Inter-organisational Application Integration
Developing Guidelines Using Multi Grounded Theory

Master's Thesis within Business Informatics
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Abstract

Background: Information technology (IT) has drastically changed the traditional way to do business. In theory, coordinating information sharing among organisational partners offers notable advantages through cost savings, productivity, improved decision making, and better customer service. Supported by modern information technology, business processes can change and be developed into new more effective forms, both internally and externally. However, as IT facilitates new business opportunities, it requires a steady flow of information and information exchange, both within intra- and inter-organisational contexts where a consensus on terms and definitions coordinating the uniform communication is vital.

Purpose: With the focal point on inter-organisational information exchange, the purpose of the thesis is to define a set of guidelines for AI that can be used and adjusted according to the needs of a specific situation or context.

Method: The thesis was carried out with a Multi Grounded Theory approach. Interviews were conducted at a local IT-company and with an associate professor of Informatics at Jönköping International Business School.

Results: Five categories were discovered which impact AI: integration governance, project management, context, integration content, and testing. The result also implied the importance to distinguish between an operational and strategic level when working with Application Integration.
1 Inter-Organisational Application Integration

Information technology (IT) has drastically changed the traditional way to do business. In theory, coordinating information sharing among organisational partners offers notable advantages through cost savings, productivity, improved decision making, and better customer service (Brown & Brudney, 1993; Dawes, 1996). Supported by modern information technology, business processes can change and be developed into new more effective forms, both internally and externally. However, as IT facilitates new business opportunities, it requires a steady flow of information and information exchange, both within intra- and inter-organisational contexts where a consensus on terms and definitions coordinating the uniform communication is vital (Fredholm, 2002).

Mechanisms for connecting applications both within and across organisational boundaries have been dealt with since the upcoming of more than two business systems and the network to run between them. In this thesis the focal point is on inter-organisational information exchange, commonly referred to as B2B Application Integration (AI). The selection of the inter-organisational perspective is based on the results from the pre-study1. These results show that inter-organisational AI-projects are becoming more common, present a higher degree of complexity, and involve more relational-oriented issues compared to intra-organisational counterparts, and thereby making the inter-organisational perspective more interesting to study.

AI is at its foundation, the mechanisms and approaches to allow partner organisations, such as suppliers and customers, to share information in support of common business events (Linthicum, 2001). The concept AI can be interpreted in a number of ways. One could interpret the concept as it concerns integrating different applications into each other. This is not an interpretation that is used in this thesis, instead the concept is interpreted as establishing AI by transferring data between the applications, i.e. one application send the data and another application receives the data, also referred to as systems interaction. However, since AI is the most used term within the existing literature, that term will also be used throughout this thesis.

A well known technique that has a long history regarding computer-to-computer based communication is Electronic Data Interchange (EDI), which also has proven to function well in various industries. EDI represents standardized electronic business documents enabling companies to communicate directly using computers (NEA, 2004). However, the nature of EDI is currently often referred to as cumbersome and rigid (NEA, 2004). This, in combination with the development of the Internet where communication protocols are fairly well coordinated, has led to a somewhat new position towards EDI where demands for cheaper, scalable, and flexible solutions with greater integration possibilities are brought forward. A recent study concluded that the use of EDI has decreased somewhat in Sweden since 2001, regardless of company size or industry (Sika, 2004). Some seven percent of companies using EDI expressed a will towards replacing EDI with more agile integration approaches.

The discussion above regarding EDI leans toward a more technical view on integration. Prior research within the field of application integration has also to a large extent focused on technical issues regarding AI. But is it possible to develop effective and flexible AI-solutions not taking organisational factors into consideration? The outcome of the pre-study highlighted some potential problem areas with AI: factors such as responsibilities, communication, and customer knowledge were identified. Different organisations and corporate cultures mean different ways of doing business and looking at communication, electronic commerce and integration. Business models may need to be aligned, or perhaps even reengineered in order to correspond to an integrated systems environment (Fredholm, 2002). Furthermore, other factors such as understanding the logic of the integrated applications, the data and its contents, and also the semantics of the data are important. Any given organisation uses an array of systems, the bulk of which speak their own separate languages, i.e. the internal structure and contents differ from other software. With above mentioned problem areas in mind, it is apparent that an integration project needs a structured support in order to minimise the risk of complications, a support that is not fully covered in prior research.

So, how do the existing software design methods deal with AI? Surprisingly, methods such as Rational Unified Process (RUP) aim to produce, within a predictable schedule and budget, high-quality software that meets the needs of its end users (Kruchten, 2000).

