Aligned architectural descriptions for a financial infrastructure

the Giro Case

niet uitleenbaar

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Acknowledgments

This report describes the results of the graduation project in order to receive my Masters Degree for the study Industrial Engineering and Management Sciences at the Eindhoven University of Technology. This project is conducted at the Inclusion Group where I have been warmly welcomed and have been working with enthusiasm.

I would like to thank Frans van Eersel and Hans Neecke for their work as supervisors. In particular I would like to thank Hans for supporting me with his personal dedication and extensive experience in the field of architecture.

I would also like to thank my university supervisors, Jan Goossenaerts and Paul Grefen, for their time, input and comments during my graduation project. Especially Jan Goossenaerts for highlighting different aspects of issues during the project and clarifying my train of thought when I thought I was stranded. I would also like to thank Paul Grefen for his straight forward commenting style and for providing me with a broader scope for the graduation project.

Finally I would like to thank my family, girlfriend and friends who have been supporting me during my studies. In particular I would like to thank Fenneke for her reviews and comments but even more for standing by my side during the last years.

I am very grateful for the opportunity the Inclusion Group has given me to be a part of their dynamic and international environment. I strongly identify with the ambition of the Inclusion Group to lift more people to prosperity and include them in the global economy.

Jasper van Tongeren

Utrecht, July 2006
Abstract

This report describes the development of architecture descriptions for a financial infrastructure. In this graduation project the implementation of a Giro system by the Inclusion Group serves as a foundation for developing architecture descriptions for the organisation. These serve as an enabler for the product creation process and form a foundation for future development of the reference architecture for the products and services of the Inclusion Group.
Executive summary

This executive summary will give a bird eyes view of the content of this graduation report.

Context

The Inclusion Group enhances the existing financial infrastructure in emerging countries. This is realized by setting up a joint-venture with national retail and banking companies to reach people currently without a bank account. The joint-venture is servicing existing financial and network structures through a Giro system based on InterClear from Interpay.

Assignment description

The graduation assignment at the Inclusion Group is initiated from a need for more structure and insight in the organisational processes. The final assignment description around which the graduation project evolves is:

*To construct an architectural framework for Inclusion Group and to fill in and deploy this architectural framework for a Giro product as an enabler for the product creation process and as a foundation for the future development of the reference architecture for the products and services of the Inclusion Group.*

The two accompanying goals, which are addressed by the final assignment, are the following:

*To use an architectural framework to reduce the risks of failure for Giro-Nil products*

*To obtain system architecture descriptions that can be re-used in financial sector transformations in other emerging countries.*

Scope

To address the assignment within time frame of the graduation project a focus needs to be applied. The research model is setup to communicate the approach of the graduation design indicated within the project phases of scope, analysis, design, implementation and evaluation. This scope establishes a realistic assignment within the time limit of the graduation project. In the analysis and design the architecture descriptions address the organisational problems indicated by the cause and effects analysis and the theory found in the scientific literature is applied. The implementation suggestions are made clear and the design is evaluated. In the planning the activities are placed in a time frame with deliverables.

Analysis

At this moment operations of the Inclusion Group are focussed on enhancing the financial infrastructure in Egypt. This is achieved through Giro-Nil, the first joint-venture of the Inclusion Group. The Product Creation Process is responsible for the development of a Financial System.
Both the Inclusion Group Product Creation Process and the Financial System, Giro-Nil, are analyzed using separate Ishikawa diagrams. For the Product Creation Process, the problems which form the basis for the analysis are lack of overview and high risk of failure. Lack of reusability and lack of accumulation of knowledge are problems concerning the Financial System.

In this graduation project descriptions of the Financial System are used as a starting point for developing the Product Creation Process. In the future, when a controlled, high quality Product Creation Process is established its outcome, the Financial System and the quality of the Financial System can be predicted and secured. The design of the graduation project will focus on the Financial System of the Inclusion Group, since the Financial System needs to be examined first before it can be decided how it can be developed.

**Design**

The system life cycle theory is applied to the financial infrastructure. From the point of view of the Inclusion Group the implementation of a Giro system through a joint-venture can be seen as the system development process. When the Giro system is fully operational the joint-venture is in the operation & maintenance life stage. From the point of view of the economy of the emerging country the operational Giro system is an enabler for the system development process of the financial infrastructure. The respective performance alerts of the two cycles are

- Risks of failure and
- A cash based financial infrastructure

These alerts are addressed with help from the 3-V model which indicates the depth of change effort needed. The FAST methodology is also based on the system life cycle concept. FAST can be documented in an Architectural Framework. Within this graduation project a multi-scale architectural framework is developed and made practical with Market Architectural Descriptions (MAD) and Business Architectural Descriptions (BAD). In this way the architectural descriptions are aligned for the Financial Infrastructure in Egypt.

To assess whether the problems found during the analysis are coped with by the architectural descriptions, an assessment is conducted with respect to the problems identified in the Ishikawa of the Financial System.

**Implementation**

The implementation of the architecture descriptions at the Inclusion Group has to be achieved by creating acceptance through meetings and presentations. To facilitate future developments of architecture descriptions an architecture management process is being implemented.
Conclusions regarding organisation

- The implementation of joint-ventures at the Inclusion Group needs more control and structure.
- The high level business ambition is not systematically and consistently translated to the implementation of the Giro system.
- A decoupling is required of the Inclusion Group Product Creation Process and its product, the Financial System.
- The architecture descriptions provide a representation of the Inclusion Group products and its environment with multiple functions.
- The architecture descriptions are serving as a proof of concept and need to be further elaborated.

Conclusions regarding graduation assignment

- The first goal of the graduation assignment is addressed by the Product Creation Process. The design of the architecture descriptions is focused on the Financial System. Therefore this goal is partially addressed by the architecture descriptions.
- The second goal of the graduation assignment is covered by the Financial System. Therefore the architecture descriptions address the Financial System.

Conclusions regarding theory

- FAST and system life cycle have given insight for interpreting the financial infrastructure.
- The Market Architectural Descriptions add value to the COMET methodology.
- The layered approach of COMET is beneficial for the development of architecture descriptions.
- COMET provides few practical modelling examples.

Recommendations

- Make the architectural descriptions accessible.
- Recommended course for architecture:
  - Involve partners in the architectural effort.
  - Develop a reference architecture.
  - Roles defined in Giro system and actual stakeholders must be decoupled.
- Establish a generic Product Creation Process for the Giro system.
Abbreviations

<table>
<thead>
<tr>
<th>AD</th>
<th>Architecture descriptions</th>
</tr>
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<tbody>
<tr>
<td>BAD</td>
<td>Business architecture descriptions</td>
</tr>
<tr>
<td>BC</td>
<td>Billing company</td>
</tr>
<tr>
<td>BIS</td>
<td>Bank for international settlements</td>
</tr>
<tr>
<td>BOM</td>
<td>Business operations model</td>
</tr>
<tr>
<td>BPS</td>
<td>Bank process services</td>
</tr>
<tr>
<td>CBE</td>
<td>Central bank of Egypt</td>
</tr>
<tr>
<td>COMET</td>
<td>Component and model-based development methodology</td>
</tr>
<tr>
<td>FAST</td>
<td>Framework for the application of systems thinking</td>
</tr>
<tr>
<td>FI</td>
<td>Financial infrastructure</td>
</tr>
<tr>
<td>FS</td>
<td>Financial system</td>
</tr>
<tr>
<td>GSC</td>
<td>Generalized scorecard</td>
</tr>
<tr>
<td>IG</td>
<td>Inclusion Group</td>
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<tr>
<td>IGS</td>
<td>International giro solutions</td>
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<tr>
<td>CEFA</td>
<td>Civil entity financial activities</td>
</tr>
<tr>
<td>MAD</td>
<td>Market architectural descriptions</td>
</tr>
<tr>
<td>MOM</td>
<td>Market operations model</td>
</tr>
<tr>
<td>MPP</td>
<td>Mass payment provider</td>
</tr>
<tr>
<td>PCP</td>
<td>Product creation process</td>
</tr>
<tr>
<td>RM</td>
<td>Requirements model</td>
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1 Company description

This chapter provides the context of this graduation assignment. This research is carried out at the Inclusion Group. First a description of the Inclusion Group is given to outline an image of its position. At this moment the Inclusion Group is occupied with setting up a joint-venture to enhance the existing financial infrastructure of a pilot country. The product portfolio is described, as well as a picture of the pilot country with stakeholders and the accompanying Giro-Nil organisation.

1.1 Vision

Modernization of financial systems is one of the main challenges when attaining sustainable economic development. Most emerging countries need to improve the architecture and efficiency of their financial systems. These countries are essentially cash and paper based. Cashless payment instruments are currently only available to a relatively small group of high-income individuals, who are being served by a large number of retail banks. The majority of the population is excluded from these financial services. The former president of the World Bank, James D. Wolfensohn, has stated:

The greatest long-term challenge for the world community in building a better world is that of fighting poverty and promoting inclusion worldwide.

Many development institutions such as the World Bank Group have recognised that there are significant benefits for everyone, if people in developing and emerging countries are able to take full advantage of information technologies for improving their lives. An efficient domestic financial system that is accessible to all people is one of the key fundamentals for meeting this challenge. The modernization of the financial systems is one of the foundations for attaining sustainable economic development and the inclusion of a significantly greater proportion of the population into prosperity. The Inclusion Group supports this vision and has organised itself accordingly. The Inclusion Group acts, both as an enabler and an accelerator in order to link more people to prosperity.

1.2 Mission

The Inclusion Group mission is to stimulate economic and social development in emerging countries by releasing the power of modern payment services to all people.

To select an emerging country, it should meet a number of key characteristics such as:

- cash-based society.
- critical mass of the target market.
- positive attitude at governmental level towards reform and liberalisation.
1.3 Organisation Structure

The Inclusion Group makes its mission practical by setting up an organisation that enhances the existing financial infrastructure in developing countries to implement new products. The organogram of Inclusion Group is depicted Figure 1. The staff functions, Communications, Finance, Legal and Office, are supportive for the Management Team of the Inclusion Group. The Business branch searches for new opportunities in financial markets in foreign countries. Its activities include market research, sales, partner management and forming of new joint-ventures. The People branch is responsible for recruiting employees, forming of joint-venture teams, development of skills, behaviour and expertise of people within the organisation. The Products branch is responsible for the consolidation of intellectual property, a giro reference model, development and governance of the business and IT architecture, development of new functionalities and creation of documented licences.

![Organisation Structure Inclusion Group](image)

1.4 First joint-venture

A modern financial infrastructure is a prerequisite for realizing sustainable economic growth and social development in any country. Egypt, like most emerging countries, lacks an efficient financial infrastructure which is reflected in a high proportion of unproductive cash in circulation. Cashless payment instruments are only in use between institutions, corporations and a small group of high-income individuals. The majority of the population is excluded from these financial services.
The Inclusion Group is setting up a joint-venture, Giro-Nil, with national partners to release this huge potential. The implementation is effectuated by implementing relevant parts of the proven marketing and technology concepts of the payment system from the Netherlands in Egypt. The Inclusion Groups environment can be characterised as very dynamic and complex. Giro-Nil is confronted with complex information processes and many actors with diverse cultural backgrounds. To some extent, the level of success of the Inclusion Group will be dependant on the success of the pilot organisation, Giro-Nil.

Within the timeframe of the payment system implementation, first a temporary project organisation is raised to achieve a viable, established organisation, Giro-Nil. In the set-up period an executive from the Inclusion Group is the Managing Director of Giro-Nil and different positions within the temporary project organisation are occupied by experienced consultants from the Inclusion Group. They focus on Operational processes, Marketing & Business Development, Information & Communication Technology, Training & Knowledge Transfer and on Implementation Management. In due course, professionals from the concerning nation will take over the management responsibility.

