projects prevents learning the method. Furthermore, there is no expectation of the management on the project teams to improve the success of the method.

This research shows that theories from different scientific disciplines are capable to identify organizational behavior in the implementation of a new working method. The SCB method is an example of a hierarchical based implementation of working methods. Nevertheless, learning on the application of the method is essential for the success of meeting the methods objectives. The analysis of the SCB method at Rijkswaterstaat showed that this process is difficult and needs additional measures, but success is also depended on the attention and effort the management gives for the implementation. It is critical the organization describes the process of implementing the method and providing the criteria to determine the success of the method and its implementation. This enables improving and learning the new method in the projects. This result in learning the method, but also enables the evaluation and appropriateness of the method in an organization based on empirical evidence.
Aanleiding
Deze afstudeerscriptie behandelt het leren van de systeem gerichte contractbeheersing (kortweg SCB) methode door Rijkswaterstaat. Rijkswaterstaat is als agentschap de uitvoerende organisatie van het Ministerie van Verkeer en Waterstaat. Haar taak is het beheren en onderhouden van de nationale weg- en waterwerken. In de laatste decennia is er kritiek ontstaan op de manier waarop deze taken worden vervuld. Mede daarom zijn de werkwijzen en de rol die Rijkswaterstaat hanteert gewijzigd. ‘De markt, tenzij…’ is de standaard in het uitvoeren van de projecten die door het ministerie worden aangedragen. Er is veranderde behoefte naar kennis en vaardigheden binnen de uitvoering van projecten; was in de traditionele situatie vooral de technisch inhoudelijke kennis cruciaal, nu ligt de nadruk op de procesmatige en contractuele kennis van werknemers.

De nieuwe werkwijzen en rolverdelingen zijn in de loop van de jaren ingevoerd binnen de verschillende onderdelen van de organisatie. Het effect van deze veranderingen is onmiskenbaar aanwezig in de organisatie. Echter, het succes van deze verschillende implementaties en de mate waarin de organisatie de methoden tijdens het gebruik ervan verbetert is niet duidelijk. De implementatie van nieuwe werkmethoden en het succes van de methoden kan worden verbeterd door een duidelijk beeld van de processen binnen de organisatie die het leren van de methoden beïnvloeden. Het onderzoek voor deze scriptie focust zich op één specifieke werkmethode binnen de organisatie zodat er inzicht in de processen van de organisatie is verkregen en specifieke verbeteringen geïdentificeerd zijn. De bestudering van het leren van de SCB methode is een voorbeeld waarvan de bevindingen ook bij andere implementaties van werkmethoden kunnen worden toegepast.

Onderzoeksdoel
Deze scriptie onderzoekt de systeem gerichte contractbeheersing. Doordat Rijkswaterstaat in haar projecten het merendeel van het fysische werk uitbesteedt aan opdrachtnemers, is het van belang dat er zekerheid wordt verkregen dat men ook de contracten uitvoert volgens de gevraagde specificaties. De systeemgerichte contractbeheersing schrijft voor dat projectteams van Rijkswaterstaat het management kwaliteitssysteem van de opdrachtnemer controleert met behulp van toetsen. Dat wordt gecontroleerd door het systeem, het proces en het product te toetsen. De gedachte is dat het systeem van de opdrachtnemer bepalend is voor de werkprocessen die het product voortbrengen. Door het toetsen van het systeem kan al vroeg in het contract worden bepaald of de processen en het product naar behoren zal worden gerealiseerd. Daarnaast worden er in theorie alleen toetsen uitgevoerd op aspecten van het systeem waarvan het projectteam projectrisico’s voor Rijkswaterstaat te hoog waardeert. Deze methode heeft tot doel, met minder inspanning voor het controleren van het contract, betere project resultaten te realiseren. Het succes van de methode wordt niet onderzocht in deze scriptie, wel is de manier waarop de organisatie dit succes probeert te beïnvloeden onderzocht. Het opspreken van fouten in het bereiken van dit succes, samen met het corrigeren en delen van kennis over deze corrigerende acties wordt leren genoemd in deze scriptie.
De hoofdvraag die centraal staat is:

_Hoe leert Rijkswaterstaat de systeem gerichte contractbeheersing methode en hoe kan dit leren worden verbeterd?_
onderzoekresultaten worden verwacht. Deze projecten hanteren verschillende invullingen van de SCB methode.

**Table S.1: Casus projecten**

<table>
<thead>
<tr>
<th>Casus project</th>
<th>Project fase (november 2009)</th>
<th>Korte omschrijving werkzaamheden</th>
<th>Omvang project</th>
</tr>
</thead>
<tbody>
<tr>
<td>A13/A16</td>
<td>Planstudie</td>
<td>Planstudie naar nieuw aan te leggen snelweg verbinding van A13 en A16</td>
<td>Kosten nog onbekend, maar omvat de aanleg van grofweg 10 km snelweg</td>
</tr>
<tr>
<td>Dordtse Biesbosch</td>
<td>Voorbereiding van uitvoering</td>
<td>Sanering en herstructurering van watersysteem</td>
<td>32 miljoen euro, 140 ha grond</td>
</tr>
<tr>
<td>A12 The Hague-Gouda</td>
<td>Uitvoering</td>
<td>Aanleg spitsstroken, aanpassing van kunstwerken en aanvoerwegen</td>
<td>150 miljoen euro, Omvat meer dan 15 km snelweg</td>
</tr>
<tr>
<td>Hollandse Ijssel</td>
<td>Uitvoering</td>
<td>Sanering en herstructurering van zwaar vervuilde rivier</td>
<td>49 miljoen euro, 20 km rivier en aanliggende objecten</td>
</tr>
</tbody>
</table>

**Resultaten**

De afwijkingen in de verschillen tussen de beschrijvingen van leren zijn samengevat in Table S.2.

**Table S.2: Overzicht afwijkingen**

<table>
<thead>
<tr>
<th>Afwijking in het verschil tussen</th>
<th>Aspect 1: fout detectie</th>
<th>Aspect 2: fout correctie</th>
<th>Aspect 3: kennis deling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theoretisch en verwachte leren</td>
<td>Geen beschrijving van succes</td>
<td>Geen verwachting om fouten te herstellen</td>
<td>-</td>
</tr>
<tr>
<td>Verwachte en daadwerkelijke leren</td>
<td>Openheid voor fouten is laag. Kennis/macht om deze fouten te herstellen wordt niet bijeengebracht</td>
<td>-</td>
<td>Beperkte kennis deling</td>
</tr>
</tbody>
</table>

De eerste afwijking bevindt zich in het verschil tussen de beschrijving van het theoretische leren en de management verwachting van het leren. In de verwachting ontbreekt een omschrijving van het succes van de SCB methode. Deze beschrijving is nodig voor projectteams om de daadwerkelijke resultaten van de projecten aan het gewenste succes te kunnen spiegelen. Hierdoor wordt het voor projectteams mogelijk om fouten te herkennen.

Het ontbreken van een verwachting van het succes van de methode kan worden verklaard door tegenstand in de organisatie om de nieuwe werkwijze te accepteren. De wens om de methode te implementeren is opgedragen door het bestuur van Rijkswaterstaat. Er zijn echter mensen en organisatieonderdelen die het niet eens zijn met de methode om meer afstand tot de aannemer te behouden tijdens de uitvoering. De methode is tegenstrijdig met traditionele
methoden om contracten te beheren, waar Rijkswaterstaat zelf de kwaliteitscontrole op werken uitvoerde. De opgedragen wens om de methode uit te voeren en de praktische vertaling van de instructies van het management in de verschillende onderdelen van de organisatie kan daarom tegenstrijdig zijn. Daarnaast is de methode en de daadwerkelijke toepassing in ontwikkeling en is er nog geen inzicht in de optimale manier om de methode toe te passen. Hierdoor kan er geen omschrijving van het verwachte succes van de methode worden gegeven, dit maakt het moeilijk om fouten in dit succes waar te nemen binnen de projecten.

De tweede afwijking bevindt zich ook in het verschil tussen het theoretische en daadwerkelijke leren. Deze afwijking heeft betrekking op het herstellen van fouten. Er wordt niet expliciet van projectteams verwacht dat zij fouten in het succes van de methode in hun projecten verbeteren. Projectteams hebben geen belang bij het verbeteren van het succes van de methode. Immers, de gevolgen van het verbeteren van de toepassing van de methode slaan neer op de opdrachtgever van hun project. Het efficiënter en effectiever beheren van contracten zorgt ervoor dat er meer zekerheid wordt verkregen over de kwaliteit van de dienst van de aannemer en dat er minder arbeidscapaciteit van het projectteam voor de beheersing nodig is. Dit beïnvloedt de scope en het budget dat door de opdrachtgever aan het projectteam wordt verstrekt. De casus geven aan dat de opdrachtgevers weinig aandacht hebben voor het productieproces van projectteams en veelal sturen op de productie van de projecten op de korte termijn.

De derde afwijking bevindt zich in het verschil tussen de verwachting en het daadwerkelijke leren van de methode. Fouten in het bereiken van succes worden niet herkend doordat de mogelijkheid om het succes van de methode te verbeteren en de informatie daarvoor niet bij elkaar wordt gebracht. Daarnaast is er in veel projecten relatief weinig openheid voor het erkennen van fouten.

Deze afwijking wordt veroorzaakt doordat de tegenstand in de organisatie om te veranderen en de methode toe te passen. Daarnaast bevindt ook in dit verschil een belangentegenstelling, de verbetering van de interne kwaliteit van het productieproces is veelal in tegenspraak met de voortgang van het project. Hierdoor worden fouten binnen projecten niet herkend of het bestaan ervan niet geaccepteerd. Hierdoor is het moeilijk om fouten te corrigeren en hiervan te leren als organisatie. In de casus is dit terug te vinden in de overheersing van de technische risico’s tijdens de uitvoering ten opzichte van de risico’s in het interne proces.

De vierde afwijking bevindt zich in het verschil tussen het verwachte en daadwerkelijke leren. De kennis die in projecten wordt opgedaan met het verbeteren van het succes van de SCB methode wordt niet voldoende gedeeld met anderen. Dit wordt veroorzaakt doordat de kennis niet expliciet wordt gedocumenteerd en niet toegankelijk is binnen de organisatie. Daarnaast is interactie tussen medewerkers van verschillende projecten beperkt.

Conclusies en aanbevelingen
De geïdentificeerde afwijkingen illustreren dat het leren van de SCB methode niet optimaal is. De vergelijking tussen het theoretisch en verwachte leren geeft aan dat de invoering van de methode hiërarchisch van aard is. Daarnaast zijn de instrumenten die worden verwacht niet voldoende om het succes van de methode in de projecten te verbeteren. Deze scriptie maakt een tweede vergelijking tussen de verwachting en het daadwerkelijke leren binnen de projecten. Dit illustreert dat door het ontbreken van een duidelijke verwachte verbetering van het gebruik van de methode in de projecten, er weinig als organisatie geleerd wordt met betrekking tot het succes van de SCB methode.
Leren zoals in deze scriptie is omschreven is het opdoen van kennis met het herkennen en
herstellen van fouten in succes van de methode binnen projecten. Daarnaast leert de organisatie
pas als deze kennis in de organisatie wordt gedeeld. Deze vorm van leren combineert het
implementeren en continu verbeteren van de SCB methode. Door dit leren in de organisatie
te verbeteren wordt het succes van de organisatie vergroot. Daarbij hoort in eerste instantie
het implementeren van de SCB methode als omschreven door het management, maar ook het
continu aanpassen van deze verwachting en het heroverwegen van de methode.

Het leren van de SCB methode bij Rijkswaterstaat kan worden verbeterd door het opheffen van
de in deze scriptie geïdentificeerde afwijkingen. Kern daarbij is dat de nadruk wordt gelegd op
het leren door de projectteams en de processen die daarvoor vanuit het management nodig
zijn. Het als organisatie toepassen en implementeren van een methode vraagt naast een
omschrijving van de methode, ook aandacht om de managementverwachting en de acties in
de projecten dichter bij elkaar te brengen. Deze scriptie levert vier aanbevelingen die het leren
van de SCB methode kunnen verbeteren.

De eerste aanbeveling is om het succes van de methode duidelijker te omschrijven in de
managementverwachting. Nu is de verwachting dat de SCB methode wordt toegepast indien
in een project wordt gewerkt met een juiste mix van toetsen, de aanwezigheid van een
recent risico-overzicht en de aanwezigheid van een koppeling tussen deze bestanden. De
aanwezigheid van deze voorwaarden is niet vertaald naar het succes van de methode in een
project. Kern van de methode is dat er tijdens de uitvoering zekerheid over de uitvoering van
het contract zoals gevraagd worden verkregen. Dit gebeurt door het zoveel mogelijk toetsen op
systeenniveau van het kwaliteitsysteem van de opdrachtnemer. Het doel is daarbij om dit
zo efficiënt en effectief mogelijk te doen. Daarvoor is het noodzakelijk dat het projectteam
zich bewust is van twee rollen in de relatie met de opdrachtnemer; enerzijds controleert
het contract beheersteam dat het gevraagde wordt geleverd, anderzijds zal zij tijdens de
uitvoering van het contract deze verwachting aanpassen. De SCB methode is slechts bedoeld
voor de eerste rol.

De tweede aanbeveling is om in de relatie tussen de opdrachtgever en de projectteams meer
aandacht te schenken aan het productieproces van de projectteams. De huidige aansturing
van projectteams gebeurt veelal op inhoudelijke eisen met betrekking tot de productie van de
werken binnen het project. Het gebrek aan aandacht voor het proces binnen het projectteam
zorgt ervoor dat fouten in het succes van de SCB methode niet worden herkend en verbeterd.

De derde aanbeveling is om de interne kwaliteit van projectteams systematisch te testen. De
huidige mogelijkheden hiervoor worden maar sporadisch gebruikt. Om continu te verbeteren
is het voor projectteams van belang om de interne kwaliteit regelmatig te testen. Dit kan
gedaan worden door reguliere evaluaties door projectmanagers en aan de hand van audits
door de managers projectbeheersing. Het vastleggen van de bevindingen van deze processen
verbeter het leren door projectteams en er kan kennis over deze acties worden gedeeld in de
organisatie.

De vierde aanbeveling is om de kennis die wordt opgedaan met het verbeteren van het succes
van de methode in de organisatie te delen. Deels kan de kennis worden overgedragen doordat
het expliciet wordt gemaakt, zoals door interne toetsen op kwaliteit. Anderzijds is een deel
van de kennis zo specifiek en situatie afhankelijk dat deze niet kan worden opgeslagen in
een document. De manier om de interactie tussen werknemers van verschillende projecten
te verbeteren is het opzetten van een organisatiebreed kennis managementsysteem. In dit
systeem kan de expliciete kennis worden opgeslagen en toegankelijk gemaakt voor anderen
binnen de organisatie. Daarnaast kunnen de kennisgebieden, werkzame projecten en

Management samenvatting (Dutch)
ervaringen van individuele werknemers worden opgeslagen, zodat het mogelijk is om de impliciete kennis persoonlijk te delen. Dit is complimenterend aan de bestaande (dienst specifieke en landelijke) kenniskringen, afdeling overleggen en afdelingsclusters.

Deze aanbevelingen zijn te vertalen in een aantal concrete verbeterpunten:

- Meer communicatie en verduidelijking van het mogelijk succes van de methode in een project.
- Sturing van het project door opdrachtgevers op productie en werkwijze van projectteams.
- Meer systematische interne kwaliteitscontroles op het functioneren van projectteams door managers projectbeheersing.
- Uitvoering van evaluaties op functioneren van projectteams door project managers en vertaling hiervan naar expliciete kennis die in organisatie wordt opgeslagen.
- Het ontsluiten van kennis die het succes van de methode in projecten kan verbeteren in zowel expliciete als impliciete vorm. Dit kan worden gedaan door het opzetten van een organisatie breed kennis informatiesysteem.

Daarmee beantwoordt deze scriptie de vraag hoe van de SCB methode bij Rijkswaterstaat wordt geleerd en wat hieraan verbeterd kan worden. De algemene toon kan wellicht negatief overkomen maar heeft slechts tot doel om tot kritische inzichten te komen die de leerpprocessen in de organisatie kunnen verbeteren. Rijkswaterstaat vraagt van haar opdrachtnemers om een kwaliteit managementsysteem te hanteren dat de kwaliteit van de producten waarborgt. Echter, het kwaliteit managementsysteem dat het productieproces van Rijkswaterstaat’s projectteams bewaakt is niet optimaal. Het leren van de SCB methode is hier slechts een onderdeel van, maar de gevonden verklaringen en aanbevelingen kunnen ook worden toegepast op andere ontwikkelingen binnen de organisatie, zoals de invoering van Economisch Meest Voordelige Inschrijving (EMVI) en dergelijke.
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Introduction
1.1 Problem exploration

Rijkswaterstaat is an executive organization of the Ministry of Transport, Public Works and Water Management (VenW) of the Dutch national government. There is political and social pressure on the organization to develop itself. This pressure is caused by: social issues (increased mobility), the belief Rijkswaterstaat is too big, expensive, belief in unnecessary public involvement (from politics), pressure from the ‘market’ for a more defined role, and the Court of Audit of the ministry demanding more efficient operational management (Rijkswaterstaat, 2009e). Furthermore, during the last decades the work of Rijkswaterstaat transformed from designing, constructing and maintaining the most important public works and water management, towards an organization that outsource these tasks and controls its contractors. These contractors involve all parties who are able to serve Rijkswaterstaat by executing tasks, so also include non-construction organizations, such as engineering and design companies. This transformation also influenced the kind of knowledge and employees that are working at Rijkswaterstaat; the technical knowledge is nowadays less important than the auditing, project control and management knowledge and skills. Nevertheless, technical knowledge is still necessary to test and manage the requirements and outcomes of contracts.

Rijkswaterstaat is responsible for managing and maintaining the main road network, water network and water system in the Netherlands. The main highway system is 3.260 km long, the main waterway network 1.686 km long and the main water system has a surface of 65.250 km² (Rijkswaterstaat, 2009j). The total costs of Rijkswaterstaat in 2008 were 4.8 Billion Euro’s, consisting mainly out of management, maintenance and developments costs. The ministry of Transport, Public Works and Water management funds these costs almost completely. Management and maintenance costs (1,5 billion) are indirectly funded by the ministry on the basis of performance agreements (so called management contracts) and development costs (2,1 billion) are directly funded from the infrastructure budget of the ministry (Rijkswaterstaat, 2008a). This indicates that the organization and its behavior have significant impact on the national economy.

The decline of direct public involvement in the tasks of Rijkswaterstaat caused the introduction of new working methods for cooperation between Rijkswaterstaat and contractors. Rijkswaterstaat introduced a new contract control method that supposed to fit this new situation. This method aims at controlling the risk of the contractor not delivering the service as described in the contract. The principle of this system based contract control (the Dutch abbreviation is SCB: ‘systeemgerichte contractbeheersing’) method is that the constructor implements the service, checks this service, and shows the results of this checks to it principle. The method is an equivalent of the quality assurance and control methods used in the private construction industry (p.2) (Stubbe, 2005). Rijkswaterstaat keeps control on the quality of the work of the contractor, by applying the SCB method, while limiting the direct involvement of Rijkswaterstaat in the actual realization of the projects.

In applying this method, Rijkswaterstaat uses the quality management system of the contractors to control the contract. The Rijkswaterstaat project teams perform tests on the system, process and the product to legitimate the confidence in the quality system of the contractor. The goal
of the SCB method is to rely on the quality management system of the contractors as much as possible. The emphasis should be on system tests and as little as possible on product and process tests. This is a tradeoff, between the number of tests by the project team and the confidence in the contractor. This tradeoff is based on risks in the project. These risks are identified in cooperation between the Rijkswaterstaat and contractor’s project team.

While the method itself is contradictory to former quality assurance methods, the national Management Board of Rijkswaterstaat decided to introduce the SCB method in the working methods of the organization. This might indicates differences between the theoretical optimal, how the organization states it behaves and how it actually behaves. In the optimal situation, the differences between these views are declining due to learning that is taking place in the organization on both the execution (project teams) and the policy formulating level (Management Boards) of the organization. Nevertheless, there is the notion that learning in the organization is not successful. This insufficient learning results in not adapting (fast) enough to the changed environment by both the individual as the organization. For this research, the focus is on learning of the SCB method at the regional department South Holland of Rijkswaterstaat. This thesis describes the problem summarized by the following problem statement:

_It is unclear whether Rijkswaterstaat is learning the SCB method and whether this learning is optimal_

### 1.2 Research goal and research question

The implementation of the SCB method is a planned, systematic change of processes in an organization. The Management Board of the organization ordered this change in working processes. Nevertheless, the application of the SCB method is continuously developing, and learning processes on the application are questioned (Putten, 2009c, Berenschot, 2006). This means that these types of radical organizational changes also include an incremental element. Different interests in the organization influence this incremental transformation; this thesis distinguishes these interests by reflecting on the actual behavior by the project teams and the expected behavior by the management of the organization. Knowledge on these views on learning the method improves incremental learning on the method. Principal of this research is the regional department South Holland of Rijkswaterstaat. Nevertheless, this research could provide useful information for other departments of Rijkswaterstaat and general organizational theory. The objective of this thesis is:

_Provide knowledge and if necessary improvements for learning the system based contract control method at Rijkswaterstaat_

To meet the research objective the main research question is:

_How is Rijkswaterstaat learning the SCB method and how could this learning be improved?_

The research strategy discussed in chapter 3 describes the framework this thesis uses to provide
the answer to this research question. In short, this thesis presents its definition of learning; this is the detection and correction of errors in applying the SCB method and sharing knowledge on these actions in the organization. This definition enables detecting deficiencies on these three aspects in the differences between the theoretical, expected and actual learning. Based on the deficiencies’ causes, measures that improve learning the SCB method at Rijkswaterstaat are identified.

The implementation of this new contract control method and the learning the method is an opportunity to study learning in the organization on a doable scope. Literature shares this approach to limit the scope of learning within an organization on a particular development in the organization. By focusing on a particular organizational change (the implementation of the SCB method) this research complies with Lahteenmaki’s view on feature research on learning in organizations (p.127) (Lahteenmaki et al., 2001). He states that there are little empirical studies on learning in organizations that really test and measure this learning; although, most likely to find learning are those studies on organizational changes.

1.3 Reading guidelines

This first chapter describes a first outline of the subject of this thesis. The third chapter describes the research methodology used in the research that is the basis for this thesis. Figure 1 visualizes the content related chapters of this thesis. The second chapter provides a description of the problem and its context from the available literature on the subject. The fourth chapter describes a theoretical framework on the definition of learning this thesis applies. The empirical evidence relates the research problem and the theoretical definition; the fifth chapter describes learning expected by the management of the organization. The sixth chapter uses cases to illustrate and compare this expected learning with actual behavior of the organization. The seventh chapter analyses the deficiencies between the literature study and the empirical evidence and formulates opportunities to improve learning. Chapter 8 discusses the conclusions and recommendations that result from this thesis. Furthermore, this chapter includes a reflection on this thesis.

Appendix A to this thesis includes a scientific article on this thesis. Appendix B provides a glossary of Rijkswaterstaat specific terms. Furthermore, the description of the gathering of empirical evidence is included in appendices C and D.
Problem description
This chapter formulates the problem researched in this thesis. The problem statement is central to this problem description; \textit{It is unclear whether Rijkswaterstaat is learning on the SCB method and whether this learning is optimal}. This chapter describes the context and nature of this problem statement; thereby it formulates the research objective of this thesis. First paragraph motivates the problem, second explores the problem context and third introduces the organizational network. The final paragraph formulates the research objective.

\section{Problem motivation}

As a result of the liberalization in the ‘80/’90’s, and moreover, the ‘Bouwfraude’ Rijkswaterstaat’s working methods were questioned and have been adapted over the last decenium. A parlements survey on building fraud in 2002 mentions the lack of control of Rijkswaterstaat on its contracts and questioned its contract control (ch6.6) (Tweede Kamer der Staten-Generaal, 2002). This survey did not start the developments at Rijkswaterstaat, these were already started at that time. Furthermore, the project management approach is adapted and the tasks of Rijkswaterstaat are reconfigured. The standard for executing tasks by Rijkswaterstaat became ‘Market, unless...’ (in Dutch: ‘de markt, tenzij,..’). This approach is facilitated by the topic specific policy documents of Rijkswaterstaat (Rijkswaterstaat, 2008b).

This organization’s change of behavior, transferred the actual implementing of the ministry’s policy to private contractors. Now Rijkswaterstaat only develops public works itself when direct public involvement is necessary, otherwise Rijkswaterstaat outsources the works an tests the work of its contractors (Verboom, 2007).

The decline in direct public involvement of Rijkswaterstaat caused the introduction of new working methods for cooperation between Rijkswaterstaat and its contractors. This is based on the paradigm that more opportunities should be transferred to the market, as the parties that form the market have skills and abilities to pick up the former tasks of Rijkswaterstaat. Rijkswaterstaat is a project based organization with line organization elements. The road and water districts are responsible for daily operations on the road and water networks, the rest of the organization is focused on supporting the districts or executing projects within the districts. These projects involve construction or maintenance on ‘wet’ infrastructure (for example, dredging of a waterway), ‘dry’ infrastructure (for example, example construction of a new highway) or traffic systems (for example, introduction of a dynamic route information panel). In the policy of Rijkswaterstaat the organization has five pillars of objectives: public oriented manager of the public works, leading client, reliable and efficient partner, people are decisive and the organization renews itself (the english translation only covers half of the original Dutch expressions, which are: publieksgerichte netwerkmanager, toonaangevend opdrachtgeverschap, betrouwbare en efficiënte partner, mensen zijn doordrangeweidend; en vernieuwingsproces) (Rijkswaterstaat, 2008b).

Within the changing environment of Rijkswaterstaat, this research focuses on learning the SCB method. This is only one aspect of learning within Rijkswaterstaat, as the whole organization is adapting to its changing environment. The implementation of the system based contract control (SCB) method for controlling contracts started from 2000. This method uses contractor quality management to control project risks and to legitimate payment to the contractor (Rijkswaterstaat, 2007b). There are signals that the transformation capabilities are not sufficient and the process of implementing this method is not completed (DAD, 2008, Verboom, 2007). As a result of an audit by the Court of Audit of the ministry for Transport, Public Works and Water Management (DAD), the Chief Financial Officer (CFO) of Rijkswaterstaat
issued a plan to implement the System based Contract Control (SCB) method gradually in
the coming years (Ministerie van Verkeer en Waterstaat, 2009a). The actual implementation
of the method is the responsibility of the regional departments of Rijkswaterstaat. This
implementation, the improvement of the application of the method and the expected effects
of the implementation of the method are not systematically documented (Van Es, 2009).