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1 The pre-study was conducted by interviewing the R&D-manager at a local IT-consultant company.

2 Software design methods such as Rational Unified Process (RUP) aim to produce, within a predictable schedule and budget, high-quality software that meets the needs of its end users (Kruchten, 2000).
as more or less isolated events. The lack of existing research discussing organisational factors regarding AI, combined with the fact that the need for AI will probably only increase in the near future, make the area of AI a highly interesting research field. Since the thesis is set in somewhat unfamiliar territory, we have chosen an inductive\(^3\) approach with the aim of developing an understanding of important aspects to consider regarding AI. Orlikowski and Iacono (2001) argue that information systems research treats IT artefacts as either absent, black-boxed, abstracted from social life, or reduced to surrogate measures. IT artefacts are usually made up of a multiplicity of fragmentary components requiring bridging and integration. According to Orlikowski and Iacono (2001), given the context-specificity of IT artefacts, it is not possible to develop a one-size-fits-all conceptualisation of how to approach IT artefacts or design processes. In the light of this it is not our intention to generate a generic AI design method, covering all steps from initial idea through design and implementation to daily AI operations. Instead the purpose of the thesis is to define a set of guidelines for AI that can be used and adjusted according to the needs of a specific situation or context.

### 1.1 Disposition

To make the readers’ understanding of the thesis’s structure easier, an illustration has been developed (see figure 1-1). The illustration shows the order of the thesis’s chapters and also presents a short explanation of each chapter’s contents.

![Figure 1-1 Disposition](image)

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\(^3\)The inductive approach means that the theory generation in the thesis is based mainly on empirical findings.
2 Working with AI-guidelines

Creating a starting point for understanding which factors influence intra-organisational AI, we were faced with several choices in terms of methodological approaches. We identified the need to go deep into a limited number of areas, rather than trying to generate a superficial image. This meant that we would analyse situations in which actors were and what implications those situations had. In other words, interplay between interpreting findings and detecting and understanding patterns.

This implied us having a hermeneutical viewpoint as researchers, using a qualitative onset. Furthermore, the scarceness of existing information led us to an inductive approach with plenty of practitioners’ input. Multi-Grounded Theory (MGT) proved to be a method offering support for theory generation based on empirical data in combination with theoretical discussions.

The hermeneutical viewpoint

Contrary to positivistic standpoints which are based on unequivocal and immaculate observations as requirements for founding theories and concepts, hermeneutical viewpoints are closely related to the concepts of “understanding” and “interpretation” (Repstad, 1999). Traditionally, positivism and hermeneutics have been the fundamental perspectives for social science. The understanding of actions and reality is a central focus when applying a rational perspective. Furthermore, the hermeneutical perspective enables the researcher to analyse situations in which the actors are and what implications the situations have (Lundahl & Skärvad, 1999). Thereafter it is possible for the researcher to rationally reconstruct the importance and consequences of specific actions. According to Guneriussen (1997), the absence of explicit interpretations of a situation, is often criticised and considered as insufficient in social science.

The focus on developing AI guidelines requires interpretations of collected data in order to understand the interplay between different actors and develop a structure for inter-organisational information sharing. The nature of the interpretation is influenced by the researcher’s perspective according to Patel and Davidsson (1991), meaning that the hermeneutical spiral does not have a fixed starting or ending point concerning the interpretation of data. The entities text, interpretation, creation of text, new interpretation, and understanding are parts of a greater whole constantly under development (Patel & Davidsson, 1991). Hence, the inception point for our work was based on prior knowledge and altered during the writing process as new knowledge was acquired and added to the base for the study.

A qualitative onset

There are different ways to approach scientific research. Although it is hard to define the “correct” course of action, it is important to establish which research approach is most suitable for fulfilling the purpose and achieving the highest possible trustworthiness regarding the conclusions. Scientific studies can be conducted using a quantitative or a qualitative onset (Carson, Gilmore, Perry & Gronhaug, 2001; Berg, 2001; Lekvall & Wahlbin, 2001; Widerberg, 2002). The choice between the two is linked to how the empirical material is best studied. In our opinion, understanding the reality of AI, its building blocks and their inter-connection, pitfalls and possibilities called for an understanding of several factors. This in turn, naturally resulted in a qualitative approach as we found it hard to penetrate deep into various problem areas using for instance a predefined survey and hence a quantitative approach. Furthermore, since quantitative research more or less gives answers to pre-defined questions (Lundahl & Skärvad, 1999) and we had an open-minded onset, not knowing quite what results to expect, we found it to be another argument for choosing the qualitative approach.