Giro-Nil distinguishes three stages within the implementation for roll out of the company, videlicet a pre-pilot, a pilot and a mass roll-out phase. In the pre-pilot phase the infrastructure is set-up as a base to agree on and to implement the processes and interfaces with other organisations involved. This is realized in the fourth quarter of 2005. With the configuration from the pre-pilot phase in the pilot phase, the aim is for real life customers to have opened a GiroAccount. The pilot phase will be used to adapt the software to local needs. This will be rounded up by the end of 2006. The mass roll-out phase will be initiated in 2007. The processes will be further automated to support high volume processing. When the mass roll-out phase is concluded Giro-Nil will be the first financial infrastructure organisation from the Inclusion Group with a Giro-based service offering.

1.5 Product Portfolio

Within countries that aim for a transition to modern payment services for all people, Inclusion Group products and services can facilitate a controlled and accelerated transition to unlock added value for its partners in the form of:

- **Economy of Scale**: By sharing the investment cost to create the infrastructure for processing acceptgiros, banks can offer a new payment service at low cost.

- **Economy of Scope**: The aim of this giro concept is to increase the number of current accounts at the partners. More accounts will make other investments in financial facilities, such as ATM's, more cost-effective.

- **Speed up Retail Market penetration**: The mass market is targeted by mass payments, like salaries, and the acceptgiro. That market that is currently not served by the banks.

Giro-Nil's activities are based on the Giro model that was implemented in The Netherlands in the sixties and seventies. Today, this model still serves as the backbone infrastructure for bill payment processing in The Netherlands and is recognized as one of the most efficient
financial systems in the world. The reference model is based on the successful Dutch Interpay model. Interpay is a company owned by all the Dutch banks and conducts the electronic and document processing services.

The two main ICT environments of Giro-Nil are an environment for document processing and an environment for payment processing. (Giro-Nil Business Plan, 2005)

The Giro model support several functions fulfilled by different products and services. The core functions and products are listed in Table 1.

<table>
<thead>
<tr>
<th>Function</th>
<th>Giro Product</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account</td>
<td>GiroAccount</td>
<td>core banking product</td>
</tr>
<tr>
<td>Bill payment</td>
<td>AcceptGiro</td>
<td>many to 1 civil entity money transfer</td>
</tr>
<tr>
<td>Cash Deposit and Withdrawal</td>
<td>CashGiro</td>
<td>cash transactions</td>
</tr>
<tr>
<td>Mass payment</td>
<td>BusinessGiro</td>
<td>1 to many civil entities money transfer</td>
</tr>
<tr>
<td>Money transfer</td>
<td>TransGiro</td>
<td>1 to 1 civil entity</td>
</tr>
<tr>
<td>Remittance</td>
<td>EuroGiro</td>
<td>intercontinental money transfer</td>
</tr>
</tbody>
</table>

1.6 Stakeholders

The Inclusion Group is one of several stakeholders who work together in setting up effective financial systems in emerging countries. The Inclusion Group is actively seeking shareholders willing to invest in new payment systems in developing countries. These shareholders need to have an already established organisation in the developing country such as public or private banks, savings banks, postal authorities and other governmental organisations. The clients for the Giro system can be mass payment providers, like governmental entities and companies with many employees, and billing companies. Billing companies are service companies with a large customer base. The mass payment providers have to pay salaries on a regular basis and therefore will provide a regular transaction flow. Billing companies will also generate a large transaction flow, but with billing customers. The customers of the new organisation will mainly be individuals who are not yet familiar with banking products and who are going to open a new account. Other stakeholders involved in setting up new organisations and regulating parties, such as bank affair regulating institutions.

In Appendix Giro-Nil a more extensive description is given of the scope, organisation, objectives, stakeholders and the ICT environment of Giro-Nil.
2 Orientation

This chapter starts with the description of the initial assignment. The initially techniques used for information gathering have lead to findings and conclusions regarding the assignment. These are described in the second section. The findings formed the foundation for the final assignment description as described in the third section of this chapter.

2.1 Initial assignment description

The Inclusion Group is setting up its first Giro-based infrastructure. For its payment processing, this joint-venture is technically founded on the proven InterClear clearing and settlement system of the Interpay company. This system is linked to document processing for making physical data electronical and needs to be adapted to the local situation of the financial infrastructure of the joint-venture organisation. Furthermore, local people need to be trained to take over the joint-venture after set up.
In particular the information system environment and interfaces with different stakeholders have to be built to specific needs. The development of the Giro-Nil organisation is executed in the form of a project organisation. This project organisation has to operate in a dynamic and complex environment as well as a foreign environment. Based on the different aspects described above, two initial goals for the research assignment at the Inclusion Group where drawn up. The first initial goal is

*To use a system development methodology to reduce the risks of failure for the Giro-Nil products.*

The second initial goal is

*To obtain system architecture descriptions that can be re-used in financial sector transformations in other emerging countries.*

The initial assignment, for achieving these two goals, is

*To set up a system architecture for Giro-Nil.*

This initial assignment serves as a point of departure, which will be analysed and refined to define the final assignment.

2.2 Quick scan results

A Quick Scan method is used to get a clear picture of the Inclusion Group and its environment. A detailed description of the methodology can be found in Appendix Quick Scan. The Giro-Nil creation process serves as a physical development of the core product of the Inclusion Group. Furthermore, findings about the Inclusion Group product creation process are mentioned which have been collected in meetings.
The first two steps of the Quick Scan were covered in the acquisition of this graduation assignment. In the third step, preliminary presentation, the formulated initial assignment was taken as a base to formulate the two main goals of the research and to achieve an overall insight of the Inclusion Group company and its business context. In the fourth step the data collection techniques were used to achieve more detailed knowledge of the business processes and the different views of members of the Inclusion Group. The data collection techniques used, are process maps, interviews, documentation and the consultation of archival information. In the fifth step, the feedback presentation, feedback was orally communicated to members of the Inclusion Group, in the form of individual meetings. The relevant information deducted from the Quick Scan is arranged by the data collection techniques.

2.2.1 Financial system Giro-Nil

The role of Giro-Nil and its products in the financial infrastructure of Egypt are described. In this section findings are organised by the data collection techniques used to acquire them. The focus in the process maps lies on the Giro products. In the interviews, documentation and archival information the focus is on the Giro-Nil project with related issues.

Process maps

The high level business description gives an overview and correlation of the different products of Giro-Nil and the supporting business processes. It gives a first insight in the descriptions of the business processes. This overview is used within the Inclusion Group for communication purposes.

![Diagram of Giro-Nil system](image)

In the centre of Figure 2 a schematic overview of the internal core processes of the Giro system is depicted. The function of GiroFlow is to scan and process physical Giro products into electronic data. The function of InterClear is clearing and settlement of transactions.
between accounts of different clients, customers and banks. At the far left side of the overview the products of Giro-Nil are named. These products are in front of the linked interfaces with the Giro system. At the far right side banking and direct interface with the customer organisations are shown. For these organisations the Giro system is the facilitator. The process map in Figure 2 does not describe the processes that must be implemented or the security measures. The considered products of the overview are shaded blue in Table 2. It has to be taken into account that the process map is high level and does not represent the current status of the Giro products.

Table 2 Considered Giro products in overview

<table>
<thead>
<tr>
<th>Function</th>
<th>Giro Product</th>
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<tbody>
<tr>
<td>Account</td>
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<td>Mass payment</td>
<td>BusinessGiro</td>
</tr>
<tr>
<td>Money transfer</td>
<td>TransGiro</td>
</tr>
<tr>
<td>Remittance</td>
<td>EuroGiro</td>
</tr>
</tbody>
</table>

Interviews

- The Inclusion Group approaches the Giro-Nil project from an operational level. The Giro-Nil core information system process is the InterClear process. Due to the required fast development the complete insight and interactions between the processes is not predetermined and grows organically.

- The management of the Inclusion Group has indicated that there is a strong need for consolidation of the business processes of the product Giro-Nil as well as a more systematic approach in order to get a clearer sight of the course of the Giro-Nil project.

- The Bank for International Settlements (BIS) has explicit guidelines and regulations. It is important to keep in mind guidelines and regulations from (international) banking institutions and Egypt government departments. It is less difficult to meet regulations when these are taken into account at an early stage of the development process.

Documentation

- The relationships and roles of stakeholders need to be articulated. To prevent arguments on responsibilities between stakeholders, it is important to state explicitly the added value of each stakeholder within the Giro-Nil context.

- There is no clear central point were the issues encountered within Giro-Nil are collected and communicated.

- The deliverables or goals mentioned in different Giro-Nil requirements documents are not all conform the SMART Acronym, videlicet Specific, Measurable, Actionable(Who is responsible?), Realistic and Time-bound.
Archival information

- In the Giro-Nil documentation little is found on the control of the processes to be. This is made clear by the Uncertainty Circle, specified within in the Appendix Quick Scan, in which the Control Side has not yet been specified.

2.2.2 Inclusion Group Product Creation Process

After having attended meetings in the context of the Quick Scan some conclusions could be drawn about product creation process on the basis of which Giro-Nil is developed.

- The knowledge gained by solving practical issues on a day to day basis in the Giro-Nil project is not consolidated in a structural manner.
- The products which need to be realized by the Giro-Nil organisation are communicated. However the course and form of the development have to be clearly defined.
- At the operational level of Giro-Nil there is a resistance for assimilating architectural descriptions, because the benefits are not immediately noticeable.

These three findings have to be further investigated with scientific techniques.

2.2.3 Business, technical and implementation risks

Three types of risks (Groossenaerts, 2006) are identified:

- Business risks
- Technical risks
- Implementation risks

In the first place the business risks have to be addressed. The scope and vision of the business idea have to be addressed and a feasibility or risks analysis has to be done. This is to make sure that the gap in the financial infrastructure is addressed by the, to be developed facilitating financial system. The technical risks will be covered by Giro technology. This is the technical solution of the financial system which is developed by the Inclusion Group. The implementation risks are coped with by meeting the requirements.

2.3 Final Assignment

The Inclusion Group is setting up a new organisation in a foreign country with complex systems and applying a new approach. The Giro-Nil organisation involves multiple technology platforms and interfaces with many stakeholder relationships and process changes within these stakeholder organisations. The formulated goals in the initial assignment indicate a need for more control and structure. The mission of the Inclusion Group indicates a need in setting up more joint-ventures in financial emerging countries. A reference model, which will be developed will serve as a
starting point to set up these new infrastructures. From this model the core of the local model is going to be derived. With some specific adaptations the local model will be suited to the local needs.

The development of the architectural framework for Giro-Nil gives an insight in the choices made to fit out the processes and can serve as a means for communication. An architectural framework serves as a base for descriptions of the processes of Giro-Nil. By giving a better overview the issues which will become more relevant in the future are already identified. In this way, the architectural descriptions will reduce the risks of failure for Giro-Nil products.

To set up a complete reference architecture for the Inclusion Group will fall outside the time span of this graduation assignment. Therefore the facilitating process for one product will be described as a proof of concept for the complete architecture of Giro-Nil. When an architecture is based on experiences with Giro-Nil the reference architecture for the Inclusion Group can be derived from it. Therefore the final assignment for this research is

To construct an architectural framework for the Inclusion Group and to fill in and deploy this architectural framework for a Giro product as an enabler for the product creation process and as a foundation for the future development of the reference architecture for the products and services of the Inclusion Group.

The initial goals of the assignment remain valid and can be specified further. The first goal consists of two parts; the reduction of the risks of failure of Giro-Nil products while developing the Giro-Nil organisation, and the Giro-Nil products when functioning as an established organisation and serving as a solution for the financial infrastructure in Egypt. Therefore the final first goal is

To use an architectural framework to reduce the risks of failure for Giro-Nil products.