The problem addressed in this thesis is whether learning this method is optimal. Thereby
this thesis provides insight in how Rijkswaterstaat is learning to use the quality management
system of the contractor to ensure itself of the quality of the service performed by the contractor
according to the SCB method. Whether learning is optimal depends on the differences
between learning from theory, the way the organization prescribes itself to behave and the
actual behavior of the organization. In the rest of this thesis, the theoretical, the expected and
the actual learning provide the knowledge on these three views. This results in identification
of the optimal learning, determination of deficiency with the actual learning, the causes for
the (possible) sub-optimal situation and improvements for actual learning.

2.2 Problem context

This paragraph introduces the SCB method and provides an overview of other developments
in the organization Rijkswaterstaat that influence the problem addressed in this research.

2.2.1 Introduction to the SCB method

This method aims at controlling the risk of the contractor not delivering the service as
described in the contract. The principle of this system based contract control (the Dutch
abbreviation is SCB: ‘systeemgerichte contractbeheersing’) method is that the constructor
implement the service, checks this service, and shows the results of these checks to it principle.
Rijkswaterstaat test this quality management system of the contractor based on the risks for
Rijkswaterstaat. The emphasis on testing the systems of the contractor, in theory results in
a higher quality of the contractor processes that produces the service of the contract. The
method is an equivalent of the quality assurance and control methods used in the private
construction industry (p.2) (Stubbe, 2005). Rijkswaterstaat keeps control on the quality and
progress of the work of the contractor by applying the SCB method, while limiting the direct
involvement of Rijkswaterstaat in the actual realization of the project. When Rijkswaterstaat
applies SCB to a contractor, it means that the service in the contract covers more than the
construction of the product. The contract includes requirements on three aspects:

- The **product** (most of the times a work).
- A control **process** on the product.
- A **system** of quality management on the product.

This service can be any execution of Rijkswaterstaat’s tasks, but primarily involves
construction or maintenance on public works. Rijkswaterstaat is only the client of the service
and prescribes the requirements of the service in the contract; furthermore, it tests based on
risks, whether the constructor performs the process of quality management satisfactorily. The
aim of the method is to rely as much as possible on the quality management system of the
contractor. Where this reliance is depended on the confidence in the system, based on the test
of risks identified by the project team.
This section describes the historical background and the characteristics of this method. Within the broader scientific literature, the method is a product of the Public Management and New Public Management theories presented in the second half of the 20th century. Public Management theories argue that the public sector should reform in order to achieve greater cost-efficiency in the production of their services. New Public Management added that this efficiency is achieved by including the market in the production of public services (p.9)(McLaughlin et al., 2002). Nevertheless, outsourcing the quality assurance of the works to the market requires methods for control, that assure the market is performing the quality management on the construction processes. The premise is that functioning of the contractor’s quality management system safeguards the final quality of the product. Checking this system enables adjusting the production process early in the realization phase of the public works, and by that influencing the quality of the product.

**Historical background**

Within the overall project management, the implementation of this new method primarily changed the contract management of projects. It also influences other parts of the project management and the project control method. The decisions and activities are based on Rijkswaterstaat project risks. First, this paragraph describes the history of applied types of contract control and seconds the contract scopes.

<table>
<thead>
<tr>
<th>RAW</th>
<th>EKB</th>
<th>SCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determined project plan</td>
<td>Determined project plan</td>
<td>Innovative working methods due to functional requirements</td>
</tr>
<tr>
<td>Product specific approach</td>
<td>Product specific approach</td>
<td>Uniform approach and standardizing</td>
</tr>
<tr>
<td>Responsibility at principal</td>
<td>Responsibility at principal</td>
<td>Responsibility at contractor</td>
</tr>
<tr>
<td>Quality management by principal</td>
<td>Quality management by principal</td>
<td>Quality management by contractor</td>
</tr>
<tr>
<td>Product based testing</td>
<td>System and product based testing</td>
<td>System based testing</td>
</tr>
<tr>
<td>Many tests</td>
<td>Combination of different types of tests</td>
<td>Risk based testing</td>
</tr>
</tbody>
</table>

Table 1 presents the quality assurance methods and their differences. This overview is originates from an early study on the succes factors of the SCB method at Rijkswaterstaat. For this research it provides initial insight on the characteristics of the methods. The control of contracts were done on bases of traditional supervising systems until roughly 1995. On basis of the RAW contracts the work of the contractors were checked by Rijkswaterstaat. RAW contracts include a very specific description of the product included in the contract. Quality management was the resposibility of Rijkswaterstaat. From 1995 until 2000 the EKB (external quality control) was the standard method of controlling contracts; although the conditions of works were still based on RAW-contracts, quality management was executed by contractors themselves. SCB contract control is becoming the standard working method from 2000 on. This method emphasises risk based decisions in the quality assurance. Rijkswaterstaat uses for its organization innovative contracts with different scopes like; Design&Construct (D&C), Engineer&Construct (E&C) and Design, Build (Finance) and Maintenance (DB(F)M) contracts. This method is characterized by contract control based
on the contractor’s quality management system and the fact that payment to the contractor is also linked with his quality management system (Kool, 2008). In the next sub-section this method is introduced more extensively, first the combination of the different contract control methods in the current situation is explained.

Table 2: Overview of works (adapted from (Rijkswaterstaat, 2007b))

<table>
<thead>
<tr>
<th>Works</th>
<th>Contract scope</th>
<th>Conditions</th>
<th>Quality assurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction</td>
<td>D&amp;C</td>
<td>UAV-gc-2005</td>
<td>SCB</td>
</tr>
<tr>
<td>Large maintenance</td>
<td>D&amp;C or E&amp;C</td>
<td>UAV-gc-2005</td>
<td>SCB</td>
</tr>
<tr>
<td>Variable maintenance</td>
<td>E&amp;C</td>
<td>UAV-gc-2005</td>
<td>SCB</td>
</tr>
<tr>
<td>Regular maintenance</td>
<td>Result</td>
<td>UAV 1989</td>
<td>Own observation</td>
</tr>
</tbody>
</table>

The standard contract control method at Rijkswaterstaat is SCB; nevertheless, the organization realizes that not all works are (yet) suitable for this method. Therefore, the corporate purchase strategy describes the contract and control method for all works. The table above provides an overview of different types of works and their contract form, conditions and type of control. In this overview, both ‘wet’ and ‘dry’ works are included. The scope of the contracts of services with constructors is Design & Construct (D&C), Engineer & Construct (E&C) or result based. The D&C and E&C contracts result in large responsibility for the contractor, as Rijkswaterstaat does not provide full lists of technical specifications of the works and their building processes. A detailed list of specifications for the works is the basis for the contracts for regular maintenance. The conditions of the contract reflect this difference in contract form; UAV-gc-2005 is a standard that requires far less detailed information of the works than the older standard UAV 1989. The contract control of regular maintenance is the own observation of works, which used to be standard before introducing the SCB method. This process needs specific technical knowledge, many paperwork and working hours. Construction, large- and variable maintenance works should use SCB as the contract control method. The management plan of Rijkswaterstaat prescribes that all projects should implement the SCB method in 2012 (Rijkswaterstaat, 2008b).

Characteristics of SCB

The method is still evolving, due to the historical embeddedness of the projects and people working at Rijkswaterstaat. There are multiple interpretations on the application of the method in this transition period towards full implementation. The documents and training of employees on the method are consistent in the organization. The theoretical base of the working method is described in the manual SCB (Rijkswaterstaat, 2007b). A knowledge group that is established in each regional department and the national section DI / IMG supports the (practical) implementation. ‘The primary objective of method is to control contracts efficient (on distance with the least possible effort) and effective (based on principal risks). Secondary objective is to legitimate payment of contractors based on this contract control’ (own translation from (Rijkswaterstaat, 2007b)). A compact version of the in the training for contract manager given reasons for implementing the method are summarized (Rijkswaterstaat, 2009f):

- It is the strategy of the organization to be a professional client.
- The organization wishes to apply uniform working methods.
- Control on distance from Rijkswaterstaat.
- It serves efficient testing.
- It increase efficiency of Rijkswaterstaat.

The SCB method describes that Rijkswaterstaat should test the product, process and system of contractors on contracts within projects that apply the method. By testing these three
Rijkswaterstaat has knowledge on contractor’s control on important risk factors for Rijkswaterstaat. Therefore, each contract controlled by SCB should have a testing strategy that includes a mix of product, process and system tests (that each tests a different aspect of the service). Tests assure the confidence in the quality management system of the contractor.

Figure 2 visualizes the operations of a contractor that performs a service for Rijkswaterstaat. This service has a functional description in the contract. The contractor granted a contract to perform a service, which he produces with his organization (system) and he verifies that the product is performing the service prescribed in the contract. Rijkswaterstaat and its project team perform tests on the contractor’s system (is there an improvement circle, archiving, actions on deviations, risk management etc.), process (all activities directly related to the realization of the product) and product (is the verification right) (Rijkswaterstaat, 2009f).

Building a mix of tests based on risks for Rijkswaterstaat results in efficient testing. This mix preferably resembles the structure of Figure 3. In the beginning of the project, testing of systems is more important than the other tests, during the project the importance of test frequency shifts towards process tests and in the final stage of the project, total test frequency is relatively low. The underlying assumption is that testing system and processes of the contractor in the start of the project results in products that are more successful than testing the product at the end of contract.
The result of the tests influences the testing strategy of the project team on the contract. There are several results of a test (Rijkswaterstaat, 2009f):

- Positive finding; the contractor performs well.
- Negative finding; possible failures divided in:
  - Deficiencies: the contractor reports that it does not meet requirements.
  - Failure: deficiency reported by Rijkswaterstaat without contingency measure by the contractor.
  - Critical failure: In Rijkswaterstaat’ view not functioning of quality control of the contractor: results in postponement of payment until the failure is resolved.

With the application of the system based contract control the risk management of the project is divided over Rijkswaterstaat and the contractor, each manages it owns risks. For successful risk management in projects there is communication on the risks. Crucial to the SCB method is the communication on the identified risks, as good cooperation between Rijkswaterstaat and its contractor results in better risk management on the project. Figure 4 visualizes the allocation of risks between Rijkswaterstaat and its contractors.

![Figure 3: Theoretical optimal testing strategy over time (adapted from (Rijkswaterstaat, 2007b))](image)

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- Negative finding; possible failures divided in:
  - Deficiencies: the contractor reports that it does not meet requirements.
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![Figure 4: Risk allocation (Rijkswaterstaat, 2006)](image)
2.2.2 Project management of Rijkswaterstaat projects.
Projects at Rijkswaterstaat use an integral management approach; the aim is to realize infrastructural projects systematically. Figure 5 visualizes this Integral Project Management (IPM) model. This is the structure different sections of the regional departments use to cooperate in projects. The project manager is responsible for the project progress. The other project team members support the project manager on their specific field of expertise. The project’s risks determine the allocation of these risks. During the project, risks are identified and when necessary contingency measures are prepared. The RISMAN method is used to identify the risks in the project on basis of their origin. The source types of risks identified within projects at Rijkswaterstaat are (Rijkswaterstaat, 2004):

- Client risks.
- Environment risks.
- Market risks.
- Project (organizational) risks.
- System risks.

The structure of project teams of Rijkswaterstaat aims at controlling in these risks. Figure 5 visualize the cooperation in this project teams from the IPM model Rijkswaterstaat created. The project manager controls the client risks. The technical manager controls the risks from the system in terms of the technical system of the project. The environmental manager controls the environment risks. The contract manager controls the market risks. The manager project management controls the risks of the project organization (Rijkswaterstaat, 2008c).

![Figure 5: Integral Project Management model (Rijkswaterstaat, 2008c)](image)

2.2.3 ISO 9001
The method’s success is depended on the quality management system of the contractor. ISO standard 9001 (the latest version is 9001:2008) certify the quality management system of contractors. This certificate is necessary for a contractor to enter the tender procedure for a contract with Rijkswaterstaat. The certificate indicates that the contractor has a quality management system that ensures that it can produce the product according to the contract specifications. Furthermore, the contractor is ‘client minded’ and can proof by documentation that he produced the product according to the contract specification.
In theory, every contractor with the ISO 9001 certificate has a quality management system that enables him to proof that he produced a product of the right quality. This is one of the reasons Rijkswaterstaat introduced the SCB method, as it is unnecessary to systematically test the quality of a product twice. Nevertheless, by applying the SCB method and performing system tests Rijkswaterstaat incidentally tests the quality management system of the contractors.

2.2.4 Systems Engineering and requirement specification

System engineering as it is used by Rijkswaterstaat (Rijkswaterstaat, 2007a), is relevant for the technical management of the projects. The method specifies the requirements for contracts and ensures an integral approach to these requirements. Figure 6 illustrates the responsibilities for the design of the works included in the contract. In summery the figure describes that Rijkswaterstaat is responsible for the specification of requirements of the overall system and the contractor is responsible for the design of the subsystems, components and elements of the system.

Figure 6: Responsibilities of systems design (p.23) (Rijkswaterstaat, 2007a)
2.3 Rijkswaterstaat organizational network

Rijkswaterstaat is an executive department of the Dutch Ministry of Transport, Public Works and Water Management and is responsible for the implementation of the ministry’s policy. Figure 7 presents the organizational chart of the Ministry. On top are the Minister and its State Secretary, they provide political legitimacy to the organization’s behavior. There are three Directorates-General: Mobility, Civil Aviation and Maritime Affairs, and Water Affairs. These Directorates-Generals construct the policy of the Ministry. Furthermore, five policy departments support the top politicians and civil servants.

Figure 7: Organizational chart Ministry VenW (Ministerie van Verkeer en Waterstaat, 2009b)
The organization of Rijkswaterstaat is decentralized; there are ten regional departments that are responsible for the implementation of the policy and five national services that support services for the regional departments. Furthermore, there are project management departments for specific projects; at this point, for HSL-South, Maas Works and Room for the River. This thesis is performed for the regional department South-Holland of Rijkswaterstaat. There are four directorates; Navigation Traffic Center (SVC), Water & Navigation and Infrastructure Realization, Roads & Traffic and Operations (Rijkswaterstaat, 2009d). The internship that is basis for this thesis is performed under supervision of the Information and Administration section (BBD), nevertheless the object of this research is situated among different sections of the regional department, such as Project management (RPM), Contract management (RCM) and Procurement Section (BIO).

The tasks of Rijkswaterstaat consist of projects on the main highways, main waterways and main water systems. Most projects have a complex client-constructor relationship, which Figure 8 visualizes. In most projects, an external client determines the objectives of the project. This external client is usually one of the Directorate-Generals from the Ministry of Transport, Public Works and Water Management.

The formal structure results in complex relations between the different departments of Rijkswaterstaat and the market party that realizes a project. Figure 8 visualizes a simplified version of the structure of client relations in a project within Rijkswaterstaat.

The external client is served by, from Rijkswaterstaat perspective, an internal client; the management team of a regional department of Rijkswaterstaat. The management team orders the project realization to a project manager. The project manager is an internal client but also a client for the market. The purchasing process on the market indicated by the dotted circle will result in the selection of a contractor. The accountability of each party to its client is a process that influences the project realization and capability to learn from errors. This research focuses on the relations involved in the purchase process. In these relations, the system based contract control (SCB) method influences are situated. This is the relation between the project manager (or his representative) and the market party.

![Figure 8: Client - contractor relation (adapted from (Rijkswaterstaat, 2004))](image)

Problem description
The individual project teams and the involved contractors experience the problem of deficiencies in the application of the method. Therefore, in this relation learning in practical application of the method is situated. The share of activities included in contracts with contractors in a typical Rijkswaterstaat project is high in comparison with the number of activities the project teams performs by itself. Therefore, the control of these activities performed by the contractors in a project is very important for the performance of the Rijkswaterstaat projects.

**Project versus line organization**

The regional departement is organized in matrix structure as described by Mintzberg (Mintzberg, 2006). The projects consist of individuals with two responsibilities; first the individual is part of the ‘line organization’ of the separate sections of the regional department (for example, example the contract management section; a full overview of all sections is included in appendix C), second the individual is part of the project team of that specific project. The line organization has it, managers and the projects have their internal clients. The individual in the project is loyal to both interests. This matrix structure is even more complex, as the internal client sometimes is a manager from the line organization. This makes identification of interests and decision making in projects difficult.

**2.5 Research objective**

This research focuses on learning the SCB method in the organization of Rijkswaterstaat. In other words, this means that the internal quality management system and sharing of knowledge on the SCB method are part of the research. The focus is on learning in the organization and not on the individual learning, that takes place within the organization. Figure 9 visualize this research focus. The actual effectiveness and the implementation of the SCB method is not part of the problem addressed in this research. This thesis focuses on a specific part of the overall learning in the organization. For practical reasons the objects of research are located within the regional department South Holland of Rijkswaterstaat.

This research focuses on the learning that involves the SCB method at Rijkswaterstaat. The problem statement states it is unclear whether the learning on the SCB method at Rijkswaterstaat is optimal. This thesis constructs the knowledge on the learning and identifies improvements for this learning.
Thereby the research objective for this thesis is:

*Provide knowledge on and when necessary improvements for learning the system based contract control method at Rijkswaterstaat*

In order to meet this objective, knowledge on learning the SCB method is necessary. The problem context described in this chapter influences this learning, but does not determine the learning. This thesis uses the premises that learning is central in improving the success of the application of the SCB method in projects. Thereby, it adopts a positivism approach to the research. The implementation of the method is not as a straightforward process, this research address on the learning that results from the implementation, but also on learning that takes place in depended of the implementation.

This thesis defines the necessity for improvements in learning based on the existence of deficiencies in differences between three views on learning. The theoretical learning describes how there should be learnt from literature, the expected learning is the learning described by the organization of Rijkswaterstaat and the actual learning is the learning that is taken place in the day to day business of the regional department. When these three views are identical, there is optimal learning on the SCB at the regional department of Rijkswaterstaat. The next chapter describes the methodology this thesis uses to meet its research objective.

*Summary problem description*

The context of the research problem is complicated and dynamic. This thesis focuses on Rijkswaterstaat as an organization and a multiform identity that learns a new working method. Learning in this case is described as the combination of implementing and improving the SCB method. The lack of knowledge and information within the organization on this learning might prevent optimal learning and underutilize opportunities to improve the method’s success.
Research methodology
This chapter describes the research methodology of the research that is the basis for this thesis. The research questions present the steps and structure of the research. The research strategy presented in the second and third paragraph of this chapter provides the information for answering the research questions.

3.1 Research questions

The introduction and problem description of this thesis provided a problem statement and research objective. This provided basic knowledge on the research problem.

The introduction provides the following **problem statement** that characterizes the problem addressed in this research:

*It is unclear whether Rijkswaterstaat is learning the SCB method and whether this learning is optimal*

The problem description of this thesis provides the **research objective**:

*Provide knowledge on, and when necessary improvements for learning the system based contract control method at Rijkswaterstaat*

This thesis determines what improvements are by comparing the theoretical, expected and actual learning the SCB method. When actual learning in the organization is meeting theoretical learning, there is optimal learning. The answer to the main research question in the conclusion chapter meets the research objective. The problem statement and research objective results in the following **main research question:**

**How is Rijkswaterstaat learning the SCB method and how could this learning be improved?**

The answers to the sub- and sub-sub questions systematically construct the answer to the main research question.

The **sub questions** and their sub-sub questions are:

1. **What is learning in the context of this research?**
   - 1.1 What is the definition of learning?
   - 1.2 What is the cognitive nature of learning?
   - 1.3 Who can learn?
   - 1.4 What aspects identify learning in an organization?

2. **What learning does the management expect in projects?**
   - 2.1 Who manages the application of the SBC method in the organization?
   - 2.2 What learning is included in the organizations formal structure?
3 How is Rijkswaterstaat actually learning the system-based contract control method?

3.1 How are errors in the contract control detected?
3.2 How are errors corrected?
3.3 How is knowledge on these actions shared?

4 What are opportunities to improve learning the SCB method at Rijkswaterstaat?

4.1 Why are there deficiencies?
4.2 How can these deficiencies be minimized?

Figure 9 presents the systematic relations of the sub questions. The eclipses visualize the topic of the sub questions of the research. The first sub question and its sub-sub questions focus on the theoretical learning. The second sub question focuses on the expected learning in the organization and its relation with the theoretical learning. The third sub question discusses the actual learning and its relation with the expected learning. The fourth sub question addresses the differences between the views on learning; it summarizes the deficiencies on the aspects from the theoretical learning, it identifies the causes of the deficiencies, and provides improvements for learning the SCB method. This analysis and design of improvements is based on the aspects of learning identified in the chapter on theoretical learning. The answers to these sub questions enable answering the main research question and meeting the research objective of this thesis.
3.2 Research strategy

In order to understand the learning at Rijkswaterstaat, it is necessary to adopt a structured research strategy. The data gathered for this research stem from scientific literature on learning, Rijkswaterstaat documents (both general policy documents as project specific documentation) and from the employees of Rijkswaterstaat (both projects employees and ‘SCB experts’). A full list of the interviews for this research is included in appendix C of this thesis.

The literature study of this research provides a theoretical model of learning that enable identification of the actual and expected learning at Rijkswaterstaat. This provides knowledge on learning on the SCB method at Rijkswaterstaat. Besides the actual learning that is occurring within the organization, there is learning expected in the projects that management describes. Combining formal policy documents and information from SCB experts within Rijkswaterstaat provide insight in this expected learning.

The knowledge on the learning on the SCB method also includes the confrontation of the actual and expected learning by reflecting the theoretical model on these two. This results into identification of opportunities for improvements that close the gap between the expected and actual. This reflection describes the reasons for the actual learning in the organization and its deficiencies from the learning in theory and expected learning. The opportunities to improve learning the SCB method consist of identification of closing the gap between the actual and expected learning, and the difference between the expected and actual learning with learning in theory. These differences and their causes enable identification of improvements for learning the SCB method. By applying this research strategy, the research meets its research objective. The research for this thesis thereby consists of an analysis and design phase.

3.3 Research methods

This paragraph explains the research methodology for the different phases of this research. Literature studies on documents from the Rijkswaterstaat organization and scientific literature provided the information for the problem identification, the theoretical learning and the expected learning.

Main part of the research of this thesis is case studies. These cases study provided the information for describing the actual learning, the case descriptions and a reflection on the difference between the actual and expected learning. This cases study consists of interviews with RWS employees and projects’ specific information. The reason for the cases study is that the objects of research are very heterogeneous projects. Furthermore, the data within these projects is very ambiguous and quantitative data collection is very ineffective (very time consuming with a low result for the research objective). Earlier research failed to research the objects in detail that is necessary to meet this research objective; for example, Verboom (Verboom, 2007) and Berenschot (Berenschot, 2006). The first, provides identification of success factors for the SCB method, but lacks in depth analysis and explanation of underlying factors. The second research provide in depth analysis and explanation of results, but lacks practical recommendations.
Therefore, this research uses qualitative cases study. The cases study provides answers on the ‘how’ and ‘why’ the learning on the application of the SCB method at Rijkswaterstaat deviates from an optimal situation, where the actual learning in projects meets the expected learning of the organization. Therefore, it is a descriptive theory-building cases study. In comparison with a survey, case studies leave the opportunity to research certain aspects of individual cases in more detail. This research method also allows the combination of different information sources; studying documents and interviewing. Case study research fits best with the research objective and is able to indicate underlying factors that can improve the learning.

In addition to the literature study, interviews with SCB experts from different divisions of the organization provided the input for the chapter on the expected learning by the organization.

The identification of improvements is based on the evaluation of the deficiencies on the aspects of learning in the differences between the three views of learning. These improvements originate from theoretical reflection and indicative evaluation of the deficiencies. This inductive evaluation is based on the in depth information provided by the case studies.

**Summary of chapter on research methodology**

This thesis analyses learning on the SCB method at Rijkswaterstaat by describing the theoretical view on learning, the expected learning by the management of the organization and the actual learning in the organization. Several projects provide cases for studying the actual learning in the organization. The differences between these views are evaluated on the aspects of learning identified in the chapter on theoretical learning. This evaluation enables identification of improvements that minimize the deficiencies on the specific aspects in these differences.
Learning in theory
This chapter describes theoretical learning by presenting a model for learning based on aspects provided by scientific literature. Thereby, this chapter forms the theoretical framework for the chapters on the actual and expected learning that reflects on learning as described in this chapter. The differences between the views on learning are evaluated on three aspects this model provides.

This chapter draws the theoretical context of this thesis. The problem description described the focus in this thesis is on learning and not on implementing the method. Implementing a method requires a clear and defined description of the method with ready to use tactics for every context specific situation. Numerous literature describe the change of organizational culture, such as Cummings and Worley that provide 6 guidelines for cultural change (p.491-492) (Cummings and Worley, 1997). The SCB method gradually has been implemented since 1995, when the former EKB method was introduced. This gradual implementation also results in evolution of the method. The SCB method itself is no change in organizational culture and implementation theory itself is of no use. Therefore, this thesis describes the development of the method (which also includes implementing) as learning the SCB method. The process also includes improving the method after the implementation by the project team, in order to improve the method's success.

The definition of learning is straightforward: “knowledge or skills acquired through study or being taught” (Oxford English, 2009). Nevertheless, a specific working definition is necessary in order to provide useful knowledge and recommendations on learning the SCB method. This chapter constructs this working definition and by that answers the first sub question of this thesis.

What is learning in the context of this research?

The answer to these sub questions is constructed using sub-sub research questions, each answered in a separate section of this chapter:

1. What is the definition of learning?
2. What is the cognitive nature of learning?
3. Who can learn?
4. What aspects identify learning in an organization?

In defining learning, this thesis use theory from scientific literature. These theories mainly originate from social science and more specific the action theory. Central in this thesis is the work of Argyris and his several co-authors, he emphasizes the individual as key figure in learning in an organization (p.922) (Antal et al., 2001). His action theory suggests that the effect of learning is visible in the actions that individuals perform on behalf of the organization (Argyris and Schön 1978). This view is suitable for the problem described in this thesis. The initial problem exploration indicates the implementation of the SCB method and understanding of the method varies over the individual employees of Rijkswaterstaat. Furthermore, the actions in executing the method are performed by individuals in the project teams. These actions form the behavior of the organization. The theories of Argyris, the description of ‘learning cycles’ and Nonaka’s theory on knowledge conversions, provide useful tools to understand the differences between theory, expected and the actual learning discussed later in this thesis. Researching three views on the learning on the SCB method provide knowledge on the actions that individuals take and by that indicate the learning in the organization. Other theories on learning in organizations focus on the organization as a
whole and less on the individuals within the organization; this thesis mention and uses ideas from this literature, but does not follow their central thoughts. For example, literature based on March has little attention for the individual in the organization (p.922) (Antal et al., 2001). Others describe learning in an organization as a final state of the organizational structure and behavior. The work of Senge (Senge, 1990) describes learning in an organization as five disciplines that should develop parallel in an organization to become a learning organization. Pedler describes the learning organization as the combination of an optimal organizational structure and its characteristics (Pedler, 1994).