The last part of the final assignment refers to the organisation to be developed by the Inclusion Group and can therefore be of more value to the Inclusion Group than Giro-Nil. The final second goal remains the same, which is

To obtain system architecture descriptions that can be re-used in financial sector transformations in other emerging countries.
3 Project description

This chapter discusses the graduation approach in three sections. First the initial research plan is given based on van Aken et al (2004). Secondly a specific approach is given to cope with the findings of the orientation in the specific context of the Inclusion Group, its product creation process and the Giro-nil case in the research model. And the last paragraph gives a planning with an activity description, a time frame and specified deliverables.

3.1 Initial research plan

The graduation project is a design oriented project for achieving added value for the processes of a graduation company. The decisions made must be scientifically justified. The graduation project usually consists of an analysis and a design phase. The specific plan for this graduation project is given in the Project Approach. The initial assignment is the starting point for an orientation. The final assignment is shaped as a specification of the initial assignment. This is possible because the focus of the initial assignment is recognized as an added value to the company and a possible starting point for the graduation project. The approach to tackle the final assignment is determined and so are the areas that require a literature study. Especially the method to come to architecture descriptions is chosen with accompanying models and tools. In the analysis the theory is adapted to practice. In the design the predetermined methods and approach are used in practice to develop a solution to the issues mentioned in the orientation and analysis. In the last chapters the design is being evaluated and conclusions are drawn. Also an evaluation of the graduation assignment is made clear. In Table 3 initial research plan is specified with a time frame, activities and deliverables.
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Deliverable(s)</th>
</tr>
</thead>
</table>
| mid Dec- mid Jan| **Orientation**                | Assignment formulation  
Initiation problem definition  
Company description  
Scope  
Stakeholders (partners, market, clients)  
Objectives  
Results of the Quick Scan of the company  
Identify relevant theory and practice  
Project Approach  
Appendix Identify the relevant components for an architectural framework |
| mid Jan- begin Mar | **Analysis**                  | Midterm report with previous defined deliverables and  
Final problem definition  
Brief literature outline  
Methods used during Analysis  
Results of Analysis  
Solution areas  
Appendix Description of Analysis  
Place an refine architectural descriptions in system development method |
| Mid Mar         | **Midterm presentation**         | Focus areas will be selected in consensus with the supervisors  
Appendix Literature used during Design  
Completion of the relevant parts of architecture descriptions |
| Mid Mar- end May| **Design**                      | Elaboration of the selected focus areas  
Argumentation of the Design decisions made  
Results of Design  
Evaluation of the Design  
Implementation plan  
Appendix Literature used during Design  
Completion of the relevant parts of architecture descriptions |
| end May- end Jun| **Documentation**               | Final report  
Conclusions and Recommendations  
Appendix Completion of appendices |
| begin Jul       | **Final presentation**           | Final presentation |
3.2 Project Approach

The project approach applies the diagnostic research model defined by van Aken et al. (2004). After the orientation the two perspectives in the business environment of the Inclusion Group are distinguished. The first perspective is Giro-Nil as the product creation process of the Inclusion Group (section 3.2.2). The second perspective is Giro-Nil as an enabler for cashless transactions in the Egyptian financial infrastructure (section 3.2.3).

3.2.1 Research model

In the research model (Figure 3) the digits in the boxes correspond to the chapters where the subjects are elaborated. The abbreviations used can be found on page I.

The research model is set up to explain the approach of this graduation assignment and the report structure. In the graduation project practice and theory are combined. On the vertical
axis three lines are visualized to give an insight in the relation of the theory found in the scientific literature (the lower row), the practical situation at the Inclusion Group (the middle row) and the graduation project (the upper row). The horizontal axis is phased in accordance with the phases of a generic graduation project to indicate the dynamics. In chapter 1 and 2 of this graduation report the initial assignment and business environment description is given. Scoping and problem analysis lead to the first distinction between the product creation process (PCP) of the Inclusion Group and the financial system product (architecture description, AD) to indicate the difference regarding intended project deliverables: in the Inclusions Group’s PCP, and as a supporting artefact, the financial system AD.

In section 2.3 the final assignment description is given.

In chapter 3 the coherence between the project tasks is explained.

In chapter 4 the theory used for analysis and design is described. It summarizes the results of the bulk of the activities in the lower row.

Chapter 5 deals with the identified gap between the high business ambition and the translation to and from the system development of Giro-Nil is indicated. To articulate this gap the system development framework approach of Whitten et al (2004) is selected.

In chapter 6 the design approach of the architectural descriptions content of the development framework is explained. The COMET methodology is selected as the approach to define the Business Architecture Descriptions with Market Architecture Description extensions. The Giro-Nil case serves as the basis for a proof of concept for the chosen system development and architectural descriptions.

In the Appendix Architecture descriptions repository a repository is made to contain the Financial System architectural descriptions.

The AD are assessed with respect to the problems identified in the Ishikawa of the Financial System.

In the last column chapter 7, 8 and 9 are indicated. These chapters are used for reflection and generalisation of the theoretical concepts used and the design for the Inclusion Group.

Chapter 7 addresses the implementation of the AD within the Inclusion Group. The employees of the Inclusion Group have provided input for the assessment and implementation part of the graduation project.

In chapter 8 the conclusions and recommendations are given. The conclusions are specified to the Inclusion Group, the Graduation assignment and to the used theory.

Chapter 9 addresses the evaluation of the process of the graduation project.

3.2.2 Inclusion Group Product Creation Process

The Inclusion Group is going to set up more Giro based financial networks in developing countries. Setting up these networks are repetitive projects of the Inclusion Group and can be seen as the product creation process of the Inclusion Group. Therefore the project needs to be structured and the architectural descriptions need to be reusable in other implementations.

How to cope with risks is made clear. Some risks can be covered by deploying the designed part of the architectural framework. Not only can the risks of failure for a completely defined architectural framework be assessed, but also the impact for the product creation process.
3.2.3 Architectural descriptions of Financial system Giro-Nil

The financial system Giro-Nil is the result of the first execution of the product creation process of the Inclusion Group. The Giro products of Giro-Nil are the consolidated functions of this financial system.

The architectural descriptions for this report are based on the Giro-Nil case. The architecture descriptions are, next to business architecture descriptions, described from a market perspective. This is a broader perspective than described in the enterprise architecture theory. One product of Giro-Nil is elaborated. This serves as a proof of concept for the description of other products. The models and tools are used to abstract or detail the descriptions.
### 3.3 Planning

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Architecture Descriptions for Giro-Nil</th>
<th>Approach Product Creation Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>week 12</td>
<td>process remarks midterm presentation</td>
<td>walk through full cycle</td>
<td><strong>Inception</strong> focus on BSM/CIM</td>
</tr>
<tr>
<td>20-24mrt</td>
<td>outline architecture descriptions full cycle and estimate difficulties</td>
<td>Rich picture</td>
<td></td>
</tr>
<tr>
<td>week 13</td>
<td>interviews and documentation for current situation technology</td>
<td>UML Sequence diagram (UML Class diagram)</td>
<td></td>
</tr>
<tr>
<td>27-31mrt</td>
<td>model primary processes and stakeholders</td>
<td>outline requirements</td>
<td></td>
</tr>
<tr>
<td>week 14</td>
<td><strong>evaluation meeting with TU/e</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-7apr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 15</td>
<td>align business model with system boundary model</td>
<td>refine context statement, actors descriptions, risk management</td>
<td><strong>Elaboration</strong> focus on Requirement model and Architecture</td>
</tr>
<tr>
<td>10-14apr</td>
<td>process remarks evaluation meeting TU/e iteration review and verification loop</td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 16</td>
<td>update cause and effect analysis</td>
<td>Reference architecture set up BOM</td>
<td></td>
</tr>
<tr>
<td>17-21apr</td>
<td>update and refine domain models elaborate report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 17</td>
<td>identify subsystems and components</td>
<td></td>
<td></td>
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<tr>
<td>24-28apr</td>
<td>interview GiroFlow system</td>
<td></td>
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</tr>
<tr>
<td>week 18</td>
<td>interviews Interclear system</td>
<td></td>
<td></td>
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<tr>
<td>1-5mei</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>week 19</td>
<td>elaborate report</td>
<td>set up MOM</td>
<td></td>
</tr>
<tr>
<td>8-12mei</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 20</td>
<td></td>
<td>elaborate BOM</td>
<td></td>
</tr>
<tr>
<td>15-19mei</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 21</td>
<td><strong>evaluation meeting TU/e</strong> process remarks evaluation meeting TU/e</td>
<td>elaborate BOM</td>
<td><strong>Construction</strong> focus on connection with current situation and Inclusion Group acceptance</td>
</tr>
<tr>
<td>22-26mei</td>
<td>re-evaluating modelled situation with physical situation Giro-Nil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 22</td>
<td></td>
<td>elaborate RM</td>
<td></td>
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<tr>
<td>29-2jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 23</td>
<td>implementation suggestions define implementation suggestions</td>
<td>refine mentioned models</td>
<td></td>
</tr>
<tr>
<td>5-9jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 24</td>
<td>design embed in organisation assessment and implementation plan</td>
<td>Component Model (structure, interaction and interface)</td>
<td></td>
</tr>
<tr>
<td>12-16jun</td>
<td>proof of concept for Inclusion/Giro-Nil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 25</td>
<td><strong>acceptation meeting Inclusion Group evaluation meeting TU/e</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19-23jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 26</td>
<td>generalize research in Inclusion and theoretical context</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26-30jun</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 27</td>
<td>make recommendations deliver concept report</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-7jul</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 28</td>
<td>round up report with final remarks prepare final presentation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-14jul</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>week 29</td>
<td><strong>final presentation (17 juli)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4 Theory

A selection of several relevant theory topics will be clarified in this chapter. The theoretical background of the system life cycle and the framework can be found in Appendix System development. The argumentation of the choice of the approach of architectural framework is given in the research of literature related to this graduation assignment (Van Tongeren, 2006).

4.1 Product Creation Process

In the process decomposition chapter of Muller (2005) the system architecture process is positioned in a wider scope. It focuses on an organisation which creates and builds systems consisting of hardware and software.

The business process for an organisation which creates and builds systems consisting of hardware and software is decomposed in four main processes as shown in Figure 4. This decomposition leaves out all connecting, supporting and other processes.

![Figure 4 Simplified decomposition of the business in four main processes](image-url)
The function of the four main processes is:

- Customer Oriented Process. This primary process is the cash flow generating part of the enterprise. All other processes cost money. This process performs in repetitive mode all direct interactions with the customer.
- Product Creation Process. This process feeds the Customer Oriented Process with new products. It ensures the continuity of the enterprise by creating products which enables the primary process to keep generating cash flow.
- People and Technology Management Process. Here the main assets of the company are managed: the know-how and skills residing in people.
- Policy and Planning Process. This process is future oriented, not constrained by short term goals. It defines the future direction of the company by means of roadmaps. These roadmaps give direction to the Product Creation Process and the People and Technology Management Process. For the medium term these roadmaps are transformed in budgets and plans, which are committal for all stakeholders.

The split up of the Policy and Planning Process from the Product Creation Process gives the Product Creation Process a clear focus: the entity to be developed. In this decomposition the evolutionary development of product variants and new releases are seen as individual instances of the Product Creation Process. For example the development of a single new feature for an existing product is performed by following the entire Product Creation Process.

For the Inclusion Group the implementation of a Giro system in a country is the Customer Oriented Process. The Product Creation Process is defined by Muller (2005) as addressing new products for generating tomorrow’s cash flow. For the Inclusion Group the scope is not only on new products, but on the complete product set of the Giro system to be implemented. At this moment the implementation process of Giro-Nil is the Product Creation Process of the Inclusion Group.

4.2 Applied system life cycle

In Figure 5 the interpretation of the system life cycle theory (Whitten et al, 2004) for the Inclusion Group environment is depicted. The Inclusion Group environment can be seen as a double instantiation of the system life cycle theory, with the Inclusion Group Product Creation Process on one side and the life cycle of the financial infrastructure on the other side.
The Egyptian financial infrastructure is the part of Egyptian society where value transactions between social entities take place. Currently, the majority of the population uses cash based transactions. This indicates an obsolescence state of the infrastructure and gives the performance alert for upgrading the economy from cash-based to cashless. This way the infrastructure can become account based. For the Egyptian financial infrastructure, the Giro-Nil project is a solution for the performance alert of being cash based. The Giro-Nil project is responsible for the change in roles of the stakeholders in the current infrastructure. Therefore Giro-Nil can be seen as an instance of the system development process of the Egyptian financial infrastructure, to go from a cash-based economy to a cashless economy. At the same time Giro-Nil is the system operation & maintenance of the Inclusion Group. This is depicted in the centre of Figure 5. Giro-Nil will serve as a case for the Inclusion Group Product Creation Process. The performance alert of the Product Creation Process of the Inclusion Group is a need for a reduction of risks of failure. The system development process can be improved by describing the architecture of the Giro system.

4.3 FAST, COMET and the 3-V model

The Framework for the Application of Systems Thinking (FAST) is based on the system life cycle concept. FAST has eight development process phases which are elaborated in Appendix System development. In Figure 6 these phases are divided over three coloured V’s, from the 3-V model (Goossenaerts, 2006c). The 3-V model provides an indication of the depth of change efforts. For instance, in a direct decision there is a straightforward way of installing a solution. Hence only the highest V needs to be addressed. As indicated in Figure 5 the 3-V model is applied twice.
For the Product Creation Process of the Inclusion Group, most work is located at the level of the first V. Acceptation needs to be initiated and the second and third V's do not need to be described in detail yet. For the financial infrastructure, architectural descriptions have been elaborated in each V. In the Egyptian financial infrastructure case, the noticed performance alert of being cash based is at the level of the first V. The elaboration of a solution in Giro-Nil requires second and third V architecture descriptions.

Each of the three V's is directly linked to a part of the repository, filled according to the COMET method (Berre et al, 2004). This can be seen in Figure 7. The colours correspond with the level of depth. Direct decisions rest upon Value and Risk Model, operations project rest upon Work System Operation Model and the ICT project rests upon Requirements Model, Component Model and Platform Specific Model. In this way a distinction in architecture descriptions can be made in accordance with the depth of the change effort.
### COMET Repository Structure

<table>
<thead>
<tr>
<th>Value and Risk Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mission Statement</td>
</tr>
<tr>
<td>2. Context Statement</td>
</tr>
<tr>
<td>3. Vision Statement</td>
</tr>
<tr>
<td>4. Risk Analysis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Worksystem Operations Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Goal Model</td>
</tr>
<tr>
<td>2. Community Model</td>
</tr>
<tr>
<td>3. Business Process &amp; Roles</td>
</tr>
<tr>
<td>4. Business Resources</td>
</tr>
<tr>
<td>5. Work Analysis Refinement</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Requirements Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use Cases &amp; Scenarios Model</td>
</tr>
<tr>
<td>2. Prototype</td>
</tr>
<tr>
<td>3. Non-Functional Requirements</td>
</tr>
<tr>
<td>4. Reference Architectural Analysis</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Component Structure</td>
</tr>
<tr>
<td>2. Component Interaction</td>
</tr>
<tr>
<td>3. Component Interface</td>
</tr>
<tr>
<td>4. Component Information</td>
</tr>
<tr>
<td>5. PIM Data Types</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Platform Specific Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Platform Profile Model</td>
</tr>
<tr>
<td>2. Component Implementation Model</td>
</tr>
<tr>
<td>3. Deployment Model</td>
</tr>
</tbody>
</table>

![Figure 7 COMET repository structure](image)

### 4.4 Multi-scale architectural framework

The FAST methodology documents the outcome of the eight phases in the information system architecture framework. This is further explained in Appendix Information system architecture framework. In Appendix Giro-Nil, the Giro system in Egypt is initially approached with the FAST methodology. During the graduation assignment, it was decided to use the COMET repository and Market Architecture Descriptions (MAD), which are extensions based on COMET, to fill in the information system architecture framework.

The COMET methodology specifically addresses how to develop a new application component. Giro-Nil is the completion of a new structure in the financial market in Egypt. Therefore the scope of Giro-Nil is broader than what both FAST and COMET are designed to model. When translating market or business opportunities to a technical implementation, the architectural descriptions at the scales of the market and of the (stakeholders) business must be aligned (Goosenaerts, 2002 and 2006c). This can be done by making use of COMET models corresponding to the three V’s. With the multi-scale approach of the Market Architectural Descriptions (MAD) and Business Architecture Descriptions (BAD), included in COMET the development is made practical. The MAD are added to cater for the autonomy of the stakeholders of the Financial System, as depicted in Figure 8. These descriptions are based on the COMET methodology with high level Petri net descriptions (Wagner et al., 2002 and Goosenaerts, 2002) substituting the UML process description techniques.
In Figure 8 the business vision of the Inclusion Group is depicted at the top. Through MAD and BAD this vision is translated to the technological implementations at the bottom of the framework. This implementation is the Giro system. The eight phases of FAST are depicted at the right side of the framework and the different roles of the stakeholders at the left side. The core is filled using COMET models. The specific models and deviations from COMET to the Inclusion Group situation are explained in section 6.2 Architectural descriptions.
4.5 Risk management

Risk management can be divided into two parts: one for the Inclusion Group Product Creation Process (PCP) and the other for the financial infrastructure in Egypt. The financial infrastructure solution, a Giro system, is being described in architecture descriptions. Within the architecture descriptions the Value and Risk Model is addressed. The COMET architecture is phased to cover the business, technical and implementation risks. In the inception phase the business risks are reduced by defining the business potential for the idea. The elaboration phase has products which reduce the technical risks. In the implementation phase all the requirements are satisfied.

In this section the risk management for the Inclusion Group product creation is addressed.

The performance alert for the Inclusion Group PCP indicates risk as an important issue. The PCP includes a project organisation for setting up the Giro system. According to Ulrich et al (2000) projects rarely proceed exactly according to plan. Some minor deviations can be accommodated with little or no impact on project performance. Other deviations can cause problem in time (delays), costs (budget overruns) or quality (poor product performance or high run process costs). When during the project planning activity the risks are explicitly identified this will minimize the number of surprises the team will have to communicate to senior management later in the project.

In this report the emphasis lies on the first goal; the reduction of the risks of failure for Giro-Nil products. The failure of the products can be on different abstraction levels. Goossenaerts (2006) has made three types of risks clear, known as business risks, technical risks and risks for not meeting requirements. The last category can be seen as implementation risks.

Specific risks for the Inclusion Group can be identified. Table 4 lists some possible risks as an indication.

Table 4 Possible risks for Inclusion Group PCP

<table>
<thead>
<tr>
<th>External Risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market</td>
</tr>
<tr>
<td>market structure</td>
</tr>
<tr>
<td>market trends</td>
</tr>
<tr>
<td>competition</td>
</tr>
<tr>
<td>competitors strengths and weaknesses</td>
</tr>
<tr>
<td>Technology</td>
</tr>
<tr>
<td>technology dependencies</td>
</tr>
<tr>
<td>legacy systems (interfaces)</td>
</tr>
<tr>
<td>Stakeholders</td>
</tr>
<tr>
<td>compliance to agreements</td>
</tr>
<tr>
<td>Product life cycle</td>
</tr>
<tr>
<td>time frame of the product</td>
</tr>
<tr>
<td>Requirements</td>
</tr>
<tr>
<td>attributes of systems (.ilities) as defined by ISO/IEC 9126 (1991)</td>
</tr>
<tr>
<td>volume</td>
</tr>
</tbody>
</table>
Internal Risks

<table>
<thead>
<tr>
<th>Development team</th>
<th>know-how</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>experience</td>
</tr>
<tr>
<td></td>
<td>interpersonal skills</td>
</tr>
<tr>
<td>Development schedule</td>
<td>time limit</td>
</tr>
<tr>
<td>Users</td>
<td>user acceptance</td>
</tr>
<tr>
<td></td>
<td>number of users</td>
</tr>
</tbody>
</table>

When considering risks, specific factors are dependant of the object of consideration. The impact of this object on the core business processes are indicative for the effort that needs to be put in the risk analysis.

### 4.6 Conclusion

The Product Creation Process is defined by Muller (2005) as addressing new products for generating tomorrow's cash flow. The Product Creation Process for the Inclusion Group has a broader scope and incorporates the complete product set of the Giro system to be implemented.

Based on the theory it can be concluded that the environment of the Inclusion Group requires a multi instantiation of the system life cycle theory; one for the Inclusion Group product creation system and one for the life cycle of the financial infrastructure of Egypt.

Another conclusion is the life-cycle stage concurrence of the Inclusion Group (System Operation and Maintenance) with Giro-Nil as implementation of a Giro system and the financial infrastructure transformation from cash based to account based (System Development Process).

When translating market or business opportunities to a technical implementation the architectural descriptions at the scales of the market and of the (stakeholder) business must be aligned using COMET models corresponding to the 3-V model. With the multi-scale approach of MAD and BAD the development is made practical. The added value of the practical design can be evaluated by assessing the covered predetermined risks on the MAD and BAD levels of descriptions.
5 Analysis

This chapter presents the results of the analysis phase. As indicated before two kinds of problems will be considered; the Product Creation Process (PCP) and the Financial System (FS). First the current Inclusion Group PCP is described and its problems are presented using an Ishikawa diagram. After that the financial system, Giro-Nil, is described. Its Giro product interdependencies are made clear and the set up of the architectural effort by the Inclusion Group is depicted. This is followed by a second Ishikawa diagram. In the last section of this chapter the decision regarding the scope for the remaining parts of the graduation effort is explained.

5.1 Inclusion Group Product Creation Process

The Inclusion Group has set up a temporary project based structure to develop and implement the Giro-Nil financial system. The implementation is phased and consists of several steps. The Giro-Nil project was initially approached by physically building system components and linking the primary processes. Related to Figure 17 Process View of System Development (Whitten et al., 2004) this can be seen as physical design and integration. With the development of an architectural framework the first steps of the system development is filled in, thereby keeping in mind the already established physical design and integration.

5.1.1 Current Product Creation Process

The Inclusion Group is setting up its first joint-venture in Egypt. The implementation team consists of the following taskforces:

- Implementation management
- Organisational development
- Marketing
- Operational processes
- ICT
- Training and knowledge

The implementation team is responsible for setting up the Giro services organisation. The team will be working on the project for at least three years. In this time period they will train local managers and embed the organisation in the local infrastructure (Giro-Nil Business plan, 2005). Three stages of the project are distinguished:

- Pre-pilot (fourth quarter 2005)
  For demonstrating the feasibility of the approach selected for the pilot and roll-out.
  During this period Giro-Nil will link and test the Giro systems.
- Pilot (first quarter 2006)
Setting up the processes needed for mass processing and cooperate with the Mass Payment Providers (MPP's) and Billing Companies (BC's). A client base is also being set up.

- Mass roll-out (first quarter 2007)
  Attracting more MPP's, BC's and individual customers through marketing campaigns. Systems become more automated as the volume of processing grows.