The theories used in this thesis to describe learning from a theoretical view, are able to identify learning on a particular development in an organization. In this thesis, this is learning a specific working method. Recommendations for learning the SCB method can only result from understanding the relation between theory, organizational wishes and practice in learning the SCB method.

4.1 Learning; error detection and corrective action

Kim describes learning has two meanings: first; ‘the acquisition of skill (know-how; operational learning)’ and second; the acquisition of ‘know-why’ (conceptual learning). He combines this to the definition that learning is ‘increasing one’s capacity to take effective action’ (p.2) (Kim, 1993). Argyris and Schön also define learning as the connection between thought and action; where learning takes place only when new knowledge result in different behavior that is replicable (p.28) (Argyris and Schön 1978). Experimental learning theory facilitates Kim’s two types of learning; scientists of this school use a learning circle to visualize experimental learning. The appearance and name of this circle vary by author. Lewin describes the cycle as ‘a process of; having a concrete experience, making observations and reflections on that experience, forming abstract concepts and generalizations based on those reflections, and testing those ideas in a new situation’ (Lewin, 1942). The Deming circle (plan-do-check-act) visualized in Figure 11, is based on the same principle, although Deming himself refers to Shewhart. Shein calls his version the ‘observation-emotional reaction-judgment-intervention cycle’. Argyris and Schön name the in principle same cycle the ‘discovery-invention on-production – generalization cycle of learning’ (in (Kim, 1993)). Kofman calls the circle the observe assesses- design –implement (OADI) circle which is visualized in Figure 10. Each transition between the phases of learning has a possible barrier preventing continuation to the next phase. Kofman’s circle is practically similar to the experimental learning circle described by Kolb (Kolb, 1984).
For this research, learning is the acquisition of knowledge and skills on the SCB method. The acquisition of knowledge and skills result into detection and correction of errors or into the discovery of opportunities. These errors are defined as 'the discrepancy between what the organization members aspire to achieve, and what they actually achieve' ((Argyris and Schön 1978, Argyris and Schön, 1996, Arthur and Aiman-Smith, 2001, March and Olsen, 1975) in (p.3)(Visser, 2009)). An error in the SCB method is the presence of difference between the aspired and actual achievement in terms of effectiveness and efficiency of the contract control. Earlier research on the success factors of the SCB method at Rijkswaterstaat provided the following success factors for the SCB method (p.49) (Verboom, 2007):

**Effectiveness:**
- Legitimacy of payment of contractors.
- Quality of the service that is realized within the project.

**Efficiency:**
- Costs of the project.
- Working hours of RWS employees on the project.

Learning involves the existence of error detection and correction actions, where the first (error detection) in fact, is the same as observing and assessing phases; and the second (error correction) is the same as the design and implement phase in the learning circles.

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**Figure 10: Kofman’s OADI Circle and Deming circle (adapted from (Kofman, 1992)) (Leadership Champion, 2008)**

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This paragraph provides the answer to the following sub-sub question:

### 1.1 What is the definition of learning?

Learning in this thesis is the acquisition of knowledge and skills on the SCB method. The acquisition of knowledge and skills result in the detection and correction of errors or discovery of opportunities. Errors are the difference between the aspired and actual achievement of individuals, where the achievement is the effectiveness and efficiency of the contract control.
4.2 Levels of learning

The levels of learning describe different cognitive natures of the learning. Argyris and Schön developed two concepts that many researchers about learning in organizations applied. These concepts identify the levels of learning. The authors note that the two concepts are ideal types and even during their own application of the concepts to cases, they notice that the theoretical distinction is hard. Nevertheless, the concepts are useful for finding interventions to the organizational behavior (Argyris and Schön 1978). These concepts can be applied to both the individual as the organization as the learning object.

The first concept of learning is ‘single loop learning’: this is the process of learning that occurs by error-detecting-and-correction to carry on the present policies or achieve present objectives (Argyris and Schön 1978).

The second concept is ‘double loop learning’: the learning that occurs by “error-detecting-and-correction that results in modification of underlying norm, policy and objectives” (Argyris and Schön 1978).

Argyris’s own explanation describes the difference between the two concepts:

“To give a simple analogy; a thermostat that automatically turns on the heat whenever the temperature in the room drops below 68 degrees is a good example of single-loop learning. A thermostat that could ask, ‘Why am I set at 68 degrees?’ and then explores whether or not some other temperature might more economically achieve the goal of heating the room would be engaging in double-loop learning” (Argyris, 1991).

Argyris and Schön developed these concepts on basis of Bateson’s first, second and third order learning. However, they argue that there is no order in the types of learning. Argyris and Schön adopt the by Bateson identified third order learning, but they called it Deutero-learning (literally meaning second order learning), which is:

“The learning that evolves when individuals reflect on the previous context for learning; the production of learning strategies, application of this strategies, evaluation of this strategies and adoption of the individual image and maps of the organization.” (Bateson, 1972 as cited In (Argyris and Schön 1978)).

Deutero learning is less interesting in terms of using the action theory to improve learning the SCB method, although the research for this thesis itself is a form of deutero learning on the SCB method. Therefore, this type of learning is not included in the model for learning.

Most scientific disciplines accept these concepts; nevertheless, the exact definition and context of the terms are sometimes a reason for misinterpretation. Table 3 provides an overview of science disciplines and their interpretation of the concepts. This research will use the terms in relation with the sociology and management disciplines, as these interpretations are close to the original concepts of Argyris and Schön and provide opportunities to identify improvement for the research problem.
The level of learning that is primary involved in learning on the SCB method is single loop learning. This involves the experimental learning circles in order to apply the method optimal. The project team and the contractor are most likely to experience this type of learning in their everyday practice of application of the method. Second, the double loop and deutero learning is more likely to be present at the management team of Rijkswaterstaat and the external client. They reflect on the application of the method and its strategic implementation.

This paragraph provides the answer to the following sub-sub question:

1.2 What is cognitive nature of learning?

Answer: The ideal types on the level of learning characterize the nature of actions that is the result of learning; either single or double loop learning. For this research, this means either the effect of learning actions are meant to implement and apply the SCB method (single loop) or question the method and reflecting on its norms (double-loop).

4.3 Learning objects

There is a distinction in the learning objects; there is the individual, the project team and the organization as separate object that are capable to learn. Individual learning is the learning that individual person experience. This phenomenon is heavy researched by psychologists and other social sciences, although they provide some useful concepts, there is still a lot of mystery around the human mind and the concept of learning. A key concept that is important for the role of individual learning in relation to organizational learning are the ‘Mental Models’ introduced by Senge (Senge, 1990). He defines them as; “deeply ingrained assumptions, generalizations, or even pictures or images that influence how we understand the world and how we take action” (p. 8). The mental models are the context wherein individuals learn, as they determine the appropriateness of new information and the ability of individual to absorb this information.

The definition of learning by an organization is defined as “increasing an organization’s capacity to take effective action” (p. 10) (Kim, 1993). An organization is an entity consisting of individuals that take action on behalf of the organization and these individuals together are part of the organization. This does not suggest that organizational learning is the sum of all individual learning by the individual members of the organization. Argyris and Schön also describe this:
“Organizations are not merely collections of individuals, yet there is no organization without such collections. Similarly, organizational learning is not merely individual learning, yet organizations learn only through the experience and actions of persons” (p.9) (Argyris and Schön 1978).

In order to understand why an organization can learn, first a working definition of an ‘organization’ is constructed. The Oxford dictionary gives the following definitions (Oxford English, 2009):

- “the action of organizing”
- “a systematic arrangement or approach”
- “an organized body of people with a particular purpose”

These definitions provide the basis of working definition of an ‘organization’. Scientific literature also provides insight in the object called an ‘organization’. Argyris and Schön provide a non-exhaustive overview of all literature on the nature of organizations; Table 4 presents this overview. Although this overview is dated, it provides a good impression on the origins of scientific literature that also influences the scientific debate field today (p.64) (Dierkes, 2001).

<table>
<thead>
<tr>
<th>Theories on Organizations; an organization is a ...</th>
<th>Associated learning approaches</th>
<th>Key Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group</td>
<td>Social psychology</td>
<td>Bales, Homans, Bavelas, Kennedy, Rome, Lewin, Weick, Kahn</td>
</tr>
<tr>
<td>Agent</td>
<td>Instrumentalism, management theory</td>
<td>Barnard, Taylor, Mayo, Roethlisberger, Drucker, Simon, Cyert, March, Chandler, Thompson, Stinchcombe, Lawrence and Lorsch</td>
</tr>
<tr>
<td>Structure</td>
<td>Sociology, theory of bureaucracy</td>
<td>Weber, Merton, Parsons, Blau, Crozier, Downes, Gouldner, Perrow, Stalker, Dunn, Rhenman</td>
</tr>
<tr>
<td>System</td>
<td>Cybernetics, information theory</td>
<td>Cannon, Wiener, Ashby, Von Bertalanffy, Deutch, Beer, Ackhoff, Churchman, Steinberger, Weaver, Wilensky, Galbraith, Dunn, Emery and Trist, Bateson</td>
</tr>
<tr>
<td>Politics</td>
<td>Political theory, theory of sociopolitical movements</td>
<td>Selznick, Simmel, Long, Lasswell, Lindblom, Schelling, Kahn, Schubik</td>
</tr>
</tbody>
</table>

Argyris and Schön conclude that there are several theories that describe what an organization is and how to intervene in these objects. Their intentions with this categorizing go beyond defining an ‘organization’. In this thesis, these categories illustrate the scientific diversity on the issue. The first column of the table presents these categories. Each of the categories has its
own associated learning approach and its key authors. These categories are:

- **Organization as a group**
  This category of theory reflects on organizations as collections of persons who interact on regular basis and share collective identity. The individual is important but also the group phenomena.

- **Organization as an agent**
  From this category of theory, organizations are instruments for the achievement of social purpose; it is a sentient, active, intelligent and purposeful subject. The viewpoint is instrumental and rational.

- **Organization as structure**
  This category of theory describes an organization as positions of individuals, their connections and the flows of information, work and authority.

- **Organization as a system**
  This category of theory identifies organizations as self-regulating entities, which maintain certain essential constancies through cycles of action, error-detection, and error-correction.

- **Organization as culture**
  This category of theory argues organizations are small societies where people create shared meanings, symbols, rituals, and cognitive schemes for internal and external interactions. The organizational learning discussed in this literature is mostly about learning to adopt the small society’s culture.

- **Organization as politics**
  This category of theory describes organizations as politics; they are governments and an interplay of contending interests and powers.

Second column of Table 4 presents the scientific disciplines the categories originate. Argyris and Schön admitted they adopted more or less the traditional organization as agent approach, but also adopted and reacted to elements of other approaches to organizations and its learning (p.330) (Argyris and Schön 1978). The definition of an organization they provide by combing the definitions from these categories of theories provides a useful definition (p. 64) (Dierkes, 2001). Argyris and Schön define an “organization” based on the presence of three criteria: ‘theory of action, cognitive enterprise undertaken by individual members and cognitive artifact made of individual images and public maps’ (p.12). Their argument for this identification is; “these characteristics illuminate the sense in which an organization may be said to know something, and to learn” (p. 12) (Argyris and Schön 1978).

The first criterion can be described as; whether the subject performs actions as defined by Argyris as ‘a theory of action’ ((Argyris, 1974) as quoted on (p.10) in (Argyris and Schön 1978)); all deliberate action have a cognitive basis’. Within organizations, these actions are not always explicit; formal corporate documents only reflect a theory of action (‘the espoused theory’) and might conflict with the theory of action observed from actual behavior (‘theory-in-use’). The theory-in-use is often tacit and thus hard to analyze. The conflict between the espoused theory and the theory in use is often un-discussable, or the theory in use might be inaccessible for individual members of the organization (p.15) (Argyris and Schön 1978).

The second criterion: a cognitive enterprise undertaken by individual members means that there are actions taken by individual members of the organization on behalf of the organization (an agency).

The third criterion is whether there is a cognitive artifact made up from individual images and public maps (a task system). This implies that there is a clear distinction of what the organization should do and what not, this distinction stern from the individual opinions
and public expectation. An organization is an artifact of individual ways of representing on organization (Argyris and Schön 1978). All members of the organization have images and maps, which are the media of learning as part of the theory-in-use at the organization. The mismatch of their images and outcomes will influence the actual theory-in-use.

This research adopts Argyris and Schön's definition for an organization as it provides most opportunities for identifying knowledge for the research object. The actions of the organization in its projects are the elements where learning and thus improvement of the organization becomes visible.

This paragraph provides the answer to the following sub-sub question:

1.3 Who can learn?

Learning is possible on the level of the individual, but also on every object that fulfill three criterions named by Argyris and Schön for an organization (for example, a project team). This means there are numerous objects from the individual towards the organization at Rijkswaterstaat that can learn the SCB method. The project teams that perform actions in controlling the contract are most crucial to learn on the SCB method. The project teams are involved in the practical application of the instruments and thereby improving the learning on the method will result in reaching the objectives of the individual projects. The internal client is responsible for allocation of resources to the project team and the project requirement. He has to learn what the method involves for this allocation and requirements. Furthermore, the managing board of the regional department should also learn how to develop the expected learning in the organization over time.

4.4 Model for learning

Learning is a complex phenomenon that is not directly measurable in the production of complex products (such as the contract control at Rijkswaterstaat). Therefore, the model presented here will provide a method to construct confidence in the presence of learning capabilities and identifies interventions in learning in the organization. Literature provides multiple ideal types for constructing the ideal ‘Learning Organization’, for example, Pedler (Pedler, 1994) and Senge (Senge, 1990). Nevertheless, this research limits the model for learning to specific actions on the SCB method in specific projects. The objective of the research does not include the improvement of learning of the organization of Rijkswaterstaat as a whole. Testing of ideal types in the empirical world is hard. Most authors conclude with describing conditions that enhance an organization to learn (Argyris and Schön 1978, Friedman et al., 2001, Pedler, 1994). This research adopt an action-oriented approach as described by Argyris and Schön (p.10)(Argyris and Schön 1978), this means focus on studying the individual and organizational actions and their reasoning. This focus on actions enables empirical analysis and according to Argyris and Schön result in more competent and effective interactions (p.10). Revans agreed to this view by describing; “there can be no learning without action and no (sober and deliberate) action without learning” (p.54) (Revans, 1980). Therefore, the presence of thee aspects identify the level of learning on the SCB method on the organizational level;

- Detection of errors in the SCB method.
- Cognitive effective correction actions (both know-how and know-why; and both single as double loop).

Learning in Theory
4.4.1 Error detection

Errors are the discrepancy between the aspired achievement and the actual achievement of the individuals within the projects. In this research, errors are the ineffective and inefficient contract control in projects; this means that the organization aspiration does not meet the actual achievement. This achievement in the contract control is about the legitimacy of payment, quality of the service that is realized in the project, the costs of the project and the working hours of RWS employees on the project. These could be, but not necessary are, caused by errors in the implementation of the SCB method in the projects.

Actions in the behavior of Rijkswaterstaat as an organization in its projects correct these errors. The cognitive nature of these actions is essential in correcting the errors and determines the definition of these errors. This links to the concepts of learning from Argyris and Schön; and the conceptual and operational learning of Kim. Single loop level of learning will involve an action that perceives errors as the gap between the actual and the aspired implementation of the SCB method (the know-how). Second loop learning actions will perceive also errors that involve the gap between aspired and achieved effectivity and efficiency of the contract control method (the know-why).

The ability of the organization to detect errors is based on the first two dimensions and operationalized by Visser (p.4-7) (Visser, 2009), he combines theories from different authors in four dimensions (Senge et al., 1994, Pedler, 1994, Lahteenmaki et al., 2001, Flood, 1999). These dimensions are used to determine the learning capabilities of an organization. Visser builds on various literatures these dimensions, these dimensions develop a spiral in which the organization is learning. When the degree of empowerment is higher, the degree of error openness is higher. More knowledge conversions are possible on these errors when the degree of error openness is higher. This could result in more competent personal that can cope with more responsibilities and thus a higher degree of empowerment. The four dimensions of Visser (p.4-7) (Visser, 2009) are:

**Dimension 1: degree of empowerment**
- Theories implicate; the more decentralized, the more errors and less detection.

**Dimension 2: degree of error openness**
- Theories implicate; the more open and trusting, the more errors are detected and corrected.

**Dimension 3: degree of knowledge conversion**
- Theories implicate; the higher the knowledge conversion, the more is learnt.

**Dimension 4: degree of adequate HR management and development**
- Theories implicate; better quality personal can cope with more responsibilities, which closes the circle with dimension 1.

4.4.2 Error correction

The correction actions and their reasons are tested in the model by evaluating the ‘good dialectic’ that enables the single and double loop learning (p. 144) (Argyris and Schön 1978). Argyris and Schön argue an organization learn effectively with both single and double loop
learning in their operations. These concepts are related to the know-how and know-why terminology of Kim. The single loop actions are the actions that implement the SCB method in the project, these actions result in know-how knowledge. The second loop actions involve the reflection on application of the method and results in know-why knowledge. The ‘good dialect’ is tested evaluating the following features from Argyrs and Schön (p.145) (Argyris and Schön 1978):

- The effectiveness of actions that try to match expectation and outcome (indicates the single loop learning).
- The sharing of memories that provide context for interpreting the present error (indicates single loop learning).
- Do the organization’s members test for congruency of organizational espoused theory with theory in use? (indicates single-loop learning).
- The testing by members of individuals of the organizational assumptions (indicates double loop learning).
- Ability of members of the organization to their map of the theory-in-use and that of the management (indicates double-loop learning).

In the model, the score of an organization on the features indicates the capabilities of the organization to take effective actions, as these actions themselves are hard to empirically identify and categorize (p.308) (Argyris and Schön 1978). The features indicate the nature of the cognitive action in the projects; the correction actions are more effective when they are of double loop nature, although single loop actions are also necessary. The model states that learning in the projects is more likely to be present when the features of both single and double loop learning are both present. The chapter on the actual learning reflects on the presence of these features in the behavior of Rijkswaterstaat in a case study.

4.4.3 Knowledge conversion

The second criteria in this model that indicates the level of learning is the conversion of knowledge. This conversion is involving the learning objects. Both the individual and the organization are learning objects on learning the SCB method. The primary learning individuals are the contract managers in the specific projects as they experience learning processes in their everyday application of the method. Besides the contract managers, other individuals will experience learning in the application of the method. The organizations that learn in the application of the SCB method are the project team of RWS, the contractors, the management team of RWS and the external client. These organizations fulfill the three criterions identified by Argyris and Schön for a learning object as the organization on the SCB method; the organizations perform actions, in these actions, individuals represent the organizations and there is a clear ‘task’ for each of the named organizations in the projects.

Learning on the SCB method at Rijkswaterstaat is only likely when the knowledge and skills on the corrective actions is shared in the organization. This means that the individuals that take actions on behalf of the organization in the projects share their knowledge and skills among different projects; by that, the Rijkswaterstaat organization learns.

This sharing of knowledge between the individual and the organization is described by Nonaka and Takeuchi (Nonaka and Takeuchi, 1995). They apply a basic distinction between tacit and explicit knowledge. Tacit knowledge cannot be expressed in words, is subjective and experience based. Whereas explicit knowledge is objective, and rational which can be expressed in words. They developed an ideal model that transfers knowledge from the individual to the organization and vice versa. They identified four types of knowledge conversion that together facilitate knowledge creation. For this research, the existence
and balance in the four types of knowledge conversion are indicating learning on the SCB method. Table 5 presents these four phases. The socialization process transfers tacit knowledge between individuals. The externalization processes involve the transformation from tacit to explicit knowledge and take place among individuals across the organization. The combination process is transferring explicit knowledge between individuals and this process is useful for sharing knowledge over projects. The internalization is transforming the explicit knowledge into tacit knowledge and takes place at the individual level.

<table>
<thead>
<tr>
<th>From Tacit knowledge</th>
<th>To Explicit knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Socialization</strong></td>
<td>(individual to individual in a project)</td>
</tr>
<tr>
<td><strong>Externalization</strong></td>
<td>(individuals over projects)</td>
</tr>
<tr>
<td><strong>Internalization</strong></td>
<td>(at the individual in projects)</td>
</tr>
<tr>
<td><strong>Combination</strong></td>
<td>(between projects)</td>
</tr>
</tbody>
</table>

In the optimal situation, these phases are all present in an organization and intensive used. Only then, these phases build a knowledge-creating spiral. (p.71) (Nonaka and Takeuchi, 1995). This spiral is the process of developing knowledge, in this model the spiral means the improvement of the knowledge and skills on the SCB method. The presence and level of usage of these four knowledge conversion phases in the projects at Rijkswaterstaat are the third aspect of learning as described in this thesis.

This paragraph provides the answer to the following sub-sub question:

1.4 What aspects identify learning in an organization?

The level of usage and possibility to identify error detection, cognitive correction actions and knowledge conversion in an organization indicate there is learning.

4.5 Application of the model in this research

The model presented in this chapter provides specification of the research strategy; the model enables the evaluation of the expected and actual learning. Furthermore, it provides a framework for identifying deficiencies in the differences between the theoretical, expected and actual learning on the SCB method. These views provide insight into the causal relation of the lack of learning and the learning objects and their actions. The meaning of expected learning is similar to the meaning of the term ‘espoused theory’ by Argyris and Schön (p.11) (Argyris and Schön 1978). The term ‘actual learning’ in this context is similar to what Argyris and Schön call ‘theory-in-use’ of the organization (p.11) (Argyris and Schön 1978). The theory that actually governs the actions within the organization describes this theory-in-use. These actions influence the learning progress at Rijkswaterstaat. Moreover, only learning on the SCB method is considered. This also includes actions that try to minimize the difference between
the actual and aspired achievement of the contract control (the error that the learning is aimed to minimize). This chapter helps to understand these three views on learning in an organization by presenting a theoretical model for learning.

This research uses the three aspects to evaluate the expected and actual learning. This chapter described how these aspects influence the capability for an organization to learn effectively, the next two chapters evaluate these three aspects and identify deficiencies in the difference with the theoretical learning. Figure 11 visualizes this process; the two differences are evaluated on basis of the three aspects, this evaluation results in the identification of deficiencies in these differences. Chapter 5 and 6 analyze the difference and describe the deficiencies on the three aspects. Chapter 7 presents causal analysis of these deficiencies. Opportunities to minimize these deficiencies are identified by reflecting on the theoretical view of these deficiencies and inductive reasoning on the causes of these deficiencies.
This chapter constructed a model that enables the identification of learning in an organization. Thereby the first sub question of this thesis is answered: What is learning in the context of this research? Throughout the model, there is attention to the objects of learning as for the opportunities to improve learning this information is useful. The model determines this level by reflecting on three aspects:
- Two dimensions that enable error detection; the degree of empowerment and error openness.
- Presence of the error correction actions based on their cognitive nature; this divides them into single or double loop actions.
- The presence and level of usage of Socialization, Externalization, Internalization and Combination as knowledge conversions.

This chapter described how learning should take place from the theoretical view. Furthermore, this thesis uses the identified three aspects to evaluate the differences between the three views on learning; theoretical, expected and actual learning. The differences that prevent improving the method’s success in the projects are deficiencies.
Expected Learning 5
This chapter describes the expected learning by the management of the organization on the SCB method. This expectation includes the description how learning should be organized within the projects and in the regional department. Thereby, this chapter answers the following sub question:

What learning does the management expect in projects?

The answer to this sub-question enables the identification of deficiencies in the difference between the actual and expected learning. These deficiencies on the aspects of learning are included in this chapter. The analysis of the causes results into opportunities to improve the learning on the SCB method in chapter 7. This chapter is based on information from Rijkswaterstaat policy documents, manuals and interviews. The list of interviews is included in appendix C.

The expected learning builds on the wish to implement the method by the senior management of Rijkswaterstaat. The first sub-sub question elaborates on the members and sections within the organization that manage the implementation of the SCB method. The second sub-sub question relates the expected learning with the theory on learning. The answer to the third sub-question is formulated by answering these two sub-sub questions:

2.1 Who manages the implementation of the SBC method in the organization?
2.2 What learning is included in the organizations formal structure?

5.1 Implementation of the SCB method

The Senior Management Advisory Unit (SDG) of Rijkswaterstaat issued the wish to split responsibilities in the projects between Rijkswaterstaat and its contractors. In this view, the quality management system of the contractor is basis for the quality assurance for Rijkswaterstaat in the projects. This approach is translated into a theoretical framework for the implementation of the SCB method and is documented in the manual SCB (Kuijpers and Berg, 2007). The implementation of the method is included in the management contracts that the regional departments sign with the national Senior Management Board of Rijkswaterstaat (p.7) (Rijkswaterstaat, 2009g).

In order for this national top-down wish to implement the working method, each regional department has a coordinator SCB that on behalf of the managing director (HID) of the regional department is responsible for the implementation of the method (p.10) (Ministerie van Verkeer en Waterstaat, 2009a). This is the head of the contract management section. An expert team supports the coordinator in this task for the regional department South Holland (p.17) (Kenniskring SCB). The expert team has the objective to promote the professional application of the method within the regional department of South Holland. Furthermore, the teams on the regional level have regular meetings where they share information and knowledge on the SCB method. The team consists of members from the districts, the technical department (RTE), the contract management department (RCM) and the Information and Administration Section (BBD).
There is a helpdesk for all questions/ issues on the implementation of the method on the national level (DI/IMG). Each regional department selected two projects for cooperation with the helpdesk. These projects at the regional departments post their questions at this helpdesk and the helpdesk provides support on the SCB method in the projects. This helpdesk stopped in 2010 (CFO, 2008), most fundamental issues are mapped and the main issue for the future is to improve the method in projects (Van Es, 2009). The tasks of the helpdesk are incorporated in the regional departments (p.20)(Ministerie van Verkeer en Waterstaat, 2009a).