The aim for the first year of Giro-Nil is to implement a proof of concept to demonstrate the working of the Giro products: GiroAccount, AcceptGiro and BusinessGiro. The duration of this project is one year (from February 2005 – January 2006). This year has been divided into four stages:

- Stage 1: Planning (February – April 2005)
- Stage 2: Design (May – June 2005)
- Stage 3: Implementation (July – October 2005)

After the first year the processes will be further automated to process the required volumes. Furthermore, the accompanying financial, administrative, security and human resource organisation will be implemented. The technical systems are built while connecting the legacy systems and adding new functionalities as seen fit at operational level. The development is driven by deliverables agreed with shareholders and issues arising while building.

5.1.2 Cause and effect Analysis Product Creation Process

By formulating the graduation assignment, Inclusion Group has indicated a need for improvement. Through interviews with employees of the Inclusion Group and partner organisations, information regarding the PCP is collected. In this way issues existing within the Inclusion Group have been identified. Subsequently these issues are analysed using an Ishikawa diagram (van der Bij et al., 2000). In this way the issues are structured with their effects and their causes. The identified causes can harm the positive outcome of the PCP of the Inclusion Group: the joint-venture as a solution for the gap in the financial system in Egypt.
The main categories of a standard Ishikawa diagram, such as Plant/Equipment, Technology, Policy and Procedure are categories uncommon for services. For the approach of an Ishikawa analysis of both the PCP and the FS six other categories below are used. Hereby, the last two categories are solely applicable for the FS. The six categories are:

- **Stakeholders.**
  The Inclusion Group knows a large variety of stakeholders with different interests. Lack of clarity concerning roles, communication and added value are its main causes.

- **Managerial.**
  The managerial root cause has some explicit concerns and lacks communication and directing tools.

- **Growth.**
  Due to natural growth issues have risen. The project gets more detailed and also new products are going being developed.

- **Consolidate.**
  The achieved milestone parts of the PCP need to be embedded in the organisation.

- **Requirements.**
  Some requirements give rise for concern. For example, the scalability of the systems with a sudden increase in transactions or the quality of the output of the systems.

- **Technology.**
  This category is also viable in this situation due to the integration of technology in the emerging country situation.

The causes of four categories applicable to the PCP of the Inclusion Group, have impact on the PCP. These causes must be dealt with in a structural way before a similar PCP is applied in a different country. For example, the unstructured way of decision making identified in the Managerial category. A complete explanation of the Ishikawa diagram is given in Appendix Cause and Effect diagram.
As identified in the Ishikawa diagram, an effect of the causes for the PCP is a lack of overview. When the overview of the systems and processes decreases, the control and insight will also decrease. The second effect of the causes is a high risk of failure. Due to external uncertainty, including financial structure and stakeholders, and internal uncertainty, such as lack of structure in approach and within processes, the chance of a negative outcome is increasing.

5.1.3 Findings

Giro-Nil is the first joint-venture of the Inclusion Group and will therefore serve as a proof of the business ambition. The PCP is being developed in an organic way and is not structured by means of a genuine road map. To be able to repeat the implementation in future projects, there is a need for development of a structural approach for implementing Giro systems in emerging countries. A consolidated PCP can serve as a reference point for tackling issues concerning time, costs and quality of development. Also organisational knowledge can be embedded in the organisation and becomes an asset of the Inclusion Group. The PCP must also become better manageable. The translation of the business vision through the decision making process regarding technology needs to be documented. Furthermore, the specific local requirements of a joint-venture needs to be fitted in a standard Giro system development project.

A reference model for the creation of new joint-ventures can be developed to solve the issues mentioned above. This reference model must describe every aspect of the Giro system which needs to be implemented when the Inclusion Group sets up joint-ventures in other emerging countries. Within this reference model, a central position for a reference architecture which describes the core information and technical processes must be achieved.

5.2 Financial system Giro-Nil

The Inclusion Group seeks opportunities to improve existing banking infrastructures in developing countries. Giro-Nil is an organisation that will close the gap within the existing infrastructures and will reach the people currently without a bank account. The architecture descriptions which will be developed have to describe Giro-Nil when operational. The Generalized Scorecard (see Appendix Value and Risk model) is filled in to get a better insight of the value and risk impact of the Giro system. The relationships between different stakeholders are elaborated and relational networks are identified which achieve added value for all stakeholders.

Within the Inclusion Group the requirements document for the Giro-Nil architecture descriptions is the Giro-Nil Overall Architecture (2006). The requirements stated in this document are compared with the findings of the requirements by the methodology used in this graduation assignment and further elaborated.
5.2.1 Giro product interdependencies

To achieve a substantial difference in the financial infrastructure the Giro system has to service high volume transactions at low cost. The target customers are the citizens currently without a bank account. The customers can open a GiroAccount at their own initiative (market pull). Or the customers can receive their monthly payments on a GiroAccount (technology push) by their employers. These employers have the functions of Mass Payment Providers (MPP’s) within the Giro system and pay using BusinessGiro. Once a GiroAccount is opened the threshold for other Giro products becomes lower.

At this moment employees need to retrieve their money in cash from a box office of their employer where often long queuing lines are present. Also for the payment of bills from utility providers, such as water and electricity companies, people need to queue up for payment. The Billing Company (BC) can send an AcceptGiro for bill payment. Customers of this BC with a GiroAccount can mail the AcceptGiro and the bill will be paid from his GiroAccount. Customers without a GiroAccount can pay the AcceptGiro cash at the nearest Post Office. The MPP and BC are roles. For instance a telecom provider can be an employer (MPP) and sends bills to its customers (BC).

GiroAccount owners will make use of CashGiro for cash deposits and withdrawals. CashGiro will be an important function when starting the Giro system when Giro gets more accepted the product will be less used. TransGiro is used to transfer money bilateral between GiroAccounts. The Giro products and their position within the financial structure is displayed in Table 5.

<table>
<thead>
<tr>
<th>Function</th>
<th>Giro Product</th>
<th>roles in market</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account</td>
<td>GiroAccount</td>
<td>owned by customers</td>
</tr>
<tr>
<td>Bill payment</td>
<td>AcceptGiro</td>
<td>customer payment to BC</td>
</tr>
<tr>
<td>Cash Deposit</td>
<td>CashGiro</td>
<td>customer cash transactions to</td>
</tr>
<tr>
<td>and Withdrawal</td>
<td></td>
<td>GiroAccount</td>
</tr>
<tr>
<td>Mass payment</td>
<td>BusinessGiro</td>
<td>MPP payment to customers</td>
</tr>
<tr>
<td>Money transfer</td>
<td>TransGiro</td>
<td>customer to customer transactions</td>
</tr>
<tr>
<td>Remittance</td>
<td>EuroGiro</td>
<td>customer to customer international transactions</td>
</tr>
</tbody>
</table>

5.2.2 Current reference architecture

Within the Inclusion Group a conceptual overview of organisational processes for joint-ventures, such as Giro-Nil, is being developed. This model is developed to be used as a rich picture and serves as a means of communication between different stakeholders. It becomes a reference point for discussion of the implementations of joint-ventures. The overview will evolve while acquiring more architectural descriptions on different layers. At this moment the channels and products which are going to be available in the established Giro-Nil organisation in 2009 are represented, as depicted in Figure 10.
5.2.3 Cause and effect Analysis Giro-Nil

The graduation assignment indicates a need for improvement. The Ishikawa diagram is used to order the causes of issues currently existing within the Inclusion Group (van der Bij et al, 2000). In this section the focus is on the ishikawa diagram of the current Giro system: Giro-Nil. The six categories uses in the Ishikawa diagram in Figure 11 have been discussed in section 5.1.2.

Figure 10 Conceptual Joint-Venture Reference Architecture

Figure 11 Ishikawa diagram Financial System
The effects of the causes identified in the Ishikawa diagram have an impact on the current financial system of the Inclusion Group. The question is whether a structural solution must be found to deal with these causes or whether some quick patching up will do. The design in this report serves as a guide to answer these questions.

Within the Ishikawa diagram of the FS an effect is a lack of reusability. When methods or systems are reused less effort is needed to achieve a positive outcome. When the right methods are reused, the success rate of the FS development increases. Another effect is the lack of accumulation of knowledge. Existing knowledge need to be consolidated and used for further maturing of a (new) joint-venture of the Inclusion Group.

5.2.4 Findings
The FS findings relate to the Giro system as currently implemented in Egypt. The information about this is acquired through interviews with employees of the Inclusion Group. Scepticism concerning banks and bank products exists with the common people in Egypt. So when introducing new bank associated products extra effort needs to be invested to overcome this negative attitude. Therefore, Giro products need to be easy accessible and well understood.

Within the Giro system different stakeholder roles can be identified. Currently, the roles are linked to the physical stakeholders. When the roles of physical stakeholders changes, the roles needed to be fulfilled in the Giro system also change. This should be decoupled.

5.3 Inclusion Group Giro product scope
At the midterm presentation a focus area is selected for further elaboration in the design. In this section an explanation of the focus area selection procedure is given. The focus areas describe one or more of the Giro functions. For the chosen focus area the architectural descriptions are elaborated. The architectural descriptions are making the decisions for achieving a Giro system in the financial infrastructure explicit. The preconditions for the focus area to be elaborated are

- Not too political sensitive
- Not too complex
- Within the scope of the graduation assignment
- Feasible within the time limit
- Be a proof of concept
- Address the already chosen technical core processes

The focus area can be derived from the functions of the Giro products in Table 6. The functions account, bill payment and mass payment are implemented within the time frame of this graduation assignment at Giro-Nil. After mid 2006 the money transfer and cash deposit and withdrawal function will also be implemented. A feasibility study of remittances is currently done within the Inclusion Group.
Table 6 Considered Giro products for focus area

<table>
<thead>
<tr>
<th>Function</th>
<th>Giro Product</th>
<th>relation to Giro-Nil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Account</td>
<td>GiroAccount</td>
<td>currently being implemented</td>
</tr>
<tr>
<td>Bill payment</td>
<td>AcceptGiro</td>
<td>currently being implemented</td>
</tr>
<tr>
<td>Cash Deposit and Withdrawal</td>
<td>CashGiro</td>
<td>implemented after mid 2006</td>
</tr>
<tr>
<td>Money transfer</td>
<td>TransGiro</td>
<td>implemented after mid 2006</td>
</tr>
<tr>
<td>Remittance</td>
<td>EuroGiro</td>
<td>feasibility study</td>
</tr>
</tbody>
</table>

The three possible focus areas which are discussed during the midterm presentation are:

- Money transfer
- Account, Bill payment and Mass payment
- Bill payment

These focus areas are shaded blue in Table 6. The money transfer and cash deposit and withdrawal scenarios are political sensitive subjects, because decisions on the design of these functions still need to be approved by the stakeholders involved. Furthermore, the decision making process of the implementation of these functions, will most likely, lie beyond the deadline of this graduation assignment. The functions account, bill payment and mass payment are being implemented within the time limit of this research assignment and fall within the scope of this assignment. Respectively, these functions are filled in with the products GiroAccount, AcceptGiro and BusinessGiro.

The last precondition of addressing the already chosen core processes is highly valued. Therefore the focus area needs to address the already chosen technical processes. Two options remain viable for the elaboration of the focus area: width-wise or in-depth. The advantages and disadvantages of both options are given in Table 7.

Table 7 Two feasible focus areas

<table>
<thead>
<tr>
<th>GiroAccount, BusinessGiro and AcceptGiro</th>
<th>AcceptGiro</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pro</td>
<td>depicts connections between the architectural descriptions and operational processes</td>
</tr>
<tr>
<td>provides view on the interfaces between stakeholders in the network</td>
<td>can be more elaborated for proof of concept</td>
</tr>
<tr>
<td>implications internal processes between different stakeholders</td>
<td></td>
</tr>
<tr>
<td>mutual coherent processes</td>
<td></td>
</tr>
<tr>
<td>Con</td>
<td>limited scope describes 1 function</td>
</tr>
<tr>
<td>limited depth</td>
<td>addresses less stakeholders</td>
</tr>
<tr>
<td>stays on abstract level</td>
<td></td>
</tr>
</tbody>
</table>
In the Appendix a set up is made for elaboration of the focus areas for the three products GiroAccount, BusinessGiro en AcceptGiro. To achieve more insight in the Giro products the Generalized Scorecard is used to depict the internal assets and processes with relation to the external stakeholders.