The method has not reached the desired implementation in the organization. This resulted in several measures to improve the implementation of the method within the organization. A helpdesk started after an audit of the Court of Audit of the ministry of Transport (DAD) in 2007, that stated that the method was not executed as theory suggested (CFO, 2007). The audit of 2008 identified some improvements in the implementation of the method, but also mentioned the lack of traceability of the method in the organization (DAD, 2008). The Chief Financial Officer of Rijkswaterstaat a national plan to promote the implementation of the SCB method on basis of this audit issued (p.9) (Ministerie van Verkeer en Waterstaat, 2009a). His plan ordered the regional departments to translate the policy in regional plans to implement the SCB method in the regional departments. This plan from the regional department of South Holland includes most recent developments on the implementation of the SCB method.

The contract manager and his contract control team are responsible for decisions on hiring of contractors and the control of these contractors. Therefore, the actual application of the instruments from the SCB method is the contract managers’ responsibility (Rijkswaterstaat, 2008c). Nevertheless, as the problem description mentioned implementation of the SCB method involves other parts of project management of Rijkswaterstaat; for instance the specification of the works realized by the contractors by the technical manager, and issues on the environmental issues of the project locations by the environment manager. The implementation and improvement of the application of the SCB method is therefore one of the key risks for the project teams at Rijkswaterstaat. The managers project management are responsible for the internal quality management of the project team, this also includes the process for learning the SCB method at their projects.

Multiple mechanisms monitor project performance at the regional department. First, there is the financial control on the projects from the CFO by the Court of audit from the ministry. The implementation of the SCB method is one of the topics in these audits pursuant to the wish of the CFO. Second, the internal client of each project is concerned about the progress of the project, but is also concerned on in the development process of this progress (betrokken opdrachtgeverschap) (Rijkswaterstaat, 2008b). This means that the internal client is concerned about the implementation of the SCB method in the projects. Nevertheless, there is no systematic monitoring of the implementation of the SCB method by the internal client to the managing director of the regional departments. Third, the Control and Oversight (BCT) section is responsible for reporting the progress of the project to the managing director of the regional department.
This paragraph provides the answer to the following sub-sub question:

2.1 Who manages the application of the SBC method in the organization?

The Director General of Rijkswaterstaat issued the implementation of the SCB method, the regional departments have a coordinator that coordinates the implementation of the method and the national Infrastructure Realization (DI/ IMG) section supports the regional departments and projects in their tasks. The Court of audit from the ministry (DAD) controls the financial results of the projects on behalf of the chief financial operations (CFO) of Rijkswaterstaat and thereby the legitimacy of payment in contracts. The internal department BCT (project control and oversight) of the regional departments controls the projects on their progress and financial progress on behalf of the managing director (HID) of the regional department. The actual application of the SCB method is located at the project teams that are subject to the client of their projects. This internal client is concerned about the progress and process for this progress. The internal quality management of projects is the responsibility of the managers project management. The implementation and improvement of the method within projects is the responsibility of the managers project management.

5.2 The expected learning

The first paragraph of this chapter illustrates different objects within the organization that are involved in implementing the SCB method at Rijkswaterstaat. This paragraph focuses on the learning that the formal structure and working processes of Rijkswaterstaat prescribe. These are the expected working processes in the organization. This also includes the actions from the line organization. These line organizations are the managers of the different sections of the regional departments that influence the actions of individuals in the project teams. This provides information about the expected learning on the SCB method at projects of the regional department.

The SCB implementation plan of the regional department states an objective of the implementation that includes the national implementation objectives. The regional plan states that the following should be realized for all projects end 2012 (p.6) (Kenniskring SCB dienst Zuid-Holland, 2009):

- Adequate and up-to-date contract control management.
- Adequate connection between risk files, risk tests and test reports.
- Adequate and up-to-date overview of findings and deficiencies.
- An efficient mix of tests.

These objectives concern the actual implementation of the instruments for the method in the projects. Learning the SCB method as this thesis described involves the internal quality management that enables the improvement of the application of the method. Therefore, the rest of this paragraph reflects on the criteria for learning from the fourth chapter. These criteria evaluate learning in the expected learning on the internal quality management.

5.2.1 Error detection in expected learning

The first paragraph indicates that empowerment of the actions in the implementation of the method is situated in the project teams. Nevertheless, openness for errors is low as the expectation to perceive these errors is low.
The national DI section provided a form for detecting the degree of implementation of the SCB method in a project (Peters, 2009). The results of this form can help project teams to detect the difference between the actual and aspired achievement of their contract control in the projects. Nevertheless, the form includes the presence of instruments related to the SCB method and the internal quality management monitoring. There are no specific questions on underlying reasons for the errors in the application of the method. Therefore, the form does not enable effective corrective actions in the internal quality management system. Besides the presence of the instruments, the form does also not provide guidelines for the aspired achievement of the contract control in a specific project.

The implementation plan describes the reporting to the internal client of the improvement progress of the implementation of the SCB method (p. 11) (Kenniskring SCB dienst Zuid-Holland, 2009). The plan announces the use of these progress reports next to existing t-reports (trimester reports used at Rijkswaterstaat to track general progress of the projects). These reports will include at least:

- Progress and planned progress of the adequate and up-to-date contract control management.
- Progress and planned progress of adequate connection between risk files, risk tests and test reports.
- Progress and planned progress of an adequate and up-to-date overview of findings and deficiencies.
- Progress and planned progress of an efficient mix of tests.
- Progress and planned progress of use of the URSCB tool.
- Progress and planned progress of using the standard IMG models (standardized documents).

This thesis could help the project teams and the SCB coordinator to detect the errors in the contract control. The plan does not mention whether the intention is on errors in the application of the method or the internal quality system of the project team. Emphasis on the linkage between the progress, planned progress and the underlying reasons for deficiencies could help to improve the internal quality management system of the SCB method.

One of the formal tasks of the manager project management is to safeguard the internal quality of the project team (p. 8) (Rijkswaterstaat, 2008c). The project manager has the task to regularly evaluate the performance of the project. Applying audits on the functioning of the project team could help fulfilling this task. These audits include reflecting on the differences between the expected and actual behavior of the project team. There is no description on the measurement of success of the method in a project for the internal quality on the implementation of the SCB method,

in December 2009 the CFO of Rijkswaterstaat reported to the regional departments that the implementation of the SCB method is not completed (CFO, 2009). In the letter, he states that one of the future improvements is the right mix of tests in projects; there are too many product tests executed (p. 2). Nevertheless, there is no description of the right mix and there is no process description how the regional departments should achieve this right mix of tests.

5.2.2 Corrective action in expected learning

The use of the implementation form is an example of an action embedded in the structure of the organization that enhances single loop learning. It aims at helping the project teams to meet the organization norms in the correction actions on the instruments of the method.
The implementation plan describes the reviewing of all contract control plans by the SCB coordinator of the regional department (p.6) (Kenniskring SCB dienst Zuid-Holland, 2009). These reviews result into recommendations that improve the quality of the plans. It is unclear whether the quality recommendations relate to the application of the instruments or the internal quality management system of the project.

Nevertheless, the form, the URSCB tool and other documents do not mention other actions that a project team should take in order to meet the organizational norms on the SCB method (single loop learning). Nor are there descriptions how the project team should question the organization norms on the SCB method (double loop learning).

5.2.3 Knowledge conversion in expected learning

An education plan to train lead-auditors was started in 2008; these lead-auditors are capable of performing audits (tests) and relate the SCB method to the ISO 9001 standard used by the contractors. This education program aims at improving the availability of a group of qualified people on a national level. The objective is that lead auditors perform all system tests in the future (p.19) (Ministerie van Verkeer en Waterstaat, 2009a). This education program of lead auditors is a good example how the knowledge on the method by the lead auditors is converted from explicit knowledge into tacit knowledge within their audits at projects (internalization). They apply the knowledge provided in the courses in their daily project activities, and they help other project team members, thereby it also involves the conversion by socialization.

The policy documents provide an example of knowledge conversion by combination. The expert group SCB arranges meetings where interested employees meet to discuss specific aspects on the application of the method. Furthermore, the regional department will provide a ‘best practice’ for the national site on SCB (maintained by the national section DI/ IMG) (16/17) (Kenniskring SCB dienst Zuid-Holland, 2009).

This paragraph provides the answer to the following sub-sub question:

2.2 What learning is included in the organizations formal structure?

The documented formal procedures provide the information for this answer. The prescribed learning on SCB method to improve the success of the method does not include error detection. There is a start of a process to detect errors in the use of instruments related to the method, but the nature of actions that follow these error detections is unclear; they are likely to be of single loop nature, aimed at correcting actions within the organizations’ norms. Formal documents do not describe either the improvement of the application of the instruments in the projects or the success of the method. Knowledge conversions are prescribed on an irregular schedule and are only limited facilitated.
5.3 Identification of deficiencies

This paragraph describes the difference between the theoretical and expected learning. The existence of this difference itself is no cause for unsuccessful learning the SCB method. There might be good reasons for maintaining the difference. Nevertheless, three aspects from the theoretical learning enable evaluation of this difference. The evaluation of these three aspects result in deficiencies when solving the difference that particular aspect result in improving learning the SCB method. This evaluation is based on reflection of the theoretical learning and inductive reasoning. Chapter 7 identifies causes for these deficiencies.

Aspect 1: error detection
There is a difference between theoretical learning and expected learning. In the expected learning, there is no clear prescription of the error. The organization does not expect this type of error detection in the learning. The implementation form SCB, mentioned in the chapter on expected learning, measures the application of instruments related to application of the SCB method. However, this does not involve errors in the success of the method in projects. There is no systematic check on the implementation of the working method expected by the management. The theoretical learning indicates that the more the project teams are empowered the more errors are likely to occur and the more error openness the more errors are detected. Nevertheless, the expected learning does not mention a systematic detection of errors in the implementation of the working method within the project teams. Nor does it define how success of the method can be measured in the projects. It is not possible to detect errors, when there is no aspired goal in which learning should develop. On the SCB method there should be a description of defining the proper usage for the quality management system of the contractor in a project.

The detection of errors is described as the first aspect of learning that enables the other two aspects. Therefore, the absence of features on this aspect in the expected learning is a deficiency in the difference between the theoretical and expected learning. In the remaining of this thesis this deficiency is called; ‘No description of the method’s success’ (deficiency 1).

Aspect 2: error correction
The nature of actions that try to improve the success of the method is unclear; they are likely to be of single loop nature thus aimed at correcting actions within the organization’s norms. Formal documents neither describe the improvement of the application of the instruments in the projects nor the internal quality management system. The empowerment to detect errors in the implementation of the method is situated at a project team’s level. The implementation plan SCB (from both the national level and regional department) does not describe a system for project teams that enables project teams to correct errors themselves. Theoretical learning suggested that learning is more effective when corrective actions are taken on the organizational level where these errors evolve.

The difference between the theoretical and expected learning on the aspect of the error correction is subjected to the lack of proper error detection in the expected learning, which is described in deficiency 2. Nevertheless, the difference on this aspect is considered as a deficiency in the difference.
Aspect 3: knowledge sharing
Knowledge conversions are only expected on an irregular schedule and are only on a limited basis facilitated. For example, the experiences of project team members’ actions that improve the success of the method are not documented. This is possibility to converse knowledge by internalization. The expected learning only involves two of the four knowledge conversion phases; this itself is not different with the theoretical learning. The other two phases involve the transformation of tacit knowledge, which is harder and more likely to identify in the actual behavior of the organization and not in the expected behavior.

Therefore, the difference between the theoretical and expected learning on this aspect is no deficiency. It is unnecessary to prescribe and expect knowledge conversion phases in policy documents. The expectation of the management should focus on facilitating knowledge conversions and leave room in the actual behavior of the organization. This facilitation is addressed in the difference between the expected and actual learning.

The deficiencies in the difference between the theoretical and expected learning are visualized in Table 6. This provides the input for chapter 7 that analyses the causes of these deficiencies.

Table 6: Deficiencies in difference between theoretical and expected learning

<table>
<thead>
<tr>
<th>Deficiency in the difference between theoretical and expected learning</th>
<th>Aspect 1: error detection</th>
<th>Aspect 2: error correction</th>
<th>Aspect 3: Knowledge sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No description of the method’s success</td>
<td>No incentives for error correction</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Summary expected learning**

This chapter provided the answer to the following sub-question: What learning does the management expected in the projects? The project teams have the responsibility to apply and learn on the SCB method in their projects. The SCB coordinator at the regional departments facilitates the implementation and developments of the method. The senior management of Rijkswaterstaat formulated the wish to apply the method. Main insight of this chapter is finding that there is no expectation of the detection and correction of errors by project teams on learning the method.
Actual learning
This chapter reflects on the actual learning of the SCB method and its differences with the expected learning. The information on actions from the cases presented in the first paragraph construct a theory on the actual learning of the regional department South Holland of Rijkswaterstaat. Chapter 4 provides a theoretical model that enables identification of learning in the cases. The last paragraph of this chapter identifies the deficiencies in the difference between the actual learning and expected learning on basis of the aspects from the model. Thereby this chapter provides the answer to sub question 3:

How is Rijkswaterstaat actual learning the system based contract control method?

The sections of this chapter answer the sub question with the following sub-sub questions:

3.1 How are errors in the contract control detected?
3.2 How are these errors corrected?
3.3 How is the knowledge on these actions shared?

6.1 Case descriptions

This paragraph describes four cases that are the basis for the case study. It presents a brief overview of the characteristics of the cases. This familiarizes the research on the learning and a specific contract control method with the practical application that it supports. This is the responsibility for construction and maintenance of public works. The next paragraphs use information on these cases as empirical basis and for illustration. The difference between the expected and actual learning at Rijkswaterstaat is determined based on the findings in the cases on the actual learning. This chapter presents four cases that at the time of the research are in development. These projects are named after their location or network name:

- Plan study A13/A16.
- Dordtse Biesbosch.
- A12 The Hague- Gouda.
- Hollandse IJssel.

The methodological elaboration on the case study and the information sources are included in appendix C and D.

Actions that result from learning on the SCB method are visible within the projects of the organization. This actual learning is analyzed using cases study that consists of interviews and documentation from four projects at the regional department South Holland of Rijkswaterstaat. Table 7 summarizes the cases, their characteristics and interviewed RWS employees. The case study in this thesis is a descriptive theory-building case study. This means it constructs a theory on the actual learning in the organization. This provides insight into the learning processes in the organization. Because the case study is theory descriptive / building, the cases are selected on the likelihood of providing useful information. The selection of cases is not subject to statistical sampling for validity as traditional hypothesis-
testing studies are (p.43) (Yin, 2008). Theoretical sampling where the processes of interests are transparently observable is sufficient for descriptive and theory building cases studies. Theoretical sampling involves the selection of cases that are likely to replicate or extend the emergent theory (p. 537) (Eisenhart, 1989). This means that the case analysis results cannot be used for theory testing or comparing learning in the cases.

Table 7: Cases overview

<table>
<thead>
<tr>
<th>Case</th>
<th>Project phase (as in November 2009)</th>
<th>Type of (main) works in project</th>
<th>Magnitude</th>
<th>Interviewed RWS employee</th>
</tr>
</thead>
<tbody>
<tr>
<td>A13/A16</td>
<td>Planning phase</td>
<td>Study phase of new highway connection</td>
<td>Costs unknown, construction of approx 10 km highway.</td>
<td>Contract manager and manager project management</td>
</tr>
<tr>
<td>Dordtse Biesbosch</td>
<td>Preparation of execution</td>
<td>Decontamination and restructuring of water system</td>
<td>32 million euro’s, 140 ha soil</td>
<td>Contract manager and manager project management</td>
</tr>
<tr>
<td>A12 The Hague-Gouda</td>
<td>Execution</td>
<td>Construction peak highway lanes</td>
<td>150 million euro’s, involves more than 15 km highway</td>
<td>Contract manager, test planner and manager project management</td>
</tr>
<tr>
<td>Hollandse Ijssel</td>
<td>Execution</td>
<td>Decontamination and restructuring river</td>
<td>49 million euro’s, 20 km river and objects</td>
<td>Contract manager and manager project management</td>
</tr>
</tbody>
</table>

6.1.1 Plan study A13 – A16

In the early phases of this project, the activities were combined with the study for the extension of the A4 from Delft to Schiedam. Both projects aim at improvement of the road mobility in the region Rotterdam – The Hague. The activities for both highway extensions were tendered out by one contract. Recently, both projects are separated into independent projects. Now two project teams from Rijkswaterstaat control both one extensions of the initial contract.

Project scope

The project A13/A16 is a study project for the possibility of a new highway connection between the A13 and A16 north of Rotterdam. The project researches the mobility, environmental, traffic safety effects of multiple alternatives on a regional level. In November 2009 the entry document (‘startnotitie’) for the project was finished, the traject nota/ MER at time of the research is almost accepted and the third phase has been realized. This third phase is the draft design of the final route for the highway (ontwerp trace besluit). The project has tendered this draft design to a combination of two engineer design companies: Witteveen en Bos and ARCADIS, who also designed the traject nota/MER.

For the study of new connections and effects on the highways A13/A16/A20 alone which involves more than this project, there is a budget of 3,6 million euro’s for the period 2009-2011 (p.26) (Rijkswaterstaat, 2009g). This illustrates the magnitude of the project.
6.1.2 Dordtse Biesbosch

The Dordtse Biesbosch is an approximately 1000 hectare water area near Dordrecht. It is part of the Hollandse Biesbosch, which is a national park. This area is part of the national water system and subjected to the responsibility of Rijkswaterstaat. Decontamination in this area is required due to regulation on soil protection (‘Wet bodembescheroming’). The decontamination plan ‘Waterbodem Rijkswateren 2006-2011’ from Rijkswaterstaat issued projects for the most contaminated waters in the Netherlands; the Dordtse Biesbosch is one of them.

Project scope

The project includes the decontamination of 140 ha water soil and the restructuring of the Jongeneele Ruigt. The objective of the decontamination is to remove toxic soil to an acceptable level; which is based on the quality of new sediment. Furthermore, the Jongeneele Ruigt is a creek area where the tide difference is 0.70 meters. This 49 hectare is decontaminated and restructured. It will transform into a green and recreational area. The total budget for all activities in this project is 31.8 million Euro (Legierse, 2005). These activities were tendered on the basis of lowest price to one contractor.

6.1.3 A12: The Hague – Gouda

The A12 highway is the oldest highway in the Netherlands; it starts in the city of The Hague and ends at Zevenaar. The 137 kilometers of highway connects the Randstad (a city metropolitan that includes the four biggest cities of the Netherlands and includes 7+ million people) with Arnhem and the German Ruhr area. The part of the highway between The Hague and Utrecht was constructed from 1933 till 1940 in clinkers. The construction and maintenance project that Rijkswaterstaat has ever since realized on the A12 is numerous. Nowadays, it is one of the most intensively used highways of the Netherlands.

The A12 stretches along 3 provinces and 36 municipalities. Within Rijkswaterstaat, three regional departments (South Holland (DZH), Utrecht (DUT) and East Netherlands (DON)) are cooperating for maintaining this highway. The focus of this case is on that part of the highway which is situated in the province of South-Holland; this is the part that is under the responsibility of the regional department of South Holland of Rijkswaterstaat. A cohesive package of measures in cooperation between the city region Haaglanden, the province South Holland and Rijkswaterstaat is implemented since 2001. This package aims at improving the traffic flow on the A12. Special legislation (“spoedwet”) from 2003 on enabled a faster realization of projects that tackle bottlenecks within the Dutch highway network.

The project office A12 is responsible for the execution of measures that belong to Rijkswaterstaat’s responsibilities. The project office has been responsible for all works on the A12 since 2001. Most employees (the project manager, but also contract manager) have been working on the project for a long period. Therefore, information within the case stretches over a longer period than the evaluated contract. Nevertheless, the case is focused on a contract between Rijkswaterstaat regional department South Holland and Ballast Nedam for which the works are under construction in order to identify actions.

Project scope

This project of Rijkswaterstaat started in 2001. The activities started with planning activities and tender preparations. Preparatory activities were tendered in preparation of the main contract. This included adaption of existing works and earthmoving that enabled construction of works in the main contract. These activities were tendered to two contractors; KWS and
Ballast Nedam. The main contract is tendered to Ballast Nedam and involves activities worth 150 million Euro, that are constructed within 1.5 year.

The main contract expires in March 2010. This is the last contract in the program “De A12 vernieuwd op weg”. This main contract includes the following works:

- Construction of peak lanes between Zoetermeer-Oost and Gouda (between the kilometers 12 and 27); Including the widening of the road and adaption of works.
- Construction of a new entry from the provincial road N219 (Zevenhuizen to Waddinxveen) to the A12.
- Reconstruction of the entry from the provincial road N209 (Bleiswijk) to the A12.

Furthermore, the contract includes an adaption of the traffic management center South-West Holland and additional works in the municipalities of Zoetermeer, Bleiswijk, Zevenhuizen/Moerkapelle, Waddinxveen, Moordrecht and Rhoon. This is a D&C contract granted on basis of most economic value criteria (EMVI). The contract explicitly states that the contract is controlled on basis of system based contract (SCB) control. The minister of Transport, Public Works and Water management opened the peak lanes on the 18 January 2010 (Eurlings, 2010).

### Hollandse IJssel

The Hollandse IJssel is a river that flows from the Waaiersluis to the Nieuwe Maas. The European Water Framework Directive (EWFD) aims at improving surface quality and groundwater quality in Europe. The project Hollandse IJssel is one of the projects that started as part of the implementation of the European directive. The project is a cooperation between 11 public organizations and has the objective to realize a clean river in a green environment with space for working, housing and recreation. The project is one of the biggest soil decontamination projects in the Netherlands. The contract scope is from the initial investigations until five years of maintenance afterwards. The contract is one of the first contracts for this kind of work, granted with the EMVI method.

The project activities involve the decontamination of more 20 km river, cleaning of 45 riverbeds and reconstruction of riverbanks. The actual execution of these activities started in 2008, the final phase of the project is starting and will continue until September 2011, these activities are located on the part of the river between Capelle aan de IJssel and Gouda. For this research, only the activities of the project on which Rijkswaterstaat is involved are considered. This project of soil decontamination and reconstruction alone involves a budget of 48,9 million euro’s (p.36) (Legierse, 2005). The actual execution of the physical work is tendered to Martens en Van Oord. Rijkswaterstaat tendered the contract control to Witteveen en Bos, who, on behalf of Rijkswaterstaat control the contract with Martens en Van Oord using the SCB method. Rijkswaterstaat itself controls the contract with Witteveen en Bos and has five specific tasks in the contract control on Martens en Van Oord:

- Approval of performance notification.
- Chair and schedule of progress meetings (with Martens en Van Oord; and Witteveen en Bos).
- Handling of deficiencies.
- Handling of claims and penalties.
- Draft of contract control plan (structure for Witteveen en Bos).
6.2 Error-detection in actual learning

The ability of the individual and project team in the cases to detect errors is determined by reflecting on the dimensions provided by the chapter on learning in theory (chapter 4). The presence of these dimensions facilitates learning and in combination with the knowledge conversion, indicates the learning capabilities of the organization. Reflection on these dimensions is based on the information from the cases described in the former paragraph, project documents (contract control plans, test plans and project control plans) and the interviews with the contract managers and manager project management from the cases.

6.2.1 Dimension 1: degree of empowerment

Visser describes the degree of empowerment as the command and control structure of the organization; positioning of responsibilities, the number of managers, responsibility on policy formulation, knowledge and information level of managers (p.4) (Visser, 2009).

The cases show that the responsibilities for specific actions of the contract control should be located at the project team level. The contract manager and its contract control team are responsible for testing the contractor’s activities by organizing system, process and product tests. The internal client directs the project team and is responsible for the project scope on behalf of the external client (mostly the ministry). The line organization managers have little knowledge on the actions that employees perform in the projects. They are not situated in the project’s organization but are dispersed over the line organization. For example, there are project managers from the national department DI, working on projects of the regional department, their managers in the line organization have little knowledge on the actions in a specific project. The internal client is only involved in actions of the SCB method when they influence the framework created by the internal client. This framework involves time, budget and scope of the project. The A12 and Biesbosch cases illustrate this; both projects are under high time pressure, this result in a lower degree of empowerment in the project teams as in the other cases. The policy formulation, on the other hand, is a centralized task, that the line and staff of the Rijkswaterstaat organization perform on internal affairs. The chapter on expected learning illustrates this. The Ministry of Transport and Public Works formulates policy on external affairs. The number of functions that include the term ‘manager’ is high. Nevertheless, Visser’s terminology means managers in terms of line organization managers. For Rijkswaterstaat these managers are not situated in the projects, but have responsibility for the Rijkswaterstaat employees in the project teams. This result in the conclusion that the number of managers involved in the actions on the SCB method of project team members is limited.

The cases provide information on the empowerment within a project and its effects on specific actions of the project team. In addition, this indicates on which level actions pursuant to learning are taken place. Learning on the SCB method should be situated at the project level as they are empowered to take actions that improve the success of the method.
A13/A16

It was not obligated to use the SCB method for the planning phase of a project. The project team decided to control its contracts in its project using the SCB method, as they have good experiences with the specific contractor using the SCB method in the earlier contract on the Trajectnota/MER phase of the project. The project team perceived that by applying the method it could save costs and effort on the contract control in comparison with the traditional contract control method. Nevertheless, the external client (division Mobility from the Ministry of Transport and Public Works) demands a heavy product test at the end of the contract. This reduces the advantages in efficiency on the quality assurance of using the SCB method by the project team. The project team has to prove to its internal client that the product from the contractor meets the contract requirements. This means that there is learning on the individual and project team level. There is experience in applying the method; there is also a reflecting (detection) on the current situation resulting in actions (corrective). Learning is not visible on the organizational and inter-organizational level; the external client does not adapt actions to the new situation in its requirements on the project.

Dordtse Biesbosch

The project team experienced difficulties in the application of the SCB method in the cooperation with the contractor. There was a difference between the capabilities and the required capabilities of the contractor to deliver Rijkswaterstaat information. For example, the activity’s plan is rejected several times. The project team decided to increase manpower on the contract control after consulting the internal client. The SCB method in an adapted form is applied for the contract control. The project team decided to help the contractor developing its capabilities. The internal client had to decide based on information from the project team on this increase of working force on the project and the additional costs. In terms of applying the SCB method, this means that Rijkswaterstaat choose to decrease the distance to its contractor and not only test the contractor on basis of system, process and product tests, but helps to construct the quality system of the contractor. The basis for this decision is discussed in the paragraph on the error openness.

In this case, the empowerment to take actions on the project scope is located at the internal client, although he is depended from the project team for the information for his decisions. This example shows that it is likely to have some learning on the SCB method on the organizational level. The information from the project team that supports the decision of the internal client also includes information on actions on the implementation of the SCB method. This information could accommodate future decisions of the internal client and could indicate learning of the SCB method on an organizational level of the regional department.