In an open discussion after the midterm presentation the AcceptGiro focus area is chosen for elaboration. The approach for architectural descriptions of AcceptGiro gives insight in the function of the specific product and the relation to other Giro products. This approach serves as a proof of concept for the other functions of the Giro system. In this way it will help to limit the risks of failure for the other Giro products.

5.4 Conclusion

After analyzing the Inclusion Group business environment several conclusions can be drawn. By drawing up Ishikawa diagrams for the PCP and the FS, the causes and effects within the Inclusion Group where identified. The effects are in line with the final assignment. This indicates that the final assignment was well chosen. The purpose of this research is to solve several causes which have been identified in both Ishikawa diagrams in order for the Inclusion Group to further enhance their business processes. Many identified causes can be solved with the help of architectural descriptions. Especially the documentation, communication and directive causes can be eliminated by the structure and transparency of the architectural descriptions.

The relationship between the product creation process and the financial system becomes more evident in the Ishikawa diagrams. Many causes of the effects in both diagrams can be found in the same areas. Due to the more tangible nature of the financial system, two extra root causes are added. These are technology and requirements, added respectively for the technology used in the Giro system and the system dependant requirements.

The first step in knowing how to undertake a project is identifying the goal of the project. In this way the product creation process can be seen as the means to create a financial system in an emerging country. Therefore, the financial is seen as the goal. To identify the qualifications of the financial system which the Inclusion Group wants to implement, the focus in this report will be on the financial system. However, to some extend the PCP will be further addressed in this report. During an acceptance meeting the implications of the FS on the PCP are discussed. The results of the acceptance meeting are discussed in chapter 7 Implementation.

While conducting the analysis it became evident that the stakeholders will play a pivotal role in the financial system. After all it is useless to design and implement a product, the financial system, without the active involvement and acceptance of its stakeholders. Therefore this research will focus on both the financial system and the market level. Both areas will be structured and documented with the help of architectural descriptions.
6 Design

In this chapter first the functional specifications for the graduation design are given. After this the structure and the method for the architecture descriptions (AD) of the Financial System (FS) are clarified. In the Market Architecture Descriptions (MAD) and Business Architecture Descriptions (BAD) the additions and alterations are explained. In the last section the implementation of the architecture descriptions will be dealt with.

6.1 Functional specifications for graduation design

The graduation assignment lies within the scope of the, to be developed architecture of Giro-Nil. The architectural framework for Giro-Nil is a base for the reference architecture which will be developed for the Inclusion Group and for other joint-ventures in the future. In this design the emphasis will lie on the current joint-venture Giro-Nil. Van Aken et al (2004) have defined functional specification for the graduation design. These specifications are applied to the subject to be designed: Financial System architecture descriptions.

6.1.1 Functional requirements

The functional requirements define the core of the performance demand of the entity (Financial System) to be designed.

The architectural descriptions will have to bridge the gap of the business vision, changing to a cashless economy, and the operational level of the Giro system. The design must document the fundamental processes and give insight in the decisions made to develop these processes. It must also serve as a visualisation for change management. The part of the architectural descriptions chosen in the focus area will serve as a proof of concept for the chosen architectural description approach and design. In the evaluation part of this report the applicability of this design is going to be evaluated.

6.1.2 User requirements

The user requirements are the specific requirements for the user point of view. In the Financial system architecture the users are the stakeholders in the joint-venture and the future customers of the system.

The Inclusion Group as a stakeholder wants to accumulate knowledge as Intellectual Ownership and to set up a blueprint for the Giro system. And the reusability through AD for the general PCP and development of new products. When developing the architectural descriptions the decisions made in developing Giro-Nil and the interfaces with external parties need to be emphasised. Because the decisions which were specifically made to meet the Egyptian situation need to be generalized when the reference architecture is drawn up.
6.1.3 Boundary conditions

These are the conditions which must be met unconditionally.

In the first place the added value for each stakeholder described in the Generalized Scorecard (see Appendix Value and Risk model) need to be achieved. When the added value is not achieved by the Giro system, the shifted value of the stakeholder needs to described or (the roles in) the Giro system adapted.

The architecture descriptions have to take into account the legacy of the already chosen technology. The preconditions previously mentioned in Inclusion Group Giro product scope must be met specifically met by this graduation design.

6.1.4 Design restrictions

These restrictions determine the preferred solution space.

The already developed implementations have to be taken into account and must be treated as legacy in Egypt. Therefore a bottom-up and top-down design needs to be developed at the same time. For bottom-up the current processes of Giro-Nil need to be drawn up in architectural descriptions. From top-down the approach is similar to the known methodologies. This need to be done with the help of models and tools which are hierarchical to achieve a clear understanding of the approach.

The architectural descriptions need to be simple to maintain.

6.2 Architectural descriptions of the Financial System

The COMET descriptions need to be understood as a pattern rather than a fixed recipe which have to be followed by the letter. The pattern consists out of a hierarchical set of models. In Figure 12 and Figure 13 the hierarchy of the models used in this research is depicted. When models are indicated the first letters of the models are used as abbreviations.

The models are adapted to cope with the specific environment of the Inclusion Group.

The Market Architecture Descriptions are a higher scale addition to the COMET methodology, which essentially addresses the business scale. Because of strategy's concern with the external environment of a business, the MAD overlaps with the Business Strategy Model (Value and Risk Model) of the Business Architecture descriptions (BAD). The BAD will not need be elaborated beyond the contributions regarding the Business Strategy model of the different stakeholders that can be found in Appendix Value and Risk model.

The COMET architecture is model driven. Four models can be identified at successive levels: the business model, the requirements model, the architecture model and the platform specific model. The platform independent model (PIM) is defined by the first three models. To complete the architectural descriptions for the Inclusion Group all boxes need to be addressed. This means the models need to be elaborated or an argumentation must be given why these boxes do not need to be elaborated. In this way the decisions made to achieve architectural descriptions are transparent and documented.
The blue shaded boxes in Figure 12 and Figure 13 are made clear in Appendix Architecture descriptions repository. The reasons for not filling in models are given in the following section. These figures are a graphic representation based on the COMET Architecture descriptions template.

### 6.3 MAD & BAD

Several additions and alterations have been made to COMET to tailor the design to the Inclusion Group situation. On a generic level the reasons for altering COMET will be made clear in this section. Some parts of COMET are not elaborated. There are three types of reasons for not elaborating parts of COMET:
a) Is irrelevant for the current situation of the Inclusion Group  
b) Is outside the scope of the proof of concept of AD given in this report  
c) Have to be done later due to limited time  

These types cover the blank boxes in Figure 12 and Figure 13. The following part makes the content of these figures clear.

### 6.3.1 Market Architecture Descriptions (MAD)

First Market Architecture Descriptions (MAD) are added to identify the key stakeholders in the financial infrastructure collaborations. MAD is based on the modelling descriptions of COMET. After MAD the Business Architecture Descriptions (BAD) are derived conform COMET. The BAD are provided of the key stakeholders, known as Bank, Bank Process Servicer, Person, Billing Company, Post Office. These stakeholders are actors in Figure 14 Market perspectives model. In reality the different stakeholders can have multiple actor roles as defined in the architectural descriptions. For instance a Post office can have a banking role, a retail network role and a supporting of mailing role. In MAD the difference between 1st and 2nd degree financial services is introduced.

**Market Strategy Model**

In this subsection of MSM-Market value and Risk model a set up is made for this model. This model can be further elaborated with influence from the stakeholders relevant to the Giro system in the market. For the type c) reason (have to be done later due to limited time) this model is not further elaborated.

**Market Operations Model**

The MOM-Goal model is addressing the goals and operations on market level. The goals are those of Government and (inter)national competition agencies, such as Bank for International Settlements. The Appendix Ten Core Principles of BIS gives the content of this model for one stakeholder. This model have to be kept in the back of the mind of the system developers, because it sets the rules for the market within which the joint-venture is operating. For now it is a type b) reason (Is outside the scope of the proof of concept of AD given in this report) for not elaborating.

The MOM-Perspectives model considers the perspectives of different actors operating in the market. This has been the rationale to generate the MAD. The internal (ICT) systems are going to be affected by the systems needed to implement the new (Giro) functions in the existing financial infrastructure within which the joint-venture is operating (see Figure 14). For each of the actors internally the impact of the changes can be implemented with help of one, two or three V’s of the 3-V model, as made clear in section 4.3 FAST, COMET and the 3-V model. The level of adaptation is dependant on the role in the financial system.
The MOM-Market Resource model depicts the market domain model with the resources necessary to perform the expected banking functions in the market environment.

The MOM-Market Collaboration model depicts the collaborations necessary for the 1st degree banking services and the AS-IS and TO-BE situation for the 2nd degree banking services in the market. The benefits for the new collaborations need to balance out the effort to achieve these collaborations.

**Market Requirements Model**
The requirements in the market fall outside the scope of this research for the similar reasons as given in the MOM-Goal model. It is a type b) reason for not elaborating.

**Market Component Model**
Market component models are not considered because in the first instance, we do not make use of market wide communications infrastructures to offer customers e-banking for instance. If such capabilities will be leveraged, then it becomes meaningful to also include a component model in the MAD chapter. This is a type a) reason.

6.3.2 **Business Architecture Descriptions (BAD)**

**Business Strategy Model**
Within BAD this is the first model to depict the stakeholders and values and risks. For each stakeholders relevant aspects of Giro-Nil are already modelled in the MAD. The added value for the stakeholders is made clear in Appendix Value and Risk model.

**Business Operations Model**

The stakeholders described in the MAD each have internal processes effected by the Giro system. For each of these stakeholders the BOM is set up. In comparison the COMET a different modelling technique is used for the BOMs. The BOMs are filled in by Petri nets. The modelling technique Petri net does not only graphical depicted models, but also have a mathematical base.

The BOMs for Person and BPS (the function which will be fulfilled by the joint-venture, Giro-Nil) are not elaborated completely. The reasons are two folded.

- Person has in the current function no IT systems which are be affected by the new systems. (Reason type a).

- The systems which are developed for the BPS are servicing the communications for the 2nd degree banking services. The requirements are derived from the services needed. Therefore the BPS systems are modelled in the Business Requirements Model.

The BOM-Goal model is a model to agree with the business stakeholders the business goals that will be met by implementing and the using the Giro system. In the specific situation of the Inclusion Group the stakeholders are perceiving the goals as the added values stated in the Generalized Scorecard.

The BOM-Business resource model not only consists of the resource models, but also domain models. The domain model represents the domain of an actor relevant to the joint-venture Giro functions. The resources are the artefacts with which the actors can achieve their added value through messages and value transactions.

The BOM-Business process and role model are composed of Petri nets. The messages and value transactions can be represented in the Petri net by tokens that are being fired. These tokens are the resources defined in the domain and resource model. The attributes of he tokens are defined in tables added to the Petri nets.

**Business Requirements Model**

The Business Requirements Model addresses the requirements for the facilitating bank and bank process services systems. These requirement are set up from the Giro functions that need to be implemented in the financial infrastructure of the concerning country. These Giro functions define the Use case models of the Giro system.