A12: The Hague - Gouda

The A12: The Hague -Gouda case presents information on the level of knowledge of the managers in relation with the responsibility of policy formulation. The project team continuously develops an up-to-date test plan based on their risk register. This process results in activities that determine the transfer of responsibilities from Rijkswaterstaat to its contractor. Simplified: emphasis on system tests means more distance and less contract control costs while the emphasis on the product test means fewer distances and more contract control costs. In reality, this is far more complex as is described in the problem description. In principle, the empowerment on these decisions is taken at the level of the project team, as they do not influence the internal client framework, but the financial justification also...
influences the behavior of the project team. In the A12 The Hague-Gouda case the Audit service from the Ministry of Transport and Public Works (DAD) concluded in their report that the current application of the contract control only partly met their requirements for financial justification of the project (Nandram et al., 2009). Besides other recommendations, the DAD mentions at least the testing of the top risks from the risk register. The project team dissent from this general policy. For example, when some risks have been tested lately, but score high in the risk register; the project team then does not test these risks in the next test planning, but chooses to test less high scoring risks. There is no systematic check on these faults in the application of the SCB method.

This case illustrates that the information on the contract control and information for justification of payment is available in the project teams of Rijkswaterstaat. However, the staff and line organization is responsible for the policy formulation; in this case the DAD as being a staff service from the client of the project at Rijkswaterstaat.

Hollandse IJssel
In this case, the responsibilities for the actions in the contract control with the SCB method on the constructor of the works is situated at Witteveen en Bos. Nevertheless, the Rijkswaterstaat project team controls the contract with Witteveen en Bos and has five tasks in the contract control on the constructor. This suggests that learning on the SCB method is primarily situated in the project team of Witteveen en Bos. Limited learning on the five specific aspects of the contract control in the SCB method is taken place at the Rijkswaterstaat project team. Nevertheless, the empowerment at the level of the project team enables learning of the project team on this specific configuration in applying the SCB method in contract control on the constructor. The project team is able to hire Witteveen en Bos for controlling the contract.

Conclusion on dimension 1: degree of empowerment
The empowerment of the execution of activities involved in controlling contracts by the SCB method observed in the cases is merely decentralized; most projects have different working regimes for the practical implementation of the method. An example is the test frequency. The more decentralized the more errors according to the literature reviewed by Visser. The cases indicate that this is true. However, the responsibilities on actions that influence the time, budget and scope framework are situated at the internal client. Project teams in the cases operate within the framework of the internal clients. The responsibilities for the actions involving the SCB method are situated at the project teams and are relatively decentralized within this framework. This results in an emphasis of learning the SCB method on the individual/team level and less on learning on the organizational level. Each project has its configuration of project team members of Rijkswaterstaat. Furthermore, the empowerment to take actions is not always located at the project scale, the client of the projects sometimes interfere with actions that could influence learning on the SCB method.

6.2.2 Dimension 2: degree of error openness
Visser refers to describe error openness as the degree in which errors are regarded as opportunities for punishment/learning, problems are covered up/dealt with, existing practices are seldom/often evaluated and the level of trust between managers and employees (p.5) (Visser, 2009).
Plan study A13/A16
The degree of error openness on actions in the contract control is relatively high. The testing of the quality system of the contractor in this project phase has a limited impact on the effects of the possible construction of the highway extension later. Nevertheless, it is of vital importance for the project that the product from the current contract meets the demands of the client. This means for the contract control that actions could be evaluated without extreme pressure on the project team members, because there is room for searching for improvement and implementing these improvements. There is the quality check of the contract by a heavy product test next to the contract control of the project team, which the client insists on as mentioned in the former section on empowerment.

Dordtse Biesbosch
There is an example where the error openness is limited in the Dordtse Biesbosch case. The contract manager and the project team experienced difficulties in their cooperation with the contractor by using the SCB method for controlling the contract. These difficulties stem from the inexperience with the SCB method of the specific contractor and involve the mismatch in expectations on, for example, the proposal for the activities plan. There is no approved activity plan from the contractor at the time of the case study interview with the contract manager, although the project tendered months ago. This is highly unusual to this type of projects. The internal client agreed to tender this contract based on the lowest price instead of the current standard: the EMVI method. This means that the quality of the contractor’s tender is not considered. This decision does not directly include the actions that characterize the SCB method, but influences these actions. Therefore, this decision is a possible error that has consequences for the contract control based on the SCB method. Including the quality system of the contractor in the tendering process could improve the possibilities of applying the SCB method in the project.

The internal client, in consultation with the project team decided to support the contractor in providing the documents for meeting Rijkswaterstaat requirements on applying the SCB method. This means that Rijkswaterstaat also suggests improvements and helps to realize these improvements in the quality system of the contractor. This is in contrast with the passive checks on the quality system of the contractor. The project team and the internal client decided not to give the contractor more time to learn in the cooperation based on the SCB method. The reasons are the absence of trust in fast learning of the contractor on its own, in combination with the time pressure on the project. This project is of high political importance and the client put more importance on the time aspect in the framework for executing the contract than the execution of the project according the SCB method. Therefore, the internal client agreed to increase the budget for time allocation by RWS employees to help the contractor to meet the deadline of the project.

A12 The Hague- Gouda
This case shows that the error openness on both the contract control method and the project can be both relatively small in the project. One of the preparatory contracts is considered a failure; the contract and its contract control resulted in the execution of the works exceeding the initial costs and time. The main cause for the budget exceeding was the dispute between the initial contractor and Rijkswaterstaat on the specification of the contract; this resulted in hiring another contractor that finished the activities that according to RWS belonged to the first contractor. The project team decided to test the risks of the contract actively in the current main contract of the project. Furthermore, the project team is heavy involved in the construction by advising the contractor on specific contract specifications. This shows that
there is little room for errors. Another reason for the lack of error openness is that the initial project budget in time and costs is very strict. The activities of the contractor in 1.5 year involve more than 150 million and there is little slack in the schedule. The type of project also results in relatively low error openness. The activities on the A12 also demand temporary closure of the highway for the contractor to work. This affects one of Rijkswaterstaat main policy pillars: ensuring the availability of the main network. Thereby all activities that are controlled by the contract control influence the public involvement of the project. An example is the control of the contract by Rijkswaterstaat on the contractors approach to the direct environment of the project sites; Rijkswaterstaat employees advised the contractor which resulted in public friendlier measures of the contractor.

Hollandse IJssel
The error openness in this case is relatively high. The project has no specific driver other than the standard project production pressure from the organization to realize the project within project time and budget. Nevertheless, the schedule for the project is not very strict. The effects of completing the dredging a week later are limited in comparison with other projects. This means for the contract control that there is more room for learning as the effects of errors are relatively small. Therefore, error detection in the project is more likely. Nevertheless, due to a specific shortage of qualified personal on the characteristics of the project (test capacity) the contract control is tendered out. This increases complexity of the degree for error openness in the project as there are new interests introduced to the project. The interests of Witteveen en Bos are different from Rijkswaterstaat’ interests concerning the detection of errors in the success of the method. Their contractual relationship safeguards sharing of the knowledge on these errors in the contract control.

Conclusion dimension 2: degree of error openness
The cases of this research show that the degree of error openness varies over projects at Rijkswaterstaat. They also indicated some key determinants for the degree of error openness in a project and the effect on learning. In the A13/A16 case the error openness is relatively high on all levels of learning; individual, team and organization. The Dordtse Biesbosch indicates that political pressure to realize the project result in relative low error openness in the contract control of a project. The A12 case confirmed that external influences on the project determine the degree of error openness in the contract control in a project. There is low error openness in the contract control there, due to the huge interests in the project. The Hollandse IJssel case shows that projects with a less strict period and external pressure have a higher degree of error openness.

The degree of openness is primarily depended on the object of learning and the external pressure on the project in learning the SCB method. People are more likely at the individual level to be open for errors, whereas on the team level errors openness is less and on the organizational level the error openness is even lesser. The main driver for this error openness is the plausible effects of the error openness. The cases illustrate that the stakes of most projects are high and the potential effects of actions on the contract control are most of the times high.
This paragraph provides the answer to the following sub-sub question:

3.1 How are errors in the contract control detected?

The cases do not provide examples of error detection on the success of the method in projects. Nevertheless, there are factors that cause differences between the cases to detect errors. These differences are caused by the difference in political and public pressure on projects; as the A12 case illustrates. The difference between the actual and aspired achievement on effectiveness and efficiency of the contract control is not detected. Standard management information system monitors the actual achievement and progress of the project, but the aspired contract control is not visible in the cases. This indicates that there is no detection of errors on the effectiveness and efficiency of the SCB method on the organizational level. Nevertheless, this paragraph provides useful information on the dimensions that enables the error detection. The empowerment of actions on the direct application and the necessary information for decisions on the application of the SCB method is situated in the project teams. The error detection in the contract control is taken place at the individual and team level, not on the organizational level (in the sense of the line organization department, regional department or national level of Rijkswaterstaat). The degree of error openness depends on external pressure on the project; when the pressure is high error openness is low, and learning is less likely, and vice versa. Errors in the contract control are detected by the project teams, where their ability to detect these errors is depended on the external pressure on the project. There is a difference between the expected and actual learning on the error detection. The cases show the implementation form does not systematically stimulate the project teams to detect errors in the success of the method in their project. In the actual learning of the organization the measurement of the application of the instruments is starting, but is not completed. This shows that error detection on the success of the method is not taken place in the cases. The project team members perceive this as an unimportant issue in the daily project activities. The chapter on actual learning indicates that the information for measuring and the empowerment to identify the errors are located at the project teams of Rijkswaterstaat. The project teams operate under the internal client’s responsibility. The ability to detect errors is located at the project teams and the responsibility to give the project team space (time/ budget to cover failures) for error detection is located at the internal client.

6.3 Effective action in actual learning

The former paragraph reflected on the error detection in the contract control in the cases, the second aspect of learning defined in the chapter on theoretical learning is the corrective action that follows the detection of an error. The lack of proper error detection on the success of the method causes a lack of cognitive actions on the success. The essence of cognitive error corrections is the error detection that should be present. Nevertheless, this paragraph provides knowledge on actions and their nature on other aspects that influence the application of the SCB method in projects.

Based on the features of ‘good dialect’ from the theory chapter this paragraph discusses the indications for both single and double loop learning in the cases. This aspect of actual learning is closely related, and depended on the expected learning on the SCB method at Rijkswaterstaat.
6.3.1 Indications on single loop learning

Single loop learning involves the correction actions that aim at continuing present policies and objectives. In learning the SCB method, this involves actions that aim at closing the gap between the aspired and actual achievement of the contract control. The chapter on learning in theory provided characteristics of actions that indicate single loop learning: the effectiveness of actions that try to match expectation and outcome and sharing of memories, which provide context for interpreting the present error.

In all four cases, the planning of tests that monitors the system, process or product of the contractor is depended on the result of tests from the past and the activities of the contractor in that specific period. Risk registers are updated on basis test results, this affect the type of the next tests that are performed on the contract. This indicates there is a form of single loop learning in place, as the actual achievement is registered. In theory, this process should also reduce the number of tests when there is good confidence between RWS and the contractor on basis of the test results. In the A12 case, this reduction of the number of test is not observed in latest testing periods, the project team systematically tests the top 10 risks in the contract. Performance of the previous test does not influence the number of tests. In the project phases of the A13/A16 and Dordtse Biesbosch case the adaption of the tests planning and risk register has not taken place yet. This indicates that the mechanism for monitoring the error is present, although the actions do result in limited single loop learning effects.

A good example of single loop learning is present in the A13/A16 case. Although it is not obligated for projects in the planning phase to apply the SCB method on their contracts, the project team decided to use the method to control its current contract. The reason for this decision is that in the former contract the confidence between the contractor and RWS was constructed. The project teams were convinced of the benefits the method could provide in the contract control of the next contract. This indicates actual achievement of applying the SCB method complies with the aspired achievement of the project team. The A12 case provides another example of single loop learning at Rijkswaterstaat at the level of the project team. In an earlier phase of the project, another contract was controlled by the SCB method. This contract included primary construction works. The contract control for this case together with the characteristics of the contract caused problems in the realization of the project works. The contract process ended with a dispute between the contractor and Rijkswaterstaat that not has been resolved within the contract. This is an example where the actual and aspired achievement of the contract control did not match. This resulted in another approach in applying the SCB method in the main contract of the project. The update frequency of the test planning became higher and there is more discussion with the contractor outside the formal tests. This helps to close the gap between the actual and aspired achievement of the contract control.

Another example of single loop learning is that most projects use personal that have experience in the application of the SCB method as test coordinator. This helps to share the memories on the achievements of the method. Furthermore, employees (pool lead-auditors) specially trained in the ISO 9001 method perform system tests in different projects of the organization. Thereby memories about the achievement of the method over the organization are shared.
6.3.2 Indications on double loop learning

The correction actions in the contract control that aim at questioning the organization’s norms are double loop learning. In learning the SCB method this involves the questioning the stated aspired achievement of the contract control. The chapter on learning in theory indicates characteristics for double loop learning, the testing by individuals in the organization of the organization’s aspired achievement of the contract control and the ability to map the theory-in-use indicate double loop learning.

The contract control did meet the aspired achievements in the Dordtse Biesbosch case. Nevertheless, the project results did not meet the expectations; the contractor’s progress did not meet the schedule. This resulted in the adaptations of the aspired contract control. This action results from consultation with the internal client of the project. Besides the testing, the project team became more involved in the production of the product by the contractor. More specific the aspiration is adapted in terms of the number of people that executed the contract control. This shows that the application of the SCB method and its aspired achievement are questioned in the organization. This includes the consideration over fewer working hours on the contract control while safeguarding good quality of services by contracts.

Another example of double loop learning is the questioning of Rijkswaterstaat tasks in the Hollandse IJssel case. By outsourcing the contract control on the contractor the project team questioned the norms and aspired achievement of the contract control of the organization. Nevertheless, a specific shortage of employees that could control the specific contract caused the decision to outsource the contract control. This indicates that there is no single and double loop learning on the success of the method.

The lack of error detection in both the actual and expected learning prohibits effective correction actions. This means there are no cognitive actions that aim at improving success of the method. There is a lack of both single and double learning actions. The norms that single loop learning actions aim to realize are unclear. Therefore, the questioning of these norms is also impossible.

An example of the missing of effective action from the actual learning is the planning of the number of tests by the project team. The number is determined in the initial contract control plan, and without consideration, remains unchanged during the whole project. Whereas the ideal situation, the contract control heavy relies on the quality management system of the contractor. Furthermore, the project internal quality management system identifies errors in the success of the method; the number of tests is based on the confidence in the contractor’s quality management system. This means that the number of tests increases in case of a lack of confidence (from tests results) and decreases when the confidence is high. In that situation, there is a cognitive, well-considered action of adjusting the success of the method by adapting the usage of the quality management system of the contractor.

Nevertheless, there are actions in the organization that affect the application of the SCB method, but they do not influence the success of the method in the projects. The difference between the actual and expected learning in this application of the instruments is limited. On the individual and project team level, there are actions that improve the experience and knowledge of the usage of the instruments from the SCB method. These actions are identified in the actual learning and are supported by the expected learning in the organization. Examples are the expert group SCB meetings, standard forms and the implementation degree form.
This paragraph provides the answer to the following sub-sub question:

3.2 How are errors corrected?

Although there is no error detection on the success of the method, there are learning actions on the project team level that influence the application of the SCB method. The cognitive nature of learning in the cases is primary single loop, which means that the actions aim at continuing to present policies and objectives. Actions in the projects aim at executing the projects, regardless of the implementation of the SCB method. This means the single loop actions are not complete; as paragraph 6.1 discussed, the error detection is lacking in the cases. Therefore, the here mentioned learning actions have no strong cognitive nature. Nevertheless, mechanisms to implement these actions are in place. The regular meetings to update risk registers and test planning are an opportunity to address the efficiency of the contract control in the projects frequently.

Furthermore, little indications are observed for the existence of double loop learning on the SCB method, this involves the considering of the organization’s norms. A good example of second loop learning could be the presence of a decision process or discussion on the distance that the RWS project teams takes to the contractor in the projects. Nevertheless, these decision processes are not observed in the cases. From a theoretical point of view, error detection and the corrective action of the learning actions should include both single and double loop-learning actions.

6.4 Knowledge conversion in actual learning

The cases indicated that most learning actions are on the level of the projects and its individuals, the process of sharing the gained knowledge enables learning by others. The cases provide examples of knowledge conversations used in the organization in learning the SCB method. The examples from the cases are discussed on their categorization by knowledge conversion phase. Table 7 illustrates the categorization from Nonaka and Takeuchi, the chapter on learning in theory elaborated on this categorization.

<table>
<thead>
<tr>
<th>From</th>
<th>Tacit knowledge</th>
<th>Explicit knowledge</th>
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<tbody>
<tr>
<td>Socialization (individual to individual in a project)</td>
<td>Externalization (individuals over projects)</td>
<td></td>
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<tr>
<td>Internalization (at the individual in projects)</td>
<td>Combination (between projects)</td>
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6.4.1 Socialization

Socialization is the conversion from tacit to tacit knowledge by individuals within a project. In the cases, this conversion phase is taken place frequently, nevertheless it also the least tangible form of knowledge conversion as it involves very context specific elements. All cases have a project team and contract control team that reflect on the day-to-day activities of the
contract control in the cases. Most of this knowledge conversion is informal and unplanned; experiences in the contact with the contractor are shared and influence the actions of the individuals within the project team in the next contact with the contractor. An example of socialization is the cooperation of a contract manager with experience in applying the SCB method in the contract control and an experienced test coordinator in a project team, during the project its likely there is a high degree of knowledge conversion. Nevertheless, due to the intangibility of this phase of knowledge conversion, real measurements in the cases are impossible.

6.4.2 Internalization
The internalization is the conversion from explicit knowledge into tacit knowledge. This means the application and use of knowledge stored in the project documents and the organization manuals. The application of the manual SCB is supported by the education of auditors that perform tests. Furthermore, there are lead auditors trained in the ISO 9001 standard and they perform system tests in the projects.

6.4.3 Externalization
Externalization is the knowledge conversion phase where tacit knowledge is converted from the individual to explicit knowledge for the project. There are case specific examples of this phase of knowledge conversion in learning the SCB method.

All cases update their risk register and their planning plan on a regular basis. In the A12 case, the register is updated using 3 monthly evaluation session on tests in that period with all involved project team members and testers. In this session, the risks are reconsidered, discussed and transferred in an updated risk register. This register is basis for a new test schedule for the next 3 months. This is an example how tacit knowledge among the individuals of the project is converted in explicit knowledge in the application of the SCB method.

Examples of externalization of knowledge on learning the SCB method are unavailable in an explicit form. It is common to evaluate projects at the end of the projects. Nevertheless, explicit knowledge on learning the SCB method is uncommon.

This phase of knowledge conversion nonsystematic embedded in the practice of the projects and the knowledge is documented in different formats. Project teams have their own individual methods for relating the risk register, test results and test plans.

6.4.4 Combination
The combination conversion where different explicit knowledge is shared over different projects and persons is ad hoc and unsystematically in the cases. There is an exchange of information over the projects by individuals that work on different projects, by using and transfer their knowledge in multiple projects. The expected learning stated that the expert group SCB (kenniskring SCB) has an important task in developing and sharing the knowledge on the SCB method. Nevertheless, during the period of this research the group had one meeting. This frequency of meetings indicates that the knowledge conversion of combination in a systematic way in the actual learning is limited.
This paragraph provides the answer to the following sub-sub question:

### 3.3 How is knowledge on these actions shared?

The number of socialization conversions in the cases is much higher than other conversions. To develop knowledge on the SCB method all four conversions should be present and the types of conversion in balance. This means increasing the number of internalization, externalization and the combination conversions.

The cases did not detect knowledge conversions on actions that improve the success of the method. There are knowledge conversions on the application of the instruments for the application of the SCB method identified in the actual and expected learning.

The theoretical view on learning prescribes presence of four knowledge conversions in an organization to be effectively share knowledge and really learn. The expected learning does include these four knowledge conversions to a minimal extend.

The actual learning shows that the individual knowledge gained on the instruments of the application of the SCB method is not converted in explicit knowledge that can be shared in the organization. There is a difference between the actual and expected learning in the sharing of knowledge. For example, not all projects use the instruments provided by the organization. A practical example is the ICT tool URSCB. Furthermore, there is a difference between the expected and actual learning in the knowledge conversion of knowledge by combination. The expected learning indicated this conversion is systematically embedded in the organization, the actual learning showed the combination of knowledge over projects on actions of the success of the method is very limited.

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### 6.5 Identification of deficiencies

This paragraph describes the difference between the expected and actual learning. The existence of this difference itself is no cause for unsuccessful learning the SCB method. There might be good reasons for maintaining the difference. Nevertheless, three aspects from the theoretical learning enable evaluation of this difference. The evaluation of these three aspects result in deficiencies when solving the difference that particular aspect result in improving learning the SCB method. This evaluation is based on reflection of the theoretical learning and inductive reasoning. Chapter 7 addresses the identification of the causes of these deficiencies.

**Aspect 1: error detection**

There is no expectation to detect errors in the success of the method. Therefore, there is no difference between the expected and actual learning on this aspect. Nevertheless, a difference could be caused by the identified deficiency on this aspect. The empowerment to take actions on the success of the method is sometimes not located at the project level. The client of projects under political or public pressure is heavy involved in the project and demands more quality assurance than the SCB method provides. This results in low error openness, which decreases error detection by the project teams.

On this aspect, there is a deficiency in the difference between the expected and actual learning on the SCB method. Even with a clear expected detection of errors in the success of
the method, the empowerment and error openness will prevent learning on the SCB method. This deficiency is called: misplaced empowerment and lack of error openness (deficiency 3).

**Aspect 2: error correction**
In the actions that aim at correcting the errors in the SCB method there is no difference with the expected learning. There are no corrections actions expected, and there are no corrections actions identified in the cases that are the result of learning the SCB method. Therefore, on this aspect there is no deficiency that prevents learning on the SCB method.

**Aspect 3: knowledge sharing**
There are no actions observed on the success of the method on which knowledge could be shared. Furthermore, there is no overview that is accessible for other project teams with contact information of employees working on projects and their knowledge expertise. Nevertheless, the number of socialization of knowledge (between individuals within projects) is taken place on others issues. The conversion of knowledge by internalization, externalization and combination are very unlikely. Not facilitating these types of knowledge conversion is a deficiency in the difference between the expected and actual learning on the SCB method. This deficiency is called limited knowledge conversions (deficiency 4).

Table 9 summarizes these deficiencies in the difference between the expected and actual learning.

**Table 9: Deficiencies in difference between expected and actual learning**

<table>
<thead>
<tr>
<th>Deficiency in the difference between expected and actual learning</th>
<th>Aspect 1: error detection</th>
<th>Aspect 2: error correction</th>
<th>Aspect 3: Knowledge sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Misplaced empowerment and lack of error openness</td>
<td>-</td>
<td>Limited knowledge conversions</td>
<td></td>
</tr>
</tbody>
</table>
Summary actual learning

This chapter provided the answer to the following sub-question: How is Rijkswaterstaat actual learning the system based contract control method? This chapter provided insight in the practice of four projects. Thereby, specific learning on the success of the method is not observed in the projects, this chapter provided the deficiencies between the actual and expected learning from the former chapter. The misplaced empowerment and lack of error openness, together with the limited knowledge conversions are the deficiencies identified in this chapter. These deficiencies and their causes provide the information for recommendations that improve the learning on the SCB method in chapter 7.
Opportunities for learning
The three views on learning (from theory, expected and actual) in earlier chapters indicate learning on the SCB method at Rijkswaterstaat is not optimal, as there are deficiencies in the differences between the views on learning. This chapter analyzes the causes for the deficiencies. The identification of these causes is a result from the in depth interviews in the cases and synthesis on the information from the previous chapters. These causes enable identification of the opportunities to improve learning on the SCB method at Rijkswaterstaat. This provides the information for answering the fourth sub question of this thesis:

What are opportunities to improve learning on the SCB method at Rijkswaterstaat?

4.1 Why are there deficiencies?
4.2 How can these deficiencies be minimized?

7.1 Identified deficiencies

Table 10 summarizes the deficiencies identified in the former chapters. These aspects in the differences between the three views are critical in preventing the organization to learn the SCB method optimal. Two aspects have no deficiencies. As stated in the former chapter, although there is a difference on these aspects, the difference is not critical. The next paragraph indicates that factors that cause these deficiencies sometimes overlap and are interrelated.

<table>
<thead>
<tr>
<th>Deficiency in the difference</th>
<th>Aspect 1: error detection</th>
<th>Aspect 2: error correction</th>
<th>Aspect 3: Knowledge sharing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between theoretical and expected learning</td>
<td>No description of success</td>
<td>No incentives for error correction</td>
<td>-</td>
</tr>
<tr>
<td>Between expected and actual learning</td>
<td>Misplaced empowerment and lack of error openness</td>
<td>-</td>
<td>Limited knowledge conversions</td>
</tr>
</tbody>
</table>
7.2 Causes for deficiencies

This paragraph describes what causes the identified deficiencies in the differences between the three views. Figure 12 visualizes the relations between the deficiencies from the former chapters, their causes and measures presented in this chapter. This schedule helps to structure the analysis in this paragraph.

![Figure 12: Schematic overview of deficiencies, causes and measures](image-url)
7.2.1 First deficiency; no description of method’s success

There is a deficiency in the difference between theoretical and expected learning. There is no description of success of the SCB method that enables error detection in the projects. The projects cannot determine the optimal usage of the quality management system of the contractors on basis of the expectation by the management. Therefore, there is also no error detection expected by the management of Rijkswaterstaat on improving the success of the method in the projects.

This first step of error detection in applying the method is not formulated. This is caused by the lack of an aspired usage of the quality management system of the contractor. The success of the method is depended on the degree the projects can use the contractors system, and what effort the project teams should do to ensure the quality of the works in the projects. The detection of an error is only possible when there is a reflection of the actual usage versus the aspired usage in the projects. This reflection should include this criterion for the success of the method in a project.

The scopes of all projects are included in the management contract of each regional department with the Senior Management Board of Rijkswaterstaat. These documents mention the implementation of the SCB method in the projects in terms of applying the instruments. It does not state an aspired achievement for the contract control on the usage of the quality management system of contractors. Thereby there is no aspired usage of the quality management system of the contractor for the project teams.

Most feasible explanation is that there is no clear description of success of the method and an aspired usage of the quality management system of the contractor, because people in the organization do not accepted the transfer of the quality management of the works in the project to the constructors. There is resistance to change within the organization (cause 1). The senior management board of Rijkswaterstaat clearly stated the intention to use the SCB method and only test the quality management of the constructor on basis of system, process and product tests. Nevertheless, the expected learning as described in chapter 5 indicates that the success of this application of the method is not clear. This ambiguity of success in the expectation on this success is caused by the dynamics of the method and resistance to the implementation (cause 2). The implementation of such a method needs a lot of time and effort; nevertheless, this process can be supported by the measures presented in the paragraph 7.3.

The dynamics of the method is described in both the problem description the chapter on expected learning of this thesis. A good example is the development of a new SCB manual that is includes content related issues. This dynamics makes it hard to describe an aspired usage in the expected learning on the method.

Individual resistance to organizational change and by that to learning is based on multiple factors. This resistance is based on the relation between content, process and context (Walker et al., 2007). Erwin and Garman reviewed and summarized recent literature with respect to these factors. They identified factors that influence the resistance to change (p.51/ p.52) (Erwin and Garman, 2010):

- Communication; the level and perceived quality of communication on the chance.
- Understanding; individuals’ understanding of change initiative and the confidence of success of the method.
- Management consistency; inconsistency in change process provides justification for resistance.
- Participation; individual perceptions of their participation.
These factors could be stimulated in the expected learning. The existence of the deficiency indicates that in the implementation process these factors are not successful. The expected learning could be improved on these factors in the implementation process in order to detect errors and improve learning on the SCB method.

### 7.2.2 Second deficiency: no incentives for error detection

In the difference between the theoretical and expected learning there is a second deficiency identified. The expected learning does not expect error detection on the success of the method in projects. The focus from the management attention and their actions is on the usage of instruments for the SCB method. There are hard milestones for using the instruments; for example, every project should have an updated risk register in 2010. Nevertheless using the right instruments does not necessarily means that the success of the method is improved. This relation between the use of the instruments and improving the success of the method should be included in the expected learning stated by the management of Rijkswaterstaat. The expectation does not mention the responsibility of project teams to correct the errors in the success of the method in their projects.

The culture within the organization causes this deficiency. There is no internal evaluation of the project teams expected by the management, because the organization has no incentives to improve its own performance. There is no need for the project teams to perform (cause 3) and thus to improve the success of the method. The evaluation of project is expected on the project results, but not on the internal quality of the project teams. The external client is able to demand these evaluations. The effect of these evaluations in terms of costs for the project management by Rijkswaterstaat are transferred to the external client, without attention from this external client there is no incentive for the organization to expect improvements in the success of the SCB method in the projects. This is caused by a lack of attention from the external client for Rijkswaterstaat project organizations and their processes. The external client underestimates the importance (cause 4) of the quality of the project management of Rijkswaterstaat. In fact, it tests only the product of the project teams and has little attention to the process of the project team.

### 7.2.3 Third deficiency: misplaced empowerment and lack of error openness

The third deficiency is situated in the difference between the expected and actual learning on the SCB method. On the error detection aspect, the misplaced empowerment and lack of error openness prevent optimal learning the SCB method. These two deficiencies on the error detection aspect are interrelated and therefore named under one deficiency in this analysis.

The error detection is not likely to evolve by itself in the actual learning. First, the method is contrasting with the old working methods of contract control, where Rijkswaterstaat had its own quality management system. This deficiency is also caused by the resistance to change within the organization (cause 1). Nevertheless, the practice of Rijkswaterstaat was, for specific works still is and during some projects become (like the Dordtse Biesbosch case) that Rijkswaterstaat organizes a quality management system where the contractor benefits from. Using the quality management system of the contractor to a high degree for contract control is conflicting with the old working methods. The quality management tasks are transferred to the contractors and should no longer be performed by Rijkswaterstaat project team. These errors in the actual behavior of the organization are not detected as such. This causes a lack of error openness.
Second cause for the absence of error detection in the actual learning is the presence of **conflicting interests** (cause 5) in the project team that should detect the errors. The project teams and their client are less prone to detect errors and learn while producing the project as there are bound to their projects framework of requirements on the short term. The line organization of Rijkswaterstaat is the functional division of employees that participate in the project teams, for instance the contract managers’ Contract Management Division. They have interest in the long-term benefits from learning on the method and therefore are more open to detect errors on the SCB method in projects. The knowledge and empowerment to influence the usage of the quality management system of the contractor by Rijkswaterstaat is not located at the same actor as the interest of increasing this usage. This division of interests over multiple actors is not a problem itself, but these interests are not considered well in the decision-making processes on the implementation of the method. Most of the time it is the client of projects that trade off these interests. On the short term the room for error detection might lead to not meeting the initial project scope of that particular project, while on the long term leaving room for error detection result in learning (and thus improving) the application of the SCB method in other projects. This short-term interest prevails most of the time as illustrated in the cases. Therefore, these conflicting interests cause the misplacement of the empowerment to detect errors in the SCB method in the project. The client of the project decides on the detection of errors, while the information and ability to influence these errors is located at the project teams. This conflict of interests in the projects is caused by the **underestimation of the importance of the quality of the project management** (cause 4) by the external client of the projects. The interests of the client and the line organization on the long term are compatible, nevertheless on the short term the chapter on actual learning indicated that the clients decisions does not include this long term interests of the line organization of Rijkswaterstaat.

### 7.2.4 Fourth deficiency difference; limited knowledge conversions

Fourth deficiency is the limited sharing of knowledge in the organization on learning of the SCB method. This is identified by the lack of optimal using internalization, externalization and combination as knowledge conversion.

The **limited interaction** (cause 6) between the employees from different projects is first cause of this deficiency. This relates to the assembly of the project teams at Rijkswaterstaat. The exchange of employees over projects is limited, what makes the interactions where knowledge is converted limited in number. This prevents exchange of information and personal over projects within the organization. In the expected learning, the lead auditor program is a good example for enabling conversion of knowledge by exchanging employees over projects, in the actual learning the use of lead auditors in the projects has only started recently and is still limited to seven lead auditors over the regional department South Holland. For employees within the project there is no access to information on the members of other project teams and their specific knowledge and skills.

Second cause of this deficiency is that on actions that influence the success of the SCB method there is no **systematic documentation of knowledge** (cause 7). This makes conversion of knowledge depended of the actions from individuals in the organization and their memory. Furthermore, the diversity of scale of the projects at the regional departments causes unequal sharing and conversion of knowledge over the projects. Knowledge on the actions concerning the success of the method by the project teams is not always documented as the project are considered small and the knowledge not worthwhile of documenting. The number of these small projects is relatively high in comparison with larger projects within the organization; these projects therefore are an important source for creation knowledge on this issue. This documentation is worthwhile as it is necessary to convert and share the knowledge over the organization.
This paragraph provides the answer to the following sub-sub question:

4.1 Why are there deficiencies?

The deficiencies in the difference between the theoretical and expected learning are caused by the resistance to change within the organization, the dynamics of the method itself and the lack of need to perform that is caused by the underestimation of the importance of the quality of the project management by Rijkswaterstaat. The deficiencies between the expected and actual learning are caused by the resistance to change within the organization, the conflicting interests between the projects and line organization, the limited interaction and the lack of systematic documentation of knowledge.

7.3 Measures to minimize deficiencies

This paragraph describes the measures that minimize the deficiencies in the differences between the theoretical, expected and actual learning on the SCB method. These measures are based on the analysis of the deficiencies in former chapter and causal relations presented in the former paragraph. By minimizing these deficiencies, learning the SCB method could improve.

7.3.1 First measure: process to define the success of the method

The first measure focuses on the dynamics of the method and the resistance to change within the organization. This measure is starting the process to define the success of the method (measure 1). The Management Board of Rijkswaterstaat could define the success of implementation and included in these criteria in the formal working processes. Right now it is stated that the implementation of the method is not yet successful as not all projects apply a right mix of tests (CFO, 2009), however a description of the right mix of tests is not included in the formal working processes of the organization. The senior management could start practical implementation of this measure by clarifying the role of the SCB method in projects. The manual SCB describes the goal of the method, but it should repeated more often and communicated to the other projects team members as the contract managers. The goal of the method is to improve the construction process of public works by including the power of the market. The SCB method should check the quality management system of the contractor based on the project risks for Rijkswaterstaat. The senior management could describe the successfulness of the method in the projects by the capability of the project teams to control the risks with the least amount working hours. This separates the goal of method from the general cooperation Rijkswaterstaat has with its contractors. The cooperation with the contractors includes two main aspects that cannot be included in the SCB method. First, there is continuous cooperation between Rijkswaterstaat and the constructor in specification of the requirements of the public work. The dynamics of most projects result in specification of the initial requirements on the works. Second, Rijkswaterstaat has a hierarchical relation as client with the contractor in which it controls it execution of the contract. The SCB method only performs this second aspect of the cooperation in the projects. Right now, the SCB method is used to control the quality of the works instead of only project risks. Not meeting the quality of the works as described in the contracts is a project risk for Rijkswaterstaat, instead of
testing each specific requirement from the contract. The effect of the measure is that there is a clear expectation of the success of the method stated by the senior management, this enables the detection of errors in the project teams. This will close the deficiencies in the difference between the theoretical and expected learning on the SCB method.

Nevertheless, the resistance to change also causes the misplacement of empowerment and lack of error openness in the difference between the expected and actual learning. Therefore, this measure should include a process for describing this success in cooperation with the project teams of the organization. In practice, this means that the success of the application of the method is depended on including the risk that describes the contractors’ fulfillment of the project requirements in the risk register, as oppose to the current practice where the fulfillment of each specific requirement on the works can result into tests.

The implementation of this method is started by the development of a new manual SCB by the national DI department. For effective error correction in the success of the method in the projects of Rijkswaterstaat, it is also necessary to promote this definition process. The process will facilitate the awareness of potential errors and stimulate project teams to detect these errors. With a clearer description of the success of the method, it becomes easier to correct errors and share knowledge on these actions. Furthermore, by defining the success of the method it becomes possible to relate this with the results of the projects. Thereby, the organization could learn double-loop, and investigate whether the SCB method is a successful contract control method. Thereby this measure facilitates the other measures to improve learning on the SCB method in the organization by enabling error detection on the success of the method in a project.

7.3.2 Second measure: attention from the client for product and process of projects

The second measure is to start a more professional relation with the external client of the projects. The interests of the client heavy impact on the project management by Rijkswaterstaat project teams. The emphasis is on the results of the project on the short term, and less on the process of the project teams to reach these results. Rijkswaterstaat assures the quality of the works in the project on basis of the constructors system and processes, but Rijkswaterstaat itself is checked on basis of their product results. In a more professional relation with it clients, attention from the client for the product and the production process is more appropriate (measure 2). In fact, this measure is based on the same theoretical assumptions that are the basis for Rijkswaterstaat for applying the SCB method to their contractors; the system produces the product by working processes, by checking the system and processes it is possible to assure the quality of the product. As the system and processes are in place before the product is produced and are less time consuming to test; this method could be beneficial in terms of effectivity and efficiency.

This measure affects the relation between the senior management board of Rijkswaterstaat and the ministry of Transport, Public Works and Water Management. This measure in the projects will reevaluate the short-term interests of producing project and the long-term interest of improving the production process of the project teams. Furthermore, the demand from the client of the projects for improving the process by project teams enables the justification of capacity for these improvements.

Thereby this measure minimizes the deficiency between the theoretical an expected learning on the error correction and in the deficiency between the expected and actual learning on the detection aspect. The expectation from the management to improve the process is made explicit and becomes part of the project scope. Furthermore, the assessment of both the
production and improvement interest are combined at the project team, where the information to improve the success of the method is located.

**7.3.3 Third measure: test internal quality of projects**

The second measure focuses on the expectation of the management and the relation of Rijkswaterstaat with its clients. This measure both affects the deficiency between the theoretical and expected as the deficiency between the expected and actual learning. This third measure focus on the internal actions Rijkswaterstaat in depended of the second measure could take to increase the awareness on the importance of the quality of the project management by Rijkswaterstaat project teams.

The testing of the internal quality of the project management (measure 3) in the projects will help to detect errors in the success of the method in the projects. There is expectation of evaluation of the quality of the project teams by the project manager, but the actual learning indicated that these evaluations seldom include the internal quality of the project teams. The individual project teams should check their internal quality of the project management.

This also includes checks on the quality of the contract control according with the SCB method. By that, it facilitates the correction of errors on a project level and systematically embeds learning in the daily behavior of the organization. The Management Board can demand more frequent testing of the internal quality of the project teams. Nevertheless, this requires capacity to perform the tests and share information from the tests in the organization.

This measure itself is not new, there are activities included in the expected learning. However, these are not always used because of underestimating their importance. The opportunity of the managers project management to perform internal audits on the contract management (and by that the application of the SCB method) should be utilized more during the time that the project risk of not successfully implementing the SCB method is high. The current used implementation form should be used on a regular base as basis for implementation of the SCB instruments. The success and transparency of the implementation of the SCB method could be improved by applying the working processes from international ISO 9001 certificate. This certification prescribes a more systematical and uniformed documentation of working processes, which also enables the conversions of knowledge by internalization and combination. The documentation is both an assurance of the quality of own working processes and makes the transfer of explicit knowledge from the projects easier.

The effect of this measure will be more emphasis on the internal quality of the project management by the project teams. This will facilitate the detection and correction of errors on the SCB method. By that learning on the method in the project teams could be improved. Furthermore, more emphasis on the documentation of these tests enables sharing of knowledge on these actions in the organization.

**7.3.4 Fourth measure: built knowledge management system**

The fourth measure is to facilitate interaction between Rijkswaterstaat employees. The person with the right knowledge for a specific project should be connected to another project with a similar knowledge demand. The information on what employees are working on project and their specific knowledge is not available in the organization. Building a knowledge management system will facilitate this type of knowledge sharing, as it will facilitate the knowledge conversions discussed by Nonaka (Nonaka and Takeuchi, 1995) with a solution by creating what the philosopher Nishida calls “Ba”; space for knowledge sharing (Nonaka
A knowledge management system is facilitating this space for a practical implementation of this space. There are two types of knowledge management systems that are characterized by either codification or personalization (p.68) (Hansen et al., 2001). Hansen et al. suggests that an organization should choose between the two types in order to share knowledge effectively. The choice between the two types is depended on the structure of the knowledge, stability of the knowledge and the routine (p.8) (Malhotra, 2002). For Rijkswaterstaat a personalization type of knowledge management system is most suitable; the knowledge on the actions that improve the success of the SCB method is dynamic, the projects the knowledge involves are very heterogeneous and their situation is dynamic. A personalization type system means a database that is accessible by all Rijkswaterstaat employees and includes information on individuals in the organization that enables interaction between these individuals. For Rijkswaterstaat such a database should include:

- All Rijkswaterstaat employees of all five IPM roles (Project manager, contract manager, environment manager, technical manager and manager project management).
- Contact details of the employees (regional department, email and telephone number).
- Chronological overview of project worked on by the employee (names of present and past projects; and short summary on the specific role of the employee in the projects).
- Include overview of all projects in execution and executed by Rijkswaterstaat.
- Short projects descriptions.
- Search function on either of the above attributes.

The most useful organizational level for construction is the national level of Rijkswaterstaat; this includes most employees and enables most knowledge exchanges thinkable within the organization. Nevertheless, for practical matters it could be useful to start a pilot for such a system in a regional department. For the learning concerning the SCB method such a system facilitates and enables the exchange of knowledge by individuals among different projects of the organization. This measure thus facilitates the conversion of knowledge by externalization as it increases the number of interactions between employees. It converts tacit knowledge into explicit knowledge over projects.

This paragraph provides the answer to the following sub-sub question:

**4.2 How can these deficiencies be minimized?**

This chapter provides four measures that aim a minimizing the deficiencies and by that improve learning on the SCB method. First measure is to start the process of defining the success of the method; this should enable the identification of success of the method in a specific project and enables error detection on this success. Second measure is more attention from the client for the product and process of projects at Rijkswaterstaat. This will increase the attention to the long-term interest of both the client and Rijkswaterstaat in improving the production process of the projects. The third measure is to test the internal quality more often by the project teams themselves; this will create the need for the projects to improve their working processes, which also include the application of the SCB method. Fourth measure is building a knowledge management system that connects project team members with a demand for knowledge with owners of this knowledge in different project teams throughout the organization.
Summary opportunities for learning

This chapter identifies the opportunities to improve learning on the SCB method. The former two chapters identify deficiencies in the differences between the three views on learning. The causes of these deficiencies enable identification of measures that minimize these deficiencies. Thereby the measures minimize the differences between the three views on learning and thus improve learning on the SCB method.
Conclusions, recommendations and reflection
This chapter discusses the conclusions constructed in this thesis, second it provides recommendations on the addressed problem, the third paragraph reflects on the research methods and content of this thesis.

8.1 Conclusions

This paragraph discusses the findings from the former chapters. The general conclusion summarizes these findings and by that provides the answer to the main research question of this thesis: How is Rijkswaterstaat learning the system based contract control method and how could this learning be improved?

Research problem
Rijkswaterstaat implemented a new working method for assuring the quality of the works that contractors construct. This method is the system based contract control method. Essential in this method is that Rijkswaterstaat project teams test this quality based on the quality management system of the contractor and only secondary on the process and final product. Rijkswaterstaat tests not all aspects of the system, process or product, the risks for Rijkswaterstaat in the project determine the aspect and number of tests. This working method is conflicting with former quality assurance methods that included more checks by Rijkswaterstaat.

It is unclear whether the implementation of this method is successful and whether the organization is learning on this method to improve the method. Therefore, the objective of this research is to provide insight in learning the new working method by Rijkswaterstaat and provide improvements for this process. This thesis defines improvements for learning as a decrease of difference between the theoretical, expected and actual learning. The theoretical learning describes how there should be learnt from literature, the expected learning is the learning described by the organization of Rijkswaterstaat and the actual learning is the learning that is taken place in day to day business of the regional department. When these three views are identical or the differences have no effect on the success of learning the method, there is optimal learning on the SCB method at the regional department of Rijkswaterstaat. The aspects on which the differences prevent optimal learning on the SCB method are identified as deficiencies. The improvements on learning try to minimize these deficiencies.

Definition of learning
Learning the SCB method includes the acquisition of knowledge and skills on actions that improve the success of the method in projects. Furthermore, it is beneficial to the organization that this knowledge is available throughout the organization. This prevents developing the same knowledge multiple times. To understand which learning the management of the organization expect and study learning in the actual behavior of the organization this thesis defined a theoretical model of learning. Three aspects characterize the level of learning in an organization:

- The degree of empowerment and error openness enable error detection on the success of the method.
- Presence of the error correction actions on basis of their cognitive nature; this divides the actions to improve the success of the method into single or double loop actions.
The presence and level of usage of socialization, externalization, internalization and combination as knowledge conversion phases. These processes transfer explicit knowledge and tacit knowledge over people and project teams within the organization.

Management expectation on learning

Based on the formal structure and processes of the Rijkswaterstaat organization this thesis describes the expected learning of the SCB method. On the national level, Rijkswaterstaat issued the implementation of the SCB method by the Director General. The Senior Management Advisory Unit constructed the theory of the method. The responsibility for the actual implementation and internal quality management system is located at the regional departments of Rijkswaterstaat. In this process the national section DI/IMG support the regional departments. The Court of Audit of the ministry controls the financial progress of the projects at the regional departments on behalf of the CFO of the Senior Management Board of Rijkswaterstaat. The BCT department is responsible for the project control on the financial progress on behalf of the managing director of the regional department. The internal client is concerned about the progress and process for this progress. The internal quality management of projects is the responsibility of the managers project management, therefore the implementation and improvement of the application are the responsibility of the manager project management.

This identifies a first deficiency in the difference between the theoretical and expected learning on the SCB method; Theory on learning suggests there should be a clear and measurable difference (the error). Otherwise, it is impossible for an organization or individual to be able to perform effective actions that correct the error and develop knowledge on these actions. Nevertheless, there is no clear description of success of the method, which makes error detection impossible. This is caused by the dynamics of the method and the resistance to change within the organization. The second deficiency is that there are no incentives for correcting errors. The missing of need for project teams to improve their working processes causes this.

Actual learning

Case studies of four projects from the regional department South Holland indicate the actual behavior of the Rijkswaterstaat on learning the SCB method. The expected learning showed that there is no error detection expected in the organization behavior on the SCB method. This suggests that there is no error detection, correction or knowledge sharing in the actual behavior of the organization. The cases studies confirm there are no errors in the success of the method detected or corrected. Nevertheless, the cases provide useful insight in the differences between the expected and actual learning the SCB method at Rijkswaterstaat. There are deficiencies in this difference on two aspects of learning identified by the theoretical learning.

There is a deficiency in the difference between the expected and actual learning in the error detection. The results from the case study show that the actions from the management, such an implementation form, do not systematically stimulate the project teams to detect errors in the success of the method. The empowerment to take detect actions and adjust the project scope is situated at the project client and the error openness in projects is low. This is caused by the resistance to change within the organization and the conflicting interests between projects and the line organization in the projects. The projects aim at the short-term interest of producing the project within the scope, while the line organization aims at the long-term interest of improving the quality of the process by the project team. The cases show that these interests can collide and prevent learning on the SCB method in the organization.
There is no deficiency in the actions that aim at correcting the errors in the SCB method between the expected and actual learning. There are no actions expected and found in the actual behavior of the organization. Nevertheless, there are actions that influence the usage of the quality management system of the contractor by the project team. These actions stem from other sources and error detection systems, for example the audits by the DAD and internal audits on risk management.

The fourth deficiency is on the knowledge sharing aspect of learning in the difference between the expected and actual learning. The cases show that there are limited knowledge conversions taken place in the organization. This is caused by the limited interaction between employees from different project teams, due to the unavailability of an overview of information on which employees work in which project and their knowledge expertise.

**Measures to improve learning**

First measure to improve learning on the SCB method is to start the process of defining the success of the method in the projects. This closes the difference between the theoretical and expected learning on the SCB method. There is no aspired usage of the quality management system of the contractor. There is the expectation on the project teams to apply a right mix of tests in assuring the quality of the works in their projects. Furthermore, this process will reduce the resistance to change within the organization by communicating the management wishes. The contract control is used for the assurance of the quality as described in the contract, and the dynamics in the requirements on the works do not interfere the contract control. This measure will facilitate the other measures to improve learning on the SCB method and by that the method itself. By defining success of the method, it also becomes possible to evaluate the method as the appropriate contract control for Rijkswaterstaat.

Second measure to improve learning is to demand the attention from the clients of project for both the project result as the project process. This more professional relationship between Rijkswaterstaat and its clients will underline the importance of the quality of the project management by project teams. Thereby it will provide an incentive for the project teams to improve the internal quality and improve the success of the SCB method in their projects.

Third measure is related to the second measure, but also influences the fourth deficiency. The project teams can test the internal quality of the project teams more frequent. Practical implementation of this measure is to certificate working process according to the ISO 9001 standard. This will increase the awareness of importance of improving the internal quality within projects. Furthermore, it provides documentation on the internal quality system that can be shared over project and support the knowledge conversion in the organization.

Fourth measure is to facilitate knowledge sharing by building a knowledge management system. This system itself does not include the knowledge, but facilitates sharing of knowledge by the Rijkswaterstaat employees. The knowledge in Rijkswaterstaat projects is very specific. Therefore, the system is not useful for passive sharing of explicit knowledge, for example by evaluation documentation of projects. The system should include a database of all Rijkswaterstaat project employees, their roles in projects, a short project description and contact information. This enables employees to share knowledge between projects in the organization. This utilizes the available knowledge in the organization on a broader scale. For the improvement of the success of the SCB method, this means that the knowledge on actions becomes available for the level of the organization that is empowered to take these actions.
General conclusion
This thesis describes learning on the system based contract control (SCB) method at the regional department South Holland of Rijkswaterstaat. The scientific literature provides a framework to identify learning that the chapter on theoretical learning presents. The three aspects of this framework enabled the identification of the learning that is actual taking place in the organization and the learning that the organization intends to do. This thesis describes these three views on learning and deficiencies in the differences between these views indicate there is no optimal situation in the learning the SCB method.

This thesis identifies that although Rijkswaterstaat demands from its contractors to improve their internal quality management by applying the SCB method, the organization itself is not successful in this development. There is no learning that improves the success of the method at Rijkswaterstaat. The example of the implementation of the system based contract control in this thesis illustrates that Rijkswaterstaat project teams remain focused on the project products and give too less attention to the internal quality management of their own production process. The management of Rijkswaterstaat has chosen to hierarchical implement this new working method in the organization. Nevertheless, there is little attention to the implementation process, which it needs to be successful and achieve the objectives of the method. This process includes the facilitation of learning on the new method.

The proposed measures try to improve the ongoing process of implementing and improving the SCB method at Rijkswaterstaat. Nevertheless, interviewees for this research and reactions to the findings indicate that the recommendations are not specific for the implementation of the SCB method. Rijkswaterstaat have introduced a variety of working methods, but the control and evaluation of the success of these methods is lacking. Therefore, the findings of this thesis could be generalized to all future introduction of working methods and the organizational structure in these implementations. It is essential that the organization evaluates its internal quality and improves its performance.

This study on learning the system based contract control method is interesting from scientific interests. It shows that different theories from different scientific disciplines are capable of identification of the behavior of an organization on the implementation of new working method. The SCB method is an example of a hierarchical based implementation of working methods. Nevertheless, learning on the application of the method is essential for the success of meeting the methods objectives. The actions that affected by the implementation of such a working method are located in the operational levels of the organization. This means that the information and capability to learn and improve the success of the method is located on the operational level of the organization. The analysis of the SCB method at Rijkswaterstaat showed that this process is difficult and needs additional measures, but success is also depended on the attention and effort the management gives for the implementation.

Thereby, this thesis contributes to the scientific literature on organizational change and development. Learning processes in organizations, unlearning and organizational culture are important for the success of implementing new working methods. Nevertheless, for enabling the organization to improve and learn a new method it is critical the organization describes the process of implementing the method and providing the criteria for determine the success of such a new method and its implementation.
8.2 Recommendations

First recommendation of this thesis is the execution of the discussed measures. This will help to improve the success of the SCB method. These measures are abstract and only indicate the direction policy should take. There is need for additional management attention in the organization to tackle the implementation of the SCB method systematically. There are developments in the organization that can have a positive influence on the problem identified in this thesis. The letter from the CFO in December 2009 (CFO, 2009) indicates there is attention for the issue. Nevertheless, it is a missed opportunity when the system of implementing new working methods remains untouched.