The Use case model-System boundary model defines the boundary of the ICT and primary process systems of the Giro system. Within the model the stakeholders and supporting systems are presented as actors. The actor Civil Entity consists of several actors as defined in the MOM-Market Resource model and therefore functions as a super class.
In the Use case model-Use case scenario model the different Giro functions are described through use cases. It becomes clear that the earlier defined collaborations transact with each other through different function related processes or functions.

The Non-functional requirements are the requirements that do not fit within the use case template. These requirements can be applicable for the complete Giro system. Also interoperation with legacy systems is described in this work product. The requirement scalability (see Figure 11 Ishikawa diagram Financial System) must be described here. This work product is not elaborated due limit time (a type c) reason)

The Reference analysis is the intermediate step between the BOM/RM and Component Model. The system boundary model derives to a set of subsystems. Subsystems are non-exclusive implying that a use case might be part of more than one subsystem. The result is a functional decomposition of the main component.
In the Giro system case the Giro functions are already needed in the financial infrastructure to achieve cashless society. Therefore the Giro system is already decomposed in the use cases.

Component model
The component model is the reference architecture as defined by COMET. It is a set of logical ties, each of which consists out of a set of components. An overview of the component model is be depicted in a 4+2 tier architecture. A non structured explanation is given of the relevant tiers to the Inclusion Group. A resemblance to Figure 10 Conceptual Joint-Venture Reference Architecture can be noticed. The component model is not further elaborated due to lack of time (reason c). The component model translates the requirements model to a consistent set of components and their interdependencies.

Platform specific model
The platform specific model defines a representation of system architecture on specific technology platforms. This model is not elaborated due to reason c).

6.4 Assessment of the architectural descriptions

Although the Inclusion Group gains more structure and insight through the architecture descriptions. First an acceptance meeting (see Appendix Acceptation Meeting) is held to gain input for the assessment of the architecture descriptions. Secondly the question needs to be answered whether the problems, as described in the Ishikawa diagram of the Financial System, are addressed by the AD design. As remarked in the Analysis chapter, regarding the Ishikawa analysis of the Financial system, when the problem causes are addressed their effects should be diminished.

As indicated earlier the focus of the design will be on the financial system. Therefore the assessment will not address the problems indicated in the Ishikawa diagram of the Product Creation Process. Although there is a relation between the PCP and FS. As a result the AD will diminish some of the causes directly related to the PCP.
For each of the six areas of concern to the Financial System, the effects of introducing architectural descriptions are explained.

- **Stakeholders**
  Within the architecture descriptions a specific focus is on the role and changes for each of the stakeholders (Business Architecture Descriptions). With the added Market Architectural Descriptions also the collaborations between the roles of the Giro system are explicitly modelled.
  The added value for the stakeholders is modelled in the Value and Risk model. In this case the Generalized Scorecard is used. These descriptions form a basis for engaging the stakeholders in the transformation of the financial infrastructure.

- **Technology**
  The technology root cause is not yet addressed within the architecture descriptions in this report. However when the descriptions are further elaborated within the component model and later within the platform specific model the technology is explicitly described.

- **Managerial**
  While elaborating the architectural descriptions the related managerial needs have risen. However the directing, security and governance causes can be covered by completing the architectural descriptions.

- **Growth**
  The architectural descriptions are based on documents. The AD can be perceived as an overview for the documents describing the systems in more detail. When the architectural descriptions are accepted within the business and or product creation processes the redundancy will be limited to a minimum. To keep all architecture descriptions up-to-date the implementation plan as described in chapter Implementation needs to be put into practice. A suitable tooling must be acquired.
  The platform connection of new functionalities on the existing Giro platform can be addressed by completing the architectural descriptions.

- **Requirements**
  The architectural descriptions have lead to more and broader awareness of the requirements throughout the organisation. With the Market Requirements Model within MAD a location for describing the external regulations has been achieved. Also while describing the use cases new decision parameters for the Giro system were explicitly indicated.

- **Consolidate**
  Through the design of the architectural descriptions the business process information is consistently modelled. The Giro functions processes can be unambiguously communicated.

It can be conclude that the architecture descriptions developed during the graduation assignment, have effects in the problem areas Stakeholders, Growth, Requirements and Consolidate. The areas Technology and Managerial must still be covered, among others by the development of additional architectural descriptions.
7 Implementation

In order for the graduation design to deliver an operational result van Aken et al (2004) has indicated requirements. Within the Inclusion Group several steps have been taken for the acceptance of architectural efforts. The architectural descriptions of the Giro system can only function as intended when high level stakeholders support it. Therefore the acceptance is the first phase of implementation. The second step the roles and responsibilities for maintaining and changing architecture descriptions to adapt to the dynamics of the Inclusion Group environment. The third step of implementation is to familiarize the people concerned with the Giro system with the architecture descriptions. Several steps in implementation have been taken already while some steps remain open. Both will be discussed in this chapter.

7.1 Implementation plan

According to van Aken et al (2004) the implementation plan for a major organisational change consists of four parts:

- A specification of the actions to be taken to implement the object design, including the timing.
- A specification of the people who have to execute the various steps and of the people who have to be involved in the change process.
- A design of the change organisation i.e. the temporary structure within which the above-mentioned people will work, e.g. in the form of teams with possibly a high level steering committee and a coordinating project team with linking pins to the various teams.
- A communication plan, specifying the ways and the timing of informing the various stakeholder groups on the nature, timing and progress of the implementation plan.

For smaller organisational changes it can be satisfying to use a more limited version of this implementation plan.

7.2 Acceptation

Within the Inclusion Group the architectural descriptions lead to a better insight of the ICT and primary processes. However the architecture needs to be anchored in the organisation. Therefore an acceptation meeting has been held at the Inclusion Group (see Appendix Acceptation Meeting). The comments made during the acceptation meeting are processed in this report.

The architectural descriptions are perceived as an added value for the set up of a reference architecture of the Inclusion Group. The added Market Architecture Descriptions are relevant to the current discussion about the roles of stakeholders.
In the current implementation process of Giro-Nil the implications of parts of the architecture for the future are not well thought-through. This can have consequences for the current Giro system. However this can have a larger impact on the repeatability of the implementation in other emerging countries.

### 7.3 Architecture management process

The architecture management process as described in this section has been enclosed in a discussion paper. Also a meeting has taken place with the Inclusion Group management where this document has been discussed. Effective implementation and management of the architecture descriptions involves active participation by several key groups. Each group has specific responsibilities and must interact with the other groups as summarized in Figure 15 Architectural management roles and responsibilities. IGS is an investment structure for financing the Giro system implementation. The local joint-venture can pay for the system on transaction base. Inclusion Group and Interpay are owners of IGS.

![Diagram of architectural stakeholders and management roles](image)

**Figure 15 Architectural management roles and responsibilities**

The specific roles of each group are:

<table>
<thead>
<tr>
<th>Architectural Stakeholders</th>
<th>Architectural Management Group (AMG)</th>
<th>Architecture Board (Executive team)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Provide input for the AMG</td>
<td>• Develop/ Update architecture</td>
<td>• Identify business requirements</td>
</tr>
<tr>
<td>• Review architectural changes and updates</td>
<td>• Identify / Review and approve /deny architectural changes</td>
<td>• Review and approve major architectural changes</td>
</tr>
<tr>
<td>• Locally sponsor the reference architecture</td>
<td>• Communicate and champion architecture</td>
<td>• Review and resolve escalated architectural issues</td>
</tr>
<tr>
<td>• Support conformance to the reference architecture</td>
<td>• Establish / Implement conformance</td>
<td>• Review and provide feedback of the effectiveness of the AMG</td>
</tr>
<tr>
<td>• Submit requests for architectural changes and exceptions</td>
<td>• Address architectural exceptions /appeals</td>
<td>• Sponsor and champion the architecture across</td>
</tr>
</tbody>
</table>

Joint-Venture(s)
IGS
IG - Products

IG - Architecture

IG - Management
- Architecture Board is responsible for providing business guidance, communicating changes in business direction, and for approving changes and variances to the architecture.

- Architecture Management Group Leader is primarily responsible for providing leadership and guidance to the Architectural Management Group (AMG). In addition to acting as liaison to the Architecture Board, the Group Leader will also ensure the appropriate resources are available and assigned to the Architectural Management Group (AMG).

- Architecture Board is responsible for managing the design, deployment, maintenance, and evolution of the Inclusion group Reference Architecture. In addition, the AMG will be responsible for the correct usage of the reference architecture throughout the Inclusion group – Joint ventures network.

- Architectural Stakeholders are those whose job is affected by the architecture. This group includes most of the I/S organisation as well as those in the business community who make I/T investment and product decisions. In addition to using the architecture for decisions making guidance, they will review architectural changes and updates and provide feedback to the Architectural Management Group (AMG) as appropriate. Primary stakeholders of the Inclusion group Reference Architecture are:
  - Joint-Ventures
  - Inclusion group Products department
  - IGS (including IT suppliers)

### 7.4 Communication

The further communication of the design will be in the form of meetings and presentations to achieve an understanding for the more transparent descriptions of the business processes of the Inclusion Group. The roles defined in the previous section can be a starting point for communication.

The builders of the Giro systems have to be involved when further detailing the architectural descriptions. A first meeting with system developers for the AD approach has been held recently at Interpay, Utrecht.

Within the Inclusion Group a company-wide reference model is being developed. Reference architecture will take a central position within this model. When developing the reference model the connection of the Giro system with the supporting organisation is going to be discussed. The architectural descriptions serve as a base for discussion.

### 7.5 Conclusion

The Inclusion Group management is convinced of the added value of architectural descriptions for the organisation. The initial steps for a company-wide implementation have been taken. The follow up will involve more participants and more detailed parts of the Giro system.
When the already achieved steps of the implementation are compared to the implementation plan of van Aken, several conclusions can be drawn.

- The actions to be taken to implement the object design are explained in this chapter. Most likely new actions are followed from the discussion on roles and with system developers.
- The specification of roles is elaborated in section 7.3.
- There is no temporary structure for implementing the design. The design will from an integral part of the organisation.
- Communication will be achieved through meetings and presentations.

The Inclusion Group management wants to achieve more structured processes. Therefore the architectural descriptions can be inserted in the process of organisational maturing. The currently existing positions and structures do not need to be changed. However a new structure needs to be added.
8 Conclusions and recommendations

Based on the previous chapters, several conclusions can be drawn. The conclusions can be separated in conclusions regarding the organisation, conclusions regarding the graduation assignment and conclusions regarding the theory used during the research. These are discussed in separate sections of this chapter. The final section lists the recommendations. This chapter can be seen as the evaluation of the object or design developed in this research project. In chapter 9 the evaluation of the process of the graduation project itself will be discussed.

8.1 Conclusions regarding the organisation

Six conclusions from this graduation project, regarding the organisation are formulated:

The implementation of joint-ventures at the Inclusion Group needs more control and structure.
The Inclusion Group formulated the graduation assignment because the current situation was not the desired situation. Setting up a new service based and ICT intensive organisation in a foreign country with many different stakeholders led to the need for more structure and control. The organisation needed a clear insight in the complex systems and their interfaces, support for management control and a tool for making the decisions consolidated in the systems transparent.

The high level business ambition is not systematically and consistently translated to the implementation of the Giro system.
The mission of the Inclusion Group is to stimulate economic and social development in emerging countries by releasing the power of modern payment services to all people. The translation of this mission to the implementation of the technical giro systems is a giant leap. The development of the Giro system has grown organically and bottom up. Before this graduation project the bridge between mission and developments had been left implicit. The design structure is not set up in a way that all development decisions are made consistent with the mission and its translation. Therefore not all requirements of stakeholders are taken into account when decisions are being made about component or system.