Second recommendation is to combine the measures with the new manual SCB. There is a new manual SCB written at the time research period of this thesis. This could be a good opportunity to adjust the expectation of the management on the projects team. The communication and cooperation that results in the process of documenting the manual could be the start of the measures presented in this thesis. This thesis identified there should be more emphasis on the objectives of the method; improving the quality assurance on the project works by testing the quality management system of the contractor that constructs the work. That is something different then using the SCB method as instrument to adjust the contract requirements or adjust the quality of the works regardless of the contract specifications. This reveals a third recommendation.

The complexity of the work of the project teams increased with the implementation of new working methods at Rijkswaterstaat. The problem context of this thesis named only the most important aspects, in reality the number is much higher. The success and implementation of these methods are interrelated. This means the organization needs time to adjust and learn these new methods. Nevertheless, there is need for new projects on the public works in the Netherlands. The organization need to integral monitor and check its own performance on these developments. This will provide the management insight in the interrelations of the methods and provides the operational levels of the organization confirmation on their performance. This enables them to learn. More emphasis or possible and obligation of the project team to audit their own working processes more frequent will help to deal with this complexity. This requires more capacity on the internal working process and less on the production the projects. Nevertheless, in the end this results in better internal working processes. Additional measure could be the implementation of the ISO certification in the whole organization. This will require initial efforts, but result in the same quality advantages for Rijkswaterstaat clients as Rijkswaterstaat has on its contractors; the improvements in the internal quality are verified and checked. The existing management information can be used to monitor the improvement of the project teams. This monitoring of the internal quality of the project teams enables them to learn.

Fourth recommendation is that within the project there should be more time and capacity available for developing and learning new working methods. The management of the organization implements the SCB method. Nevertheless, to improve the performance of the organization it is useful to stimulate learning on the working processes by the project teams.
8.3 Reflection

This reflection discusses content related research choices and its impacts, but also discusses research project content related issues. The general conclusion is not as pessimistic as it looks at first sight, by applying the narrow definition of learning as the detection and correction of errors that stems from theoretical view, it is likely to find deficiencies with everyday practice at Rijkswaterstaat. Nevertheless, the purpose of this thesis to increase awareness on the influence of new working methods on the organization’s behavior. This scientific critical reflection is useful for that purpose. There are successes on the changed role Rijkswaterstaat has adopted in, but the organization still is under development. In this process, it is important to test the organization on its learning skills, as these will influence the development of the organization. This thesis is an attempt to support this process.

This development process needs a check on the internal quality of working processes of specific implementations of working methods. This requires a more professional approach to these implementations and the overall project management. There is no distinction between the success of the project management of a project by Rijkswaterstaat and the success of the public works in this project. These are interrelated, but the cases showed that there is little attention to the success of the project management by Rijkswaterstaat. In order for Rijkswaterstaat to improve its organizational behavior, more emphasis to the internal working processes is necessary. This view comply with policy pillars of Rijkswaterstaat to become a more professional client, in my view Rijkswaterstaat itself need a more professional client that put more emphasis on the production process of the projects.

The most important advantage for Rijkswaterstaat of being the executive department for Public Works on the national infrastructure over project specific organization is the possibility to preserve knowledge and skills in the organization. During the organizational development management, attention is necessary for this process. This meets some policy wishes to attract the right employees, improve the knowledge and preserve knowledge. Nevertheless, there is need for operationalized programs that show the benefits to the people that benefit from these advantages.

The topic of this thesis is more complex in practice as theory would suggest. The numerous perceptions from different sections and individuals in the organization complicate a conceptual design of improvements on the problem. Furthermore, the organization itself is dynamic during the research; a letter in December 2009 from the CFO announced more management attention to the implementation of the SCB method, a recommendation that this thesis supports. The relation between practical application in the projects and the policy of the organization is difficult to identify, the use of the theoretical model on learning supports the insight this relation. Nevertheless, the abstract level of the scientific literature requires several operationalization steps to understand the connection between the theory on learning and the practical implementation at Rijkswaterstaat.

The scope of the research problem in this thesis is limited to the particular implementation of the SCB method. Nevertheless, the findings of this thesis suggest a generalization to learning on other implementations of working methods at Rijkswaterstaat. This is problematic from a scientific view, the research indicate problems in the internal quality of the projects at Rijkswaterstaat concerning the SCB method, but the measures to improve learning will also influence other implementations of working methods. This thesis did not consider these relations. With the SCB as example for learning within an organization and its deficiencies
that prevent learning, it is useful to consider adjusting the organization to become a learning organization as described in literature. Senge relates the learning organization to the parallel development of ‘personal mastery, mental models, building shared vision, team learning and System engineering’ (p.6-10) (Senge, 1990). This will help to deal with changes of the environment and new working method for the internal working processes. Nevertheless, the long history of Rijkswaterstaat could be an example of an organization that withstands the time.

The thesis might undervalue the importance of the individual in the organization. Personal beliefs and drives influence the learning and implementation of such a working method. Nevertheless, the knowledge on improvements of the success of a method should be incorporated in the organizations structure and institutions.

The research methodology of this thesis provided insight in different perceptions on the learning of the method in the organizations. This suits the problem environment; the multiformity of Rijkswaterstaat itself and its conflicting interests. Most visible is this in the projects where these perceptions meet each other in practical decisions. The cases proved to be useful to describe these issues. Nevertheless, this emphasis in the research on actual learning in the organization might undervalue the actions and institutions in the organization that influence the learning on the method.

The most difficult part of this the research of this graduation thesis is the problem definition that involves multiple scientific fields. The choice to focus on learning as a part of the implementation and continuous development of a single working method increased complexity of the research analyses. Limiting the research in the actual learning to actions that influence the success of the method, while not considering or measuring this success in the cases caused that this research does not provide a holistic view on the SCB method. Nevertheless, it provides useful identification of factors that prevent the organization from learning. By improving learning in the organization the organization success might increases, while it is not sub optimized on the success of the SCB method.
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Learning an organization new working methods: The system based contract control (SCB) method at Rijkswaterstaat

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Abstract
Rijkswaterstaat is adapting its role in the construction of public works. The organization implemented a new working method to assure the contractors fulfill their contracts. The objective of the method is that Rijkswaterstaat check the quality system of the contractor based on the project risks for Rijkswaterstaat. Learning is defined as detection and correction of errors and sharing knowledge on these actions in the organization. It is unclear whether and how the project teams learn on the method. This article presents a theoretical model that tests what learning is expected by the management of the organization. Furthermore, four cases identify the learning in the actual behavior of the organization. This results in the statement that the management does not expect learning, and therefore does not take place in the organization. Improvements that enable error detection, error correction and knowledge sharing on the method for this leaning are included in the article.

Key words: Organizational learning, organizational change process, action theory, descriptive theory building case study

1 Introduction
Rijkswaterstaat is the executive organization of the Ministry of Transport, Public Works and Water Management (VenW) of the Dutch national government. Rijkswaterstaat is responsible for managing and developing the national infrastructure facilities in the Netherlands. The standard for executing tasks by Rijkswaterstaat became ‘Market, unless...’ (in Dutch: ‘de markt, tenzij...’) during the last two decades. This approach is facilitated by the topic specific policy documents of Rijkswaterstaat (Rijkswaterstaat, 2008b). This organization’s change of behavior, transferred the actual implementing of the policy to private contractors. Now, Rijkswaterstaat only develops public works itself when direct public involvement is necessary, otherwise Rijkswaterstaat tests the work of its contractors (Verboom, 2007).

The decline of direct public involvement of Rijkswaterstaat caused introduction of new working methods for cooperation between Rijkswaterstaat and contractors. Rijkswaterstaat introduced a new contract control method that fits this new situation. This method aims at controlling the risk of the contractor not delivering the service as described in the contract. The principle of this system based contract control (the Dutch abbreviation is SCB:
The implementation of the SCB method is a planned, systematic change of processes in an organization. The Management Board of the organization ordered this change in working processes. Nevertheless, the application of the SCB method is continuously developing and learning processes on the application are questioned (Putten, 2009c, Berenschot, 2006). This means that these types of radical organizational changes also include an incremental element. Miner and Mezias share this view (p.88) (Miner and Mezias, 1996). This article describes learning as implementing a single working method as part of organizational change in combination with continuous improving the method. The purpose of this article is to provide insight in learning a new working method by Rijkswaterstaat and provide improvements for this process. This article provides an answer to the question:

**How is Rijkswaterstaat learning the SCB method and how could this learning be improved?**

This article uses an analysis on theoretical learning, the learning behavior that the organization states it is performing and the actual learning behavior of the organization to describe the learning the SCB method at Rijkswaterstaat. This tactic to find improvements in learning is based on the difference between what Argyris and Schön named ‘espoused theory’ and ‘theory in use’, when these two views are conflicting learning in an organization is not optimal (p.15) (Argyris and Schön 1978). This article adds a comparison with a theoretical view on learning to their approach. Differences from this comparison, between the theoretical view and the espoused theory (expected learning in this article) are a second potential cause for suboptimal learning the new working method. The confrontation of three views on learning and the existence of differences between these views results in opportunities to improve the learning. Figure A.1 visualizes this research strategy by presenting the research framework.
Miner et al suggests that there is a need for more systematic empirical research on learning in organizations (p.94) (Miner and Mezias, 1996), this article provides this insight. Furthermore, it includes both aspects Tsang identifies as an dichotomy of descriptive and prescriptive research on leaning in an organization (Tsang, 1997). Thereby this article closes the gap between literature on organizational learning and change, and the practical implementation of these theories in everyday business of organizations. Literature from Argyris and Schön (Argyris and Schön 1978, Argyris, 1990), Pedler (Pedler, 1994), Senge (Senge, 1990), Revens (Revens, 1980) and Cummings and Worley (Cummings and Worley, 1997) provides useful theoretical knowledge, but lacks organization specific solutions. Focusing on a particular organizational change (the implementation of the SCB method) this article comply with Lahteenmaki’s view on feature research on learning in organizations (p.127) (Lahteenmaki et al., 2001). He states that there are little empirical studies on learning in organizations that really tests and measures this learning; although, most likely to identify learning are those studies on organizational changes. This indicates that the implementation and improvement of the SCB method in a complex organization as Rijkswaterstaat is interesting from a scientific view.

This article presents the methodology that provides the answer to this question in section 2. Section 3 describes a model from scientific literature on learning in an organization. This model enables the identification of learning actions from the expected learning by the organization in section 4, and the actual learning that is taken place in the Rijkswaterstaat organization in section 5. Section 6 discusses causes and solutions to the differences between the three views on learning from sections 3, 4 and 5. Section 7 concludes this article with the answer to the question stated in this introduction.
This article argues that the differences between three views on learning on the three aspects of learning can include deficiencies that prevent optimal learning on the SCB method. Differences between the theoretical description of learning, expected and the actual learning exist by nature; factors that affect learning on the SCB method to improve the success are deficiencies. This consideration is based on the in depth knowledge gained during the research.

The theoretical learning in the third section constructs a model that enables the identification of learning in an organization. Furthermore, it embeds the research strategy and methodology in scientific literature on learning in organizations. By that, it describes how an organization should learn and behave in order to learn a new working method effectively. This section is the result of literature study.

The fourth section on expected learning is a result of the combination of information from interviews and document study. This section describes how the organization states it behaves. This includes what learning on the method is embedded in the formal working processes at Rijkswaterstaat.

The learning behavior of the organization on the SCB method is most visible in projects of Rijkswaterstaat. The actions in the contract control this learning affect are located in the projects. The case study for this article studied this actual learning in four projects at the regional department South Holland of Rijkswaterstaat. The case studied involved study on project specific documents and in depth interviews with crucial individuals of the project teams. Table A.1 presents the cases and their main characteristics. The last column shows the roles of the interviewed persons in the projects. The case study in this article is used as descriptive theory building on actual learning in the organization. Therefore, the selection of cases is based on the likelihood of providing useful information and insight in the organization processes. The selection of cases in the descriptive theory-building case studies is not subjected to statistical sampling for validity as traditional hypothesis-testing studies are (Yin, 2008). Theoretical sampling where the processes of interests is transparently observable is sufficient for descriptive and theory building cases studies. Theoretical sampling involves the selection of cases that are likely to replicate or extend the emergent theory (Eisenhart, 1989). This means the case analysis results are not used for theory testing or comparing learning in the cases.
3 Theoretical learning

This section draws the theoretical context of this research. The problem description described focus is on learning and not on implementing the method. Implementing a method requires a clear and defined description of the method with ready to use tactics for every context specific situation. Numerous literature describe the change of organizational culture, such as Cummings and Worley that provide 6 guidelines for cultural change (p.491-492) (Cummings and Worley, 1997). The SCB method gradually has been implemented since 1995, when the former EKB method was introduced. This gradual implementation also results in evolution of the method. The SCB method itself is no change in organizational culture and implementation theory itself is of no use. Therefore, this research describes the development of the method (which also include implementing) as learning the SCB method.

The product that the contract control processes at the Rijkswaterstaat projects deliver is complex. The results of the actions that the project teams undertake on the contract control, influence the total project result indirectly, nonlinear and over a long period. The learning in these actions is therefore difficult to measure and evaluate on their success. In order to study this learning in an organization this section provides a model that enables to describe the learning in an organization. This model provides a method to identify the differences between the three views on learning the SCB method. Essential in this model is the work of Argyris and his several co-authors. The emphasis in their work is on the individual as key figure in learning in an organization (p.922) (Antal et al., 2001). His action theory suggests that the effect of learning is visible in the actions that individuals perform on behalf of the organization (Argyris and Schön 1978). Other theories on learning in organizations focus on the organization as a whole and less on the individuals in the organizations; this article mentions and uses ideas from other literature, but does not follow their central thoughts. For example literature based on March has little attention for the individual in the organization (p.922) (Antal et al., 2001). Others describe learning in an organization as a final state of the organizational structure and behavior. The work of Senge (Senge, 1990) describes learning in
an organization as five disciplines that should develop parallel in an organization to become a learning organization. Pedler describes the learning organization as combination of an optimal organizational structure and its characteristics (Pedler, 1994). At the other end of the scientific spectrum on organizational learning there is the emphasis on the individual and learning culture. Revans describes his action learning as the product of programming knowledge and questioning (Revans, 1980) and Rank described unlearning as a perquisite for learning (Rank, 1932/1989).

Testing of ideal types of learning in the empirical world is hard, most authors end with describing conditions that enhance an organization to learn (Argyris and Schön 1978, Friedman et al., 2001, Pedler, 1994). This research adopt an action-oriented approach as described by Argyris and Schön (p.10)(Argyris and Schön 1978); this focus is on studying the individual and organizational actions and their reasoning. This focus on actions enables empirical analysis and according to Argyris and Schön result in more competent and effective interactions (p.10). Revans agreed to this view by describing: “there can be no learning without action and no (sober and deliberate) action without learningû (p.54) (Revans, 1980). Argyris and Schön define learning as the connection between thought and action; where learning takes place only when new knowledge result in different behavior that is replicable (p.28) (Argyris and Schön 1978). These actions and the learning that is taken place in the organization is observable in the projects which include the control of contracts by the SCB method. This article describes learning as the detection of error, the correction of errors and the sharing of knowledge on these actions. Thereby it combines current debates on learning in an organization described by Easterby-Smith et al, more specific the territorial debates which is dominated with Nonaka and Argyris’ classic theory on organizational learning with its emphasis on specific actions by individuals (Easterby-Smith et al., 2000).

First aspect of learning is the ability of the organization to detect errors, this aspect is determined on basis of the by Visser identified and operationalized first two dimensions (p.4-7) (Visser, 2009). First, there is empowerment, the more the power to take actions is decentralized the more errors are made and the less these are detected. Nevertheless, the more employees are educated, the more it possible to decentralize power without decreasing the ability of the organization to detect errors. Second, there is error openness, the more open the organization is to errors the more errors are detected.

Second aspects of learning is the correction of errors, errors could corrected by actions from the Rijkswaterstaat employees. The actions in the contract control are located at the project teams, they decide on which parts of the system the contractors are checked during the project. The cognitive nature of these actions is essential in correcting the errors and determines the definition of these errors. This links to the concepts of learning from Argyris and Schön; and the conceptual and operational learning of Kim (Kim, 1993). Single loop level of learning will involve an action that perceives errors as the gap between the actual and the aspired implementation of the SCB method (the know-how). Second loop learning actions will perceive also errors that involve the gap between aspired and achieved result of the contract control method (the know-why of Kim). In ideal organizational learning there is both single as double loop learning according to Argyris and Schön (p. 144) (Argyris and Schön 1978).

Third aspect of learning, is sharing of knowledge in the organizations on the actions from projects. This involves sharing of knowledge between the individual and the organization is described by Nonaka and Takeuchi (Nonaka and Takeuchi, 1995). They apply a basic distinction between tacit and explicit knowledge. Tacit knowledge cannot be expressed in words, is subjective and experience based. Whereas explicit knowledge is objective, and rational that can be expressed in words. They developed an ideal model that transfers
knowledge from the individual to the organization and vice versa. This model is visualized in Table A.2, in the ideal situation all four types of knowledge conversions (socialization, externalization, internalization and combination) are taken place in an organization.

<table>
<thead>
<tr>
<th>From</th>
<th>To Tacit knowledge</th>
<th>To Explicit knowledge</th>
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<tr>
<td>Tacit knowledge</td>
<td><strong>Socialization</strong></td>
<td><strong>Externalization</strong></td>
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<td>(individual to individual in a project)</td>
<td>(individuals over projects)</td>
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<td>Explicit knowledge</td>
<td><strong>Internalization</strong></td>
<td><strong>Combination</strong></td>
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<tr>
<td></td>
<td>(at the individual in projects)</td>
<td>(between projects)</td>
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### 4 Expected learning

The Senior Management Advisory Unit (SDG) of Rijkswaterstaat on the national level issued the wish to increase the distance between Rijkswaterstaat and its contractors. The CFO of this board is responsible for the implementation of the method. In this view, the quality system of the contractor is central to the contract control by Rijkswaterstaat project teams. This approach is translated in a theoretical framework for the SCB method and is documented in the SCB manual (Kuijpers and Berg, 2007). The implementation of the method is included in the management contracts that the regional departments sign with the national Senior Management Board of Rijkswaterstaat (Rijkswaterstaat, 2009g). This wish to apply the method is transferred into policy plans of the regional departments. Furthermore, the CFO on basis of audits from the Court of Audit of the ministry of Transport, indicated multiple times the implementation is not successful (CFO, 2007, CFO, 2008, CFO, 2009).

### Deficiency 1 No description of success of the method

There is a difference between theoretical learning and expected learning. In the expected learning, there is no clear prescription of the error. The organization does not expect this type of error detection in the learning. The implementation form SCB, mentioned in the chapter on expected learning, measures the application of instruments related to application of the SCB method. However, this does not involve errors in the success of the method in projects. There is no systematic check on the implementation of the working method expected by the management. The theoretical learning indicates that the more the project teams are empowered the more errors are likely to occur and the more error openness the more errors are detected. Nevertheless, the expected learning does not mention a systematic detection of errors in the implementation of the working method within the project teams. Nor does it define how success of the method can be measured in the projects. It is not possible to detect errors.
The detection of errors is described as the first aspect of learning that enables the other two aspects. Therefore, the absence of features on this aspect in the expected learning is a deficiency in the difference between the theoretical and expected learning. In the remaining of this article this deficiency is called; ‘No description of success’ (deficiency 1).

There is no description of success of the method in the expected learning on the method that enables the detection of errors in the projects. The theoretical learning states that an error can only be detected when there is an aspired achievement. This deficiency is caused by the dynamics of the method and the resistance to change within the organization.

**Deficiency 2 No incentive for error correction**

The nature of actions that try to improve the success of the method is unclear; they are likely to be of single loop nature thus aimed at correcting actions within the organization's norms. Formal documents neither describe the improvement of the application of the instruments in the projects nor the internal quality management system. The empowerment to detect errors in the implementation of the method is situated at a project team’s level. The implementation plan SCB (from both the national level and regional department) does not describe a system for project teams that enables project teams to correct errors themselves. Theoretical learning suggested that learning is more effective when corrective actions are taken on the organizational level where these errors evolve.

The difference between the theoretical and expected learning on the aspect of the error correction is subjected to the lack of proper error detection in the expected learning, which is described in deficiency 2. Nevertheless, the difference on this aspect is considered as a deficiency in the difference.

The project teams that make these errors do not correct the errors in the success of the method. The success of the method affects the project results in terms of scope and budget. The client of the project bares the costs for the project. The expectation of the client is that the project teams produce the project, but they have little attention to the internal process that produces the project. There is the expectation from the management to apply instruments that are used for the method. Therefore, the project teams have no incentive to improve their internal quality by correcting errors in the application of the SCB method.

Knowledge conversions are only expected on an irregular schedule and are only on a limited basis facilitated. For example, the experiences of project team members’ actions that improve the success of the method are not documented. This possibility to converse knowledge by internalization. The expected learning only involves two of the four knowledge conversion phases; this itself is not different with the theoretical learning. The other two phases involve the transformation of tacit knowledge, which is harder and more likely to identify in the actual behavior of the organization and not in the expected behavior.

Therefore, the difference between the theoretical and expected learning on this aspect is no deficiency. It is unnecessary to prescribe and expect knowledge conversion phases in policy documents. The expectation of the management should focus on facilitating knowledge conversions and leave room in the actual behavior of the organization. This facilitation is addressed in the difference between the expected and actual learning.
Actual learning

The expected learning showed that there is no error detection expected in the organization behavior on the SCB method. This suggests that there is no error detection, correction or knowledge sharing in the actual behavior of the organization. Nevertheless, the cases provide useful insight in the differences between the expected and actual learning the SCB method at Rijkswaterstaat. The emphasis again is on the first aspect of learning identified by the theoretical learning; the detection of errors. This is the fundament under the other two aspects of learning.

Deficiency 3  Misplaced empowerment and lack of error openness

There is a difference between the expected and actual learning on the error detection. The results from the case study show the actions from the management, such an implementation form, do not systematically stimulate the project teams to detect errors in the usage of the quality management system of the contractor. All four cases implemented the SCB method, but there is no clear idea on the success of this implementation. The incidental measurement of the application of the instruments is detected in the actual learning of the organization. Nevertheless, this type of detection does not include the learning in the method itself. This showed that error detection in the success of the method is not taken place in the cases. This is perceived as an unimportant issue in the daily project activities. This is the first difference between the expected and actual learning. The expected learning suggests that the project teams perform internal audits on the internal quality of the project team activities. The case interviews indicated that these audits are rarely done on contract management. Other internal audits on risk management and capacity management that influence the application of the SCB method are performed in the cases.

There is no expectation to detect errors in the success of the method. Therefore, there is no difference between the expected and actual learning on this aspect. Nevertheless, a difference could be caused by the identified deficiency on this aspect. The empowerment to take actions on the success of the method is sometimes not located at the project level. The client of projects under political or public pressure is heavy involved in the project and demands more quality assurance than the SCB method provides. This results in low error openness, which decreases error detection by the project teams.

On this aspect, there is a deficiency in the difference between the expected and actual learning on the SCB method. Even with a clear expected detection of errors in the success of the method, the empowerment and error openness will prevent learning on the SCB method. This deficiency is called: misplaced empowerment and lack of error openness (deficiency 3).

In the actions that aim at correcting the errors in the SCB method there is no difference with the expected learning. There are no corrections actions expected, and there are no corrections actions identified in the cases that are the result of learning the SCB method. Therefore, on this aspect there is no deficiency that prevents learning on the SCB method.

Deficiency 4  Limited knowledge conversions

There are no actions observed on the success of the method on which knowledge could be shared. Furthermore, there is no overview that is accessible for other project teams with contact information of employees working on projects and their knowledge expertise. Nevertheless, the number of socialization of knowledge (between individuals within projects) is taken place on others issues. The conversion of knowledge by internalization, externalization and combination are very unlikely. Not facilitating these types of knowledge conversion is
a deficiency in the difference between the expected and actual learning on the SCB method. This deficiency is called limited knowledge conversions (deficiency 4).

Discussion and analysis

The three views on learning (theory, expected and actual) in earlier sections indicate that learning the SCB method at Rijkswaterstaat is not optimal, because there are deficiencies in the differences between the views on learning. This chapter indicates the causes for the deficiencies identified in the former section. Thereby, the opportunities to improve learning on the SCB method at Rijkswaterstaat are identified. Furthermore, this section discusses measures that improve the learning presented. Figure A.2 presents the relation between the deficiencies, causes and measures.

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**Figure A.2: Schematic overview of deficiencies, causes and measures**
Most feasible explanation for the first deficiency is that people in the organization do not accepted the transfer of the quality management of the works in the project to the constructors. There is resistance to change within the organization (cause 1). The senior management board of Rijkswaterstaat clearly stated the intention to use the SCB method and only test the quality management of the constructor on basis of system, process and product tests. Nevertheless, the expected learning as described in chapter 5 indicates that the success of this application of the method is not clear. This ambiguity of success in the expectation on this success is caused by the dynamics of the method and resistance to the implementation (cause 2).

The second deficiency is that there is no internal evaluation of the project teams expected by the management. This is because the organization has no incentives to improve its own performance. There is no need for the project teams to perform (cause 3) and thus to improve the success of the method. The evaluation of project is expected on the project results, but not on the internal quality of the project teams. The external client is able to demand these evaluations. The effect of these evaluations in terms of costs for the project management by Rijkswaterstaat are transferred to the external client, without attention from this external client there is no incentive for the organization to expect improvements in the success of the SCB method in the projects. This is caused by a lack of attention from the external client for Rijkswaterstaat project organizations and their processes. The external client underestimates the importance (cause 4) of the quality of the project management of Rijkswaterstaat. In fact, it tests only the product of the project teams and has little attention to the process of the project team.

Third deficiency has complex causes. The error detection is not likely to evolve by itself in the actual learning. First, the method is contrasting with the old working methods of contract control, where Rijkswaterstaat had its own quality management system. This deficiency is also caused by the resistance to change within the organization (cause 1). Nevertheless, the practice of Rijkswaterstaat was, for specific works still is and during some projects become (like the Dordtse Biesbosch case) that Rijkswaterstaat organizes a quality management system where the contractor benefits from. Using the quality management system of the contractor to a high degree for contract control is conflicting with the old working methods. The quality management tasks are transferred to the contractors and should no longer be performed by Rijkswaterstaat project team. These errors in the actual behavior of the organization are not detected as such. This causes a lack of error openness.

Second cause for the absence of error detection in the actual learning is the presence of conflicting interests (cause 5) in the project team that should detect the errors. The project teams and their client are less prone to detect errors and learn while producing the project as they are bound to their projects framework of requirements on the short term. The line organization of Rijkswaterstaat is the functional division of employees that participate in the project teams, for instance the contract managers’ Contract Management Division. They have interest in the long-term benefits from learning on the method and therefore are more open to detect errors on the SCB method in projects. The knowledge and empowerment to influence the usage of the quality management system of the contractor by Rijkswaterstaat is not located at the same actor as the interest of increasing this usage. This division of interests over multiple actors is not a problem itself, but these interests are not considered well in the decision-making processes on the implementation of the method. Most of the time it is the client of projects that trade off these interests. On the short term the room for error detection might lead to not meeting the initial project scope of that particular project, while on the long term leaving room for error detection result in learning (and thus improving) the application of the SCB method in other projects. This short-term interest prevails most of the time as
illustrated in the cases. Therefore, these conflicting interests cause the misplacement of the empowerment to detect errors in the SCB method in the project. The client of the project decides on the detection of errors, while the information and ability to influence these errors is located at the project teams. This conflict of interests in the projects is caused by the underestimation of the importance of the quality of the project management (cause 4) by the external client of the projects. The interests of the client and the line organization on the long term are compatible, nevertheless on the short term the chapter on actual learning indicated that the clients decisions does not include this long term interests of the line organization of Rijkswaterstaat.

Fourth deficiency is the limited sharing of knowledge in the organization on learning of the SCB method. This is identified by the lack of optimal using internalization, externalization and combination as knowledge conversion.

The limited interaction (cause 6) between the employees from different projects is first cause of this deficiency. This relates to the assembly of the project teams at Rijkswaterstaat. The exchange of employees over projects is limited, what makes the interactions where knowledge is converted limited in number. This prevents exchange of information and personal over projects within the organization. In the expected learning, the lead auditor program is a good example for enabling conversion of knowledge by exchanging employees over projects, in the actual learning the use of lead auditors in the projects has only started recently and is still limited to seven lead auditors over the regional department South Holland. For employees within the project there is no access to information on the members of other project teams and their specific knowledge and skills.

Second cause of this deficiency is that on actions that influence the success of the SCB method there is no systematic documentation of knowledge (cause 7). This makes conversion of knowledge depended of the actions from individuals in the organization and their memory. Furthermore, the diversity of scale of the projects at the regional departments causes unequal sharing and conversion of knowledge over the projects. Knowledge on the actions concerning the success of the method by the project teams is not always documented as the project are considered small and the knowledge not worthwhile of documenting. The number of these small projects is relatively high in comparison with larger projects within the organization; these projects therefore are an important source for creation knowledge on this issue. This documentation is worthwhile as it is necessary to convert and share the knowledge over the organization.

Improvements in learning the SCB method

The first measure focuses on the dynamics of the method and the resistance to change within the organization. This measure is starting the process to define the success of the method (measure 1). The Management Board of Rijkswaterstaat could define the success of implementation and included in these criteria in the formal working processes. Right now it is stated that the implementation of the method is not yet successful as not all projects apply a right mix of tests (CFO, 2009), however a description of the right mix of tests is not included in the formal working processes of the organization. The senior management could start practical implementation of this measure by clarifying the role of the SCB method in projects. The manual SCB describes the goal of the method, but it should repeated more often and communicated to the other projects team members as the contract managers. The goal of the method is to improve the construction process of public works by including the power of the market. The SCB method should check the quality management system of the contractor based on the project risks for Rijkswaterstaat. The senior management could describe the
successfulness of the method in the projects by the capability of the project teams to control the risks with the least amount working hours. This separates the goal of method from the general cooperation Rijkswaterstaat has with its contractors. The cooperation with the contractors includes two main aspects that cannot be included in the SCB method. First, there is continuous cooperation between Rijkswaterstaat and the constructor in specification of the requirements of the public work. The dynamics of most projects result in specification of the initial requirements on the works. Second, Rijkswaterstaat has a hierarchical relation as client with the contractor in which it controls the execution of the contract. The SCB method only performs this second aspect of the cooperation in the projects. Right now, the SCB method is used to control the quality of the works instead of only project risks.

The second measure is to start a more professional relation with the external client of the projects. The interests of the client heavy impact on the project management by Rijkswaterstaat project teams. The emphasis is on the results of the project on the short term, and less on the process of the project teams to reach these results. Rijkswaterstaat assures the quality of the works in the project on basis of the constructors system and processes, but Rijkswaterstaat itself is checked on basis of their product results. In a more professional relation with it clients, **attention from the client for the product and the production process** is more appropriate (measure 2). In fact, this measure is based on the same theoretical assumptions that are the basis for Rijkswaterstaat for applying the SCB method to their contractors; the system produces the product by working processes, by checking the system and processes it is possible to assure the quality of the product. As the system and processes are in place before the product is produced and are less time consuming to test; this method could be beneficial in terms of effectivity and efficiency.

**Testing of the internal quality of the project management** (measure 3) in the projects will help to detect errors in the success of the method in the projects. There is expectation of evaluation of the quality of the project teams by the project manager, but the actual learning indicated that these evaluations seldom include the internal quality of the project teams. The individual project teams should check their internal quality of the project management.

This also includes checks on the quality of the contract control according with the SCB method. By that, it facilitates the correction of errors on a project level and systematically embeds learning in the daily behavior of the organization. The Management Board can demand more frequent testing of the internal quality of the project teams. Nevertheless, this requires capacity to perform the tests and share information from the tests in the organization.

This measure itself is not new, there are activities included in the expected learning. However, these are not always used because of underestimating their importance. The opportunity of the managers project management to perform internal audits on the contract management (and by that the application of the SCB method) should be utilized more during the time that the project risk of not successfully implementing the SCB method is high. The current used implementation form should be used on a regular base as basis for implementation of the SCB instruments. The success and transparency of the implementation of the SCB method could be improved by applying the working processes from international ISO 9001 certificate. This certification prescribes a more systematical and uniformed documentation of working processes, which also enables the conversions of knowledge by internalization and combination. The documentation is both an assurance of the quality of own working processes and makes the transfer of explicit knowledge from the projects easier.

The fourth improvement is to facilitate knowledge sharing. According the theoretical model on learning, the process of learning a new working method is complete with this third aspect.
It is useful to share the knowledge on these actions, once there is a clear description on the successful implementation of the method and there are actions on the improvement of this success. These sharing of knowledge can be facilitated by building a knowledge management system. This will facilitate the knowledge conversions discussed by Nonaka (Nonaka and Takeuchi, 1995) with a solution by creating what the philosopher Nishida calls “Ba”; space for knowledge sharing (Nonaka and Konno, 1998). A knowledge management system is facilitating this space for a practical implementation of this space. There are two types of knowledge management systems that are characterized by either codification or personalization (p.68) (Hansen et al., 2001). Hansen et al. suggests that an organization should choose between the two types in order to share knowledge effectively. The choice between the two types is depended on the structure of the knowledge, stability of the knowledge and the routine (p.8) (Malhotra, 2002). For Rijkswaterstaat a personalization type of knowledge management system is most suitable; the knowledge on the actions that improve the success of the SCB method is dynamic, the projects the knowledge involves are very heterogeneous and their situation is dynamic. A personalization type system means a database that is accessible by all Rijkswaterstaat employees and includes information on individuals in the organization that enables interaction between these individuals. For Rijkswaterstaat such a database should include:

- All Rijkswaterstaat employees of all five IPM roles (Project manager, contract manager, environment manager, technical manager and manager project management).
- Contact details of the employees (regional department, email and telephone number).
- Chronological overview of project worked on by the employee (names of present and past projects; and short summery on the specific role of the employee in the projects).
- Include overview of all projects in execution and executed by Rijkswaterstaat.
- Short projects descriptions.
- Search function on either of the above attributes.

7 Conclusions and recommendations
This analysis in this article provides the answer to the question;

How is Rijkswaterstaat learning the SCB method and how could this learning be improved?

The analysis consists of identification of differences between learning in theory, the learning that is expected by the organization and the actual learning in the organization. The deficiencies in the differences between these views indicate that learning is not successful and can be improved. When the organization behaves as it says it behaves and this behavior complies with the scientific literature on this issue, learning is optimal. The theoretical learning showed that in order to learn and improve the application of a method there should be errors detected, corrected and knowledge should be shared on these actions. This theoretical learning provides a framework to identify the learning in the organization. The expected learning indicates that Rijkswaterstaat organization does not describe when the method is expected to be successful. This error detection in the application of the SCB method in the actual behavior is therefore impossible. The cases studies describe the actual behavior of the organization in the projects. This actual learning indicates that there is no learning on the SCB method as defined in this article. This means there are no actions that aim at improving the success of the method in the projects. Nevertheless, there is learning on the application of
instruments that support the SCB method and ad hoc actions from individuals that improve the success of the method in projects.

There are measures that are capable of minimizing the deficiencies in the differences between the three views on learning, by that they improve the learning on the SCB method at Rijkswaterstaat. First measure is to start the process of defining the success of the method; this should enable the identification of success of the method in a specific project and enables error detection on this success. Second measure is more attention from the client for the product and process of projects at Rijkswaterstaat. This will increase the attention to the long-term interest of both the client and Rijkswaterstaat in improving the production process of the projects. The third measure is to test the internal quality more often by the project teams themselves; this will create the need for the projects to improve their working processes, which also include the application of the SCB method. Fourth measure is building a knowledge management system that connects project team members with a demand for knowledge with owners of this knowledge in different project teams throughout the organization.

This study on learning on the implementation of the system based contract control method is interesting from scientific interests. It shows that theories from different scientific disciplines are capable of identification of the behavior of an organization on the implementation of a new working method. The SCB method is an example of a hierarchical based implementation of working methods. Nevertheless, learning on the application of the method is essential for the success of meeting the methods objectives. The analysis of the SCB method at Rijkswaterstaat showed that this process is difficult and needs additional measures, but success is also depended on the attention and effort the management gives for the implementation.

Thereby, this article contributes to the scientific literature on organizational change and development. Learning processes in organizations, unlearning and organizational culture are important for the success of implementing new working methods. Nevertheless, for enabling the organization to improve and learn a new method, it is critical the organization describes the process of implementing the method and providing the criteria to determine the success of the method and its implementation.
Article references


RIJKSWATERSTAAT (2008b) Ondernemingsplan Rijkswaterstaat 2012: We pakken door!


## Appendix B: Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BBD</td>
<td>Information and Administration Section</td>
</tr>
<tr>
<td>BCT</td>
<td>Control and Oversight Section</td>
</tr>
<tr>
<td>CBT</td>
<td>Contract control team, the part of the RWS project team that controls the contract</td>
</tr>
<tr>
<td>CFO</td>
<td>Chief financial officer of the Senior Management Board of Rijkswaterstaat</td>
</tr>
<tr>
<td>Contract control Plan</td>
<td>Document that describes the procedures on the supervision of the contract by the RWS contract control team (Dutch: contract beheersplan (CBP))</td>
</tr>
<tr>
<td>DAD</td>
<td>Dutch abbreviation for Court of Audit from the ministry of Transport, Public Works and Water Management (Departementaal auditdienst)</td>
</tr>
<tr>
<td>DG</td>
<td>Director-general</td>
</tr>
<tr>
<td>DZH</td>
<td>Regional department South Holland</td>
</tr>
<tr>
<td>EMVI</td>
<td>Dutch abbreviation for economically most favourable tendering, which also include some basic quality checks for the tender (Economisch meest voordelige inschrijving)</td>
</tr>
<tr>
<td>Manager project management</td>
<td>The person in a RWS project team that is responsible for supervising the project and its internal quality. This person is from the operations support department (BBD). (Dutch: manager projectbeheersing)</td>
</tr>
<tr>
<td>Min V&amp;W</td>
<td>Dutch Ministry of Transport, Public Works and Water Management</td>
</tr>
<tr>
<td>MT</td>
<td>Management team (direction + departement heads)</td>
</tr>
<tr>
<td>PM</td>
<td>Project Manager</td>
</tr>
<tr>
<td>RCM</td>
<td>Contract management section</td>
</tr>
<tr>
<td>RWS</td>
<td>Rijkswaterstaat, the Dutch Directorate-General for Public Works and Water Management</td>
</tr>
<tr>
<td>SCB</td>
<td>Dutch abbreviation for System based contract supervision (systeemgerichte contract beheersing)</td>
</tr>
<tr>
<td><strong>System based contract control</strong></td>
<td>The supervision of contracts based on the contractors quality management on basis of risks (Dutch: systeemgerichte contractbeheersing (SCB))</td>
</tr>
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<td>----------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Test Coordinator</strong></td>
<td>The person that coordinates the testing that is basis for the contract supervision on basis of risks. It is not uncommon that this task is one the tasks of the contract manager, but some projects have a specific team member that is only responsible for this task (Dutch: Toetscoordinator)</td>
</tr>
<tr>
<td><strong>URSCB</strong></td>
<td>ICT tool for Uniform Registration of System based contract control projects</td>
</tr>
</tbody>
</table>
Appendix C: Empirical sources overview

The research for this thesis included interviews summarized in table C.1 and the meeting visible in table C.2.

Table C.1: Interviews

<table>
<thead>
<tr>
<th>Person</th>
<th>Role</th>
<th>Department</th>
<th>Date of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theo van Putten</td>
<td>Research Supervisor/ knowledge manager</td>
<td>RWS DZH BBD</td>
<td>At least weekly meetings</td>
</tr>
<tr>
<td>Leo van Es</td>
<td>Senior advisor SCB</td>
<td>RWS DI IMG</td>
<td>7 December 2009</td>
</tr>
<tr>
<td>Roelof Triemstra</td>
<td>Head of section Contract management</td>
<td>RWS DZH RCM</td>
<td>27 October 2009</td>
</tr>
<tr>
<td>Simon Voorberg</td>
<td>Contract manager</td>
<td>RWS DZH RCM</td>
<td>21 January 2010</td>
</tr>
<tr>
<td>Rob Ouwendijk</td>
<td>Contract manager</td>
<td>RWS DZH RCM</td>
<td>17 November 2009</td>
</tr>
<tr>
<td>Lida Nugteren</td>
<td>Contract manager</td>
<td>RWS DZH RCM</td>
<td>17 November 2009</td>
</tr>
<tr>
<td>Guus Helmer</td>
<td>Contract manager</td>
<td>RWS DZH RCM</td>
<td>4 November 2009</td>
</tr>
<tr>
<td>Ard Willems</td>
<td>Test Coordinator</td>
<td>RWS DZH RCM</td>
<td>4 November 2009</td>
</tr>
<tr>
<td>Ryan Budhan</td>
<td>Manager Project Management</td>
<td>RWS DZH BBD</td>
<td>15 January 2010</td>
</tr>
<tr>
<td>Jeroen van Netten</td>
<td>Contract manager</td>
<td>RWS DZH RCM</td>
<td>11 November 2009</td>
</tr>
<tr>
<td>Rob Jongkind</td>
<td>Head of section RI</td>
<td>RWS DZH RI</td>
<td>10 March 2010</td>
</tr>
<tr>
<td>Falentijn de Kramer</td>
<td>Manager Project Management</td>
<td>RWS DZH BBD</td>
<td>11 January 2010</td>
</tr>
</tbody>
</table>

Table C.2: attended meetings

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Target group</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly section meeting; all managers project management present</td>
<td>Section meeting; presentation with discussion on midterm findings</td>
<td>10 December 2009</td>
</tr>
<tr>
<td>SCB training</td>
<td>Employees of traffic management center Dordrecht</td>
<td>16 November 2009</td>
</tr>
<tr>
<td>National expert group knowledge sharing evaluation</td>
<td>Knowledge managers from different regional departments of RWS</td>
<td>27 January 2010</td>
</tr>
<tr>
<td>Presentation Final Results</td>
<td>Managers project management + SCB Coordinator DZH</td>
<td>1 March 2010</td>
</tr>
</tbody>
</table>
Appendix D: Case study protocol

This case study protocol is based on the guidelines of Yin (p.79-92) (Yin, 2008). The case study results obtained by applying this case study protocol are input for the chapter actual learning and the construction of improvements in this thesis.

Introduction of the case study and purpose of the protocol

The cases reflect on the identified theoretical model for learning and thereby are used as proxy to determine the actual learning in the organization on the SCB method at Rijkswaterstaat. Furthermore, it tests the difference between the actual and expected learning and its causes in the cases.

The case study provides the answer to sub-research question 3 and its sub-sub questions:

*How is Rijkswaterstaat actual learning the system based contract control method?*

3.1 How are errors in the contract control detected?
3.2 How are errors corrected?
3.3 How is knowledge on these actions shared?

Furthermore, it provides information that enables the answer to the first and second sub-sub question of research question 4:

*What are opportunities to improve learning the SCB method at Rijkswaterstaat?*

4.1 Why are there deficiencies?
4.2 How can these deficiencies be minimized?

The cases are evaluated in their current learning on the SCB method on basis of the theoretical model for learning constructed in chapter 4. By that the case study is used as a theory building research as defined by Eisenhart (p.534) (Eisenhart, 1989). The case study is basis for building the theory on how learning is actual present in the organization. The theoretical proposition points the attention, limits the scope and suggests possible links between phenomena. The proposition of this case study is based on the problem description of this thesis, the proposition is the existence of deficiencies in the differences between the actual and expected learning on the SCB method at Rijkswaterstaat. This case study builds a theory on the actual learning at Rijkswaterstaat on basis of the theoretical model for learning and provides insight in the differences between the actual and expected learning.
This case study protocol is used to structure and to safeguard the reliability of the case study for the research of this thesis. By applying this protocol to all case study there is an uniform way of collecting case information.

Cases selection

The case study performs its analysis on specific study units. These study units are the cases studied in the case study. Following the definition of a case: “Cases are empirical units, theoretical constructs, and subject to evaluation, because scientific and practical interest are tied to them” (Ragin in (p.1) (Scholz and Tietje, 2002)). The cases identified for this case study are projects within the organization of Rijkswaterstaat. Other objects that could function as cases are individuals, specific tasks in the projects teams, a specific department or the whole organization of Rijkswaterstaat. The project is the optimal scale for defining cases as:

- The learning on the SCB method is situated at this level; the corrections by effective actions are traceable within projects; some of them are documented.
- The introduction of the SCB method is possible with every new contract; although its common to introduce it at the start of a new project.
- It is possible to identify different objects of learning (individual/organizational) on this scale.
- It is possible to research the relationships between the learning objects on this scale.
- The learning cycles within projects are relatively limited in time (maximum of several years).
- The results, characteristics and processes in projects are relatively well documented on the scale of projects. This enables document study on the scale of the cases.
- The scope of projects allows multiple cases be included in the research. Which is beneficial to the research own learning cycle and improves validity of findings from the research.
- The availability of the resources for the cases; individuals currently working on the projects are available for research.

In the realization of public works there are multiple demarcations for projects and their project teams; Rijkswaterstaat has a project team for the works (or even multiple teams, as the organization has multiple sometimes overlapping departments), the contractor(s) has it project team and there are many more possible project teams involved a single realization of a public work. For the demarcation of projects as cases, this case study applies the view from Rijkswaterstaat regional department South Holland. From this view, activities from the employees are a project, when a project manager and the other IPM roles from the regional department are assigned to the project.

In order to construct validity this case research uses multiple cases and multiple sources of evidence on those cases. There is a valid argumentation on the selection of cases. The selection of cases in the descriptive theory-building case studies is not subjected to statistical sampling for validity as traditional hypothesis-testing studies are (p.43) (Yin, 2008). Theoretical sampling where the processes of interests is transparently observable is sufficient for descriptive and theory building cases studies. Theoretical sampling involves the selection of cases that are likely to replicate or extend the emergent theory (p. 537) (Eisenhart, 1989). For this research the selection of projects as case study is performed according to the knowledge and experience of the contract managers, as they are key individuals in the actions the organization takes on the SCB method. The selected cases are cases that involve different kind of project phase, type of projects and magnitudes. Table D.1 presents the overview of the cases of this cases study and their characteristics.
### Data collection

For the purpose of this research the most important information resources are the internal project documents that describe the formal cooperation of the RWS project team and the information from the RWS employees in projects. The contract supervision plan (Contract beheersplan) of the cases are gathered and are studied before interviewing the people involved in the projects. The type of data that is obtained from the interviews are the evidence and reflection on the aspects of learning identified by the theoretical model. The Case A12 Den Haag – Gouda is used as pilot case to determine the appropriateness of the case study questions and whether the role of the interviewed resulted in the required information to answer to the case study proposition. This pilot case study resulted in the observation that interviewing the test coordinators of the cases did not result in additional insight in the learning the SCB method, although it did provide useful information on the application of the SCB method itself. Therefore, the test coordinators of the other cases were not interviewed for this research.

### Table D.2: Case specific documents

<table>
<thead>
<tr>
<th>Case</th>
<th>Document</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>A13/A16</td>
<td>Contract control plan</td>
<td>RWS-720328-v5-Contractbeheersplan_OTB_A13161</td>
</tr>
<tr>
<td>Dordtse Biesbosch</td>
<td>Contract control plan</td>
<td>Final 15 September 2009</td>
</tr>
<tr>
<td></td>
<td>Test planning</td>
<td>Final (several from April until November 2009)</td>
</tr>
<tr>
<td></td>
<td>Test meetings reports</td>
<td>Final (several from April until November 2009)</td>
</tr>
<tr>
<td></td>
<td>Risk register</td>
<td>Final (several from April until November 2009)</td>
</tr>
<tr>
<td>Hollandse Ijssel</td>
<td>Contract control RWS – WiBo</td>
<td>Final 13 July 2009</td>
</tr>
<tr>
<td></td>
<td>Contract control plan RWS on constructor</td>
<td>Final 5 June 2009</td>
</tr>
</tbody>
</table>
For the purpose of providing input for the answer to the question on the differences between the actual and expected learning, the case study also include interviews of the managers project management. This enables both verification of the actual learning on basis of the theoretical model for learning as information on the difference between the expected and actual learning on the SCB method in the cases. The manager project management is responsible for the internal quality of the projects at Rijkswaterstaat.

The people interviewed for the case studies and their roles are summarized in Table D.3.

Table D.3: Interviews at Rijkswaterstaat for cases

<table>
<thead>
<tr>
<th>Case</th>
<th>Person</th>
<th>Role</th>
<th>Date of interview</th>
</tr>
</thead>
<tbody>
<tr>
<td>A13/A16</td>
<td>Rob Ouwendijk</td>
<td>Contract manager</td>
<td>17 November</td>
</tr>
<tr>
<td>Dordtse Biesbosch</td>
<td>Lida Nugteren</td>
<td>Contract manager</td>
<td>17 November</td>
</tr>
<tr>
<td>A12 The Hague-Gouda</td>
<td>Guus Helmer</td>
<td>Contract manager</td>
<td>4 November 2009</td>
</tr>
<tr>
<td></td>
<td>Ard Willems</td>
<td>Test Coordinator</td>
<td>12 November 2009</td>
</tr>
<tr>
<td></td>
<td>Ryan Budhan</td>
<td>Manager Project Management</td>
<td>15 January 2010</td>
</tr>
<tr>
<td>Hollandse IJssel</td>
<td>Jeroen van Netten</td>
<td>Contract manager</td>
<td>11 November</td>
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<tr>
<td></td>
<td>Falentijn de Kramer</td>
<td>Manager Project Management</td>
<td>11 January 2010</td>
</tr>
</tbody>
</table>

Case study questions

For the contract managers the questions for the interviews are constructed on basis of the theoretical model for learning. First the basic questions for the contract managers, during the interview there are also additional questions asked that provided in depth information on the cases. As this is a descriptive theory-building case study, the comparison of the cases is not the objective of the study. Therefore the validity and reliability of the case study is not affected by adding questions to later cases, as it is in theory testing case studies (p. 40-45) (Eisenhart, 1989, Yin, 2008).

These questions formed the basis of the interview with the contract managers;

General information (with the purpose of defining the case characteristics)

1. What are the project scope and activities?
2. What contracts have there been in the past of this project?
3. What contracts (with who) are currently supervised?
4. What is the scope of this contracts?

On the implementation of the SCB method (with the purpose to identify the degree of implementation of the method in the case)

5. How is the SCB method implemented?
6. How many test have been performed? And which type of tests?
7. How is the relation with the contractor?
On the learning on the SCB method (with the purpose to discover the learning on the method, in the case)

8  How is the SCB method been learned/ evolving in the project?
9  Who decides upon changes in the application of the SCB method in the project?
10  What changes have been made and why?
11  How are these changes evaluated?

On learning in the organization (with the purpose of identifying the learning mechanisms in general in the case)

12  Who in the project team are trained in applying the SCB method?
13  What meetings are organized in the project team to discuss the project progress?
14  How are these meetings documented?
15  How is the knowledge obtained in this project shared in the organization?

For the interviews with the managers project management, there are some additional questions that explicitly focus on the difference between the actual and expected learning in the projects:

16  Do you share the view on the actual learning in the project according to the theoretical model constructed by this research? Why do you (do not) agree?
17  What do you think about the expected learning? (as described by the implementation plan and rest of the chapter of this research)
18  How are evaluations organized in the project?
19  What is the effect of these evaluations?
20  How is the progress of learning measured?
21  How could this be measured?
22  How is the internal quality supervised on the application of the SCB method?
Validation case information and conclusions

In order to provide a validate case study and draw worthwhile conclusions from the case study information, verification of the information is necessary. This verification process is done by applying the phases visible in table E.4; these phases include the interview data collection and its verifications.

Table E.4 Validity phases

<table>
<thead>
<tr>
<th>Phase</th>
<th>What</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Interview on expected learning</td>
<td>Expert on SCB: Leo van Es (IMG)</td>
</tr>
<tr>
<td>Phase 2</td>
<td>Construction of chapter on expected learning</td>
<td>Author</td>
</tr>
<tr>
<td>Phase 3</td>
<td>Interviews on actual learning</td>
<td>With contract managers of cases</td>
</tr>
<tr>
<td>Phase 4</td>
<td>Construction of chapter on actual learning</td>
<td>Author</td>
</tr>
<tr>
<td></td>
<td>Construction of concept chapter for improvements</td>
<td>Author</td>
</tr>
<tr>
<td>Phase 5</td>
<td>Interviews; validation of information of contract managers on actual learning and reflection on differences actual-expected learning and improvements</td>
<td>With managers project management</td>
</tr>
<tr>
<td>Phase 6</td>
<td>Construction of chapter on differences between actual and expected learning and improvements and improvements</td>
<td>Author</td>
</tr>
</tbody>
</table>
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