A decoupling of the Inclusion Group Product Creation Process and its product, the Financial System is required.
The Inclusion Group plays an important role in enhancing the financial infrastructure in the emerging country from a cash-based to a cashless society. The Giro system accelerates the development process of the national economy. More monetary value stays at the banks and can subsequently be invested in new projects which will boost the economy through their revenues. At this moment the Inclusion Group is implementing the Giro-Nil joint-venture through its product creation process, to enhance the financial infrastructure in Egypt. It is important to focus first on the financial system so that the goal of the project creation process becomes clear. After that the product creation process has to be designed in a way
that it can develop the desired financial system and that this process and thereby its outcome become predictable and of high quality.

The architecture descriptions provide a representation of the Inclusion Group and its environment with multiple functions:

- Base for communication
- Provides insight in choices made
- Consistency models and descriptions
- Checklist for completeness
- Addressing issues

The architectural descriptions (AD) have to be consistent and easy to access. Furthermore, the acceptance and implementation need to be taken into account. The AD need to be backed up by the entire organisation. To enhance communication, the high level descriptions need to be easy to understand. More detailed descriptions can be more technical, and therefore more accurate. With help of the AD issues can be addressed now and in the future. The problems identified in the Ishikawa diagram of the financial system are diminished with the designed AD.

The architecture descriptions are serving as a proof of concept and need to be further elaborated

The proof of concept of the AD in this report will help to initiate architecture within the Inclusion Group organisation. This will be the initial step towards a more structured and well documented approach of the Giro system. In the Implementation chapter a guide is given to anchor the architectural efforts within the Inclusion Group organisation. When the AD models are all elaborated the functions and lay out of the Giro system will become clear to people throughout the organisation and to stakeholders.

8.2 Conclusions regarding Graduation Assignment

The conclusions regarding the graduation assignment indicate how the graduation goals have been answered by the design. The identified needs for control and structure have led to this first graduation goal:

*To use an architectural framework to reduce the risks of failure for Giro-Nil products*

In the analysis the decision has been made to focus on the financial system during the graduation design. The reduction of risks of failure for the specific Giro-Nil products is primarily dependant on the current implementation process of Giro-Nil. In the report this process is indicated as the Product Creation Process (PCP). To achieve a substantial reduction of risks of failure the PCP have to be based on architecture descriptions which are initiated in this report. The majority of the parts of the Financial System architecture descriptions, which have been installed bottom up, have to be perceived as legacy systems.

The AD in the design serve as a proof of concept. When the descriptions are elaborated in the future they will systematically reduce the risks of failure. The effect on the reduction of
risks of failure in this report is the degree to which the problems identified in the Ishikawa diagram of the Financial System contribute to these risks.

The second goal connects to the problem indicated in the Ishikawa diagram of the financial system:

To obtain system architecture descriptions that can be re-used in financial sector transformations in other emerging countries.

Therefore the graduation design addresses this goal. With the systemically approach of the architecture it can serve as a reference when a new joint-venture is being set up. Even when some functionalities change the interdependencies are well documented and traceable in the COMET methodology. The layered approach of COMET identifies different abstraction levels. When changes are required the impact can be assessed and implemented while overseeing the consequences to the already designed Giro system.

8.3 Conclusions regarding Theory

Several conclusions can be drawn when the design and the theory used in this report are related:

FAST and system life cycle have given insight for interpreting the financial infrastructure, and the Inclusion Group Product Creation Process.
The relation between the Inclusion Group, Giro-Nil and the financial infrastructure could be translated with help from the FAST and the system life cycle concepts.

MAD will be of additional value to the COMET methodology
The COMET methodology is less adapted to model a service oriented network organisation, then to model industrial production facilities or business processes. Therefore Market Architecture Descriptions (MAD) are added, based on COMET methodology. With MAD the stakeholder roles and the collaborations between them are elaborated, as well as derivation relationships among MAD models and the business architectural descriptions (BAD) of the stakeholders.

The layered approach of COMET is beneficial for the development of architecture descriptions
In this graduation project the top-down, mission-to-system layered approach of the architectural descriptions have been very helpful. The methodology addresses themes from the business strategy level to platform specific detailing, and each layer can be iteratively approached. Hence no giant leaps need to be taken, and within each layer knowledge can be accumulated.

Few modelling examples within COMET
At this moment the COMET methodology explains the structure extensively. However the connection to practice can be enhanced by providing more examples and by documenting best practices.
8.4 Recommendations

Based on this graduation project, three recommendations can be given.

Make the architectural descriptions accessible
During the acceptance meeting difficulties arose while explaining the UML and Petri net models. For many Inclusion Group employees these techniques are “too technical”. This means that first the techniques need to be explained before thorough understanding can be achieved. On the other hand simplified representations for each architectural layer need to be made as well.

Recommended course for architecture
- **Involve partners in the architectural effort**
  Trough involving the partners who built the Giro system the insight in their value in the Giro system increases which in turn increases synergy.
- **Develop a reference architecture**
  As a basic blue print of the architecture of the Giro system a reference architecture can be made. Subsequently, specific local adaptations can be made to the reference architecture.
- **Roles defined in Giro system and actual stakeholders must be decoupled**
  The roles defined in the Giro system are necessary to fulfil Giro functions. A shift of the roles between stakeholders during implementation should have not effect the architectural descriptions.

Establish a generic product creation process of the Giro system
To draw up and consolidate a product creation process is essential, to maintain and further develop the quality of the projects. With the help of architecture descriptions the static structure of the Giro system can be consolidated to serve as a solid base for the product creation process of the Inclusion Group. Together with the experience of implementing Giro-Nil a basic development approach for the Giro system can be set up. Each time a new joint-venture is set up an instance can be made to adapt the specific requirements of the implementation of the Giro system in an emerging country.
9 Evaluation

In this chapter the process of the graduation project itself is evaluated. The strong points of the process will be discussed as well as new insights gained during the process. As with most learning experiences, there were steps one would have done differently in hindsight. This graduation project is no different in that respect. Both the strong points and the new insights will be discussed from different points of view in the following sections.

9.1 Inclusion Group

It was nice to be able to work in such a dynamic organisation like the Inclusion Group. Due to its open organisational culture, people from all layers within the organisation where easy to approach and very willing to share their insights in the organisations business processes. This greatly benefited my understanding of the organisation. Despite this willingness to share information, my understanding of the processes would have been further enhanced by seeing the business processes for myself. Since most processes of the Inclusion Group take place abroad this has not been possible.

During the first period of my graduation there was no fixed Inclusion Group office location. Therefore appointments had to be made for setting up meetings. As a result sometimes the synergy achieved while casually sharing ideas was not there. However the meetings where mostly well structured and with a clear purpose.

9.2 Eindhoven University of Technology

Examining the relatively new field of Enterprise Architecture has been very interesting. This field of studies follows the idea that addressing information technology issues within a company needs to be done using a holistic approach. This is in line with the view of my studies Industrial Engineering and Management Science. However the fact that the subject of this report is relatively new also presented some difficulties. There is no textbook architectural approach which exactly fits this graduation assignment. Therefore a lot of time was initially absorbed in the process of clarifying the project approach. Finally, during the midterm meeting the focus area for the architecture descriptions was determined.

While elaborating the architectural descriptions, my TU/e supervisor and I came to the conclusion that added architecture descriptions (MAD) were necessary to efficiently model the Inclusion Group environment. Setting up these architectural descriptions is an ongoing process of constantly refining and extending the models as a result of new insight gained during the development of these architectural descriptions. Therefore, more time was spent on the development of the architectural descriptions then first estimated. Due to the MAD elaboration the effort of the architectural descriptions has been on the high abstraction layers. As a result the descriptions are drawn up less in depth and have a broader span.

To conclude I would like to remark that the knowledge of my two supervisors from the University was complimentary, which broadened my perspective on most issues dealt with in this research.
## 10 Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AcceptGiro</td>
<td>function of the Giro system to transfer money from many to 1 account. An</td>
</tr>
<tr>
<td></td>
<td>AcceptGiro is a standardized, paper payment form(at). It effectuates payments</td>
</tr>
<tr>
<td></td>
<td>of invoices based on the Giro system.</td>
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<tr>
<td>Architecture</td>
<td>The fundamental organisation of a system embodied in its components, their</td>
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<tr>
<td></td>
<td>relationships to each other, and to the environment, and the principles</td>
</tr>
<tr>
<td></td>
<td>guiding its design and evolution. (IEEE Std 1471-2000)</td>
</tr>
<tr>
<td>Architecture</td>
<td>description</td>
</tr>
<tr>
<td></td>
<td>A collection of products to document an architecture. (IEEE Std 1471-2000)</td>
</tr>
<tr>
<td>Billing Company</td>
<td>organisation that invoices customers for services. They are the issuers of</td>
</tr>
<tr>
<td></td>
<td>AcceptGiro’s. Such as telecom operators or electricity companies.</td>
</tr>
<tr>
<td>BusinessGiro</td>
<td>function of the Giro system to transfer money from 1 to many accounts.</td>
</tr>
<tr>
<td>CashGiro</td>
<td>function of the Giro system to deposit and withdraw cash to a GiroAccount.</td>
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<tr>
<td>Clearing</td>
<td>exchange of information about financial transactions between banks by an</td>
</tr>
<tr>
<td></td>
<td>intermediary (clearing house).</td>
</tr>
<tr>
<td>Clearinghouse</td>
<td>intermediary, which performs exchange of financial transactions between</td>
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<tr>
<td></td>
<td>banks.</td>
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<tr>
<td>EuroGiro</td>
<td>function of the Giro system to transfer money between accounts</td>
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<tr>
<td></td>
<td>intercontinental.</td>
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<tr>
<td>Financial</td>
<td>Infrastructure</td>
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<tr>
<td></td>
<td>the basic financial systems and structures that a country [or organisation]</td>
</tr>
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<td></td>
<td>needs in order for its economy to work properly. (Longman Dictionary, 1995)</td>
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<tr>
<td>Financial market</td>
<td>banks and other financial institutions that make business contracts with each</td>
</tr>
<tr>
<td></td>
<td>other (Longman Dictionary, 1995)</td>
</tr>
<tr>
<td>Financial system</td>
<td>a system which supports (or enhances) the Financial Infrastructure</td>
</tr>
<tr>
<td>GiroAccount</td>
<td>bank account in the Giro system environment.</td>
</tr>
<tr>
<td>Giro system</td>
<td>instantiation of a Financial System: payment and banking system with</td>
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<tr>
<td></td>
<td>standardized mass transaction capabilities and clearing and settlement of</td>
</tr>
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<td></td>
<td>transactions between banks.</td>
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<tr>
<td>Mass Payment</td>
<td>Provider</td>
</tr>
<tr>
<td></td>
<td>organisation that pays employees or pensioners. They use the BusinessGiro for</td>
</tr>
<tr>
<td></td>
<td>mass payments. Such as government or large organisations.</td>
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<tr>
<td>Process</td>
<td>An activity which takes place over time and which has a precise aim regarding</td>
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<tr>
<td></td>
<td>the result to be achieved. The concept of a process is hierarchical which</td>
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<td></td>
<td>means that a process may consists of a partially ordered set of sub processes.</td>
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<td></td>
<td>(Muller, 2005)</td>
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<tr>
<td>Settlement</td>
<td>settlement of the financial position between participating banks by a</td>
</tr>
<tr>
<td></td>
<td>settlement agent due to payments exchanged through a clearinghouse.</td>
</tr>
<tr>
<td>System</td>
<td>A collection of components organized to accomplish a specific function or set</td>
</tr>
<tr>
<td></td>
<td>of functions. (IEEE Std 1471-2000)</td>
</tr>
<tr>
<td>TransGiro</td>
<td>function of the Giro system to transfer money from 1 to 1 account.</td>
</tr>
</tbody>
</table>
11 References


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