Quality in relation to scientific studies means that the researcher tries to understand human behaviour and interpret experiences (Lundahl & Skärvad, 1999). Qualitative studies are often constructed as in-depth studies, enabling the understanding of phenomena in multiple dimensions within a certain context (Lundahl & Skärvad, 1999; Repstad, 1999). The studies address the character of something, seeking the content or meaning (Carson et al., 2001; Widerberg, 2002), through answering questions of how and why (Carson et al., 2001). According to Berg (2001), qualitative research refers to concepts, definitions, metaphors, symbols, and descriptions with a continuous analysis and interpretation of data, facilitating a deeper understanding of the subject (Johannessen & Tufte, 2002). Flick (2002) describes qualitative research as being oriented towards analysing concrete cases in their temporal and local particularity, starting from people’s expressions and activities in their local contexts, which was just what was conducted during the interviews.

Multi-Grounded Theory

Working with AI-guidelines
MGT is a modified (extended) version of the Grounded Theory (GT) approach (Goldkuhl & Cronholm, 2003). GT is a qualitative research method (Cronholm, 2002; Strauss, 1987; Strauss & Corbin, 1990) focusing on theory development. GT is often described as an empirically focused method allowing data to set the tone when generating theories (Alvesson & Sköldberg, 1994). Applying GT strives to explain different entities within a social context (Cronholm, 2002). The generation of theories is based on identifying concepts and categories with accompanying attributes, and then try to find patterns, relations, and relevant research to the phenomena. According to Goldkuhl and Cronholm (2003), the reluctance in GT to bring in established theories implies a loss of knowledge. MGT tries to combine certain aspects from inductivism and deductivism. In the process of theory generation, the use of pre-existing theories may give inspiration and perhaps also challenge some of the abstractions made. Furthermore, Goldkuhl and Cronholm (2003) mean that theory development should aim at knowledge integration and synthesis. According to Goldkuhl and Cronholm (2003), MGT functions as a synthesis between inductivism (GT) and deductivism, trying to abolish oppositions through avoiding weaknesses and incorporating strengths in each approach (figure 2-1). The MGT-approach and the actual theory generation process will be explained later in this section.

4 Combining inductive and deductive thinking is often referred to as an abductive approach (Alvesson & Sköldberg, 1999)

2.2 Practical Application of the Multi Grounded Theory Approach

Working with MGT is basically following an initial idea or line of thought and then continuously combine, analyse and evaluate results from data. This in order to develop a theory based on empirical observations. To further enhance the emerging theory, reflection and revision takes place based on existing research with in the field of study. Over time, the initial, some-

Figure 2-1 Multi Grounded Theory (MGT) as a synthesis between inductivism (GT) and deductivism.

Figure 2-2 The theory generation process over time

As mentioned earlier, the inductive approach of MGT means that data and empirical findings play a central role during the research process. Lowe (1996) describes the process of data collection for generating theory (theoretical sampling) as a phase where the researcher jointly collects codes and analyses data and decides what data to collect next and also where to find it. This facilitates an emergent development of theory. When using theoretical sampling, one must be prepared to follow where the data leads. Lowe (1996) argues that the consequence of this procedure is that it is impossible to determine in advance exactly which data or how much that should be collected. The data for a study can be collected through interviews, surveys, observations and secondary information (Merriam, 2002b; Berg, 2001). The way of collecting data must be determined on the basis of which source will yield the best information (Merriam, 2002b).

Interviews

In this thesis interviews were conducted since we felt it was the best way of really getting an in-depth understanding of how practitioners experience application integration. There are different kinds of interviews; highly structured, semi-structured and unstructured (Merriam, 2002b; Johannessen & Tufte, 2002; Holloway, 1997). The interviews conducted were semi-structured meaning that an interview guide was prepared before the interviews (Johannessen & Tufte, 2002; Lundahl & Skärvad, 1999) containing a combination of standardised and non-standardised questions formulated in advance while other questions were formulated during the interview. There was no strict order to follow and not all interviews were
sequenced in the same way (Holloway, 1997). A lot of room was left for improvisation and adaptation to given answers. The flow of the conversation was what determined the sequence and also inspired new questions to be asked. The nature of the MGT-approach also led us to base questions in latter interviews to areas of importance expressed in former ones. The interview guides can be found in appendices 1, 4, 7, and 10.

Lundahl and Skärvad (1999) identify advantages with using standardised interviews such as providing a basis for a structured, quantitative processing of received answers, whereas non-standardised interviews deliver advantages such as more substantial and varied answers. A risk with the non-standardised interview technique is that a respondent may present some areas of a problem, while others may not, possibly rendering any comparison more difficult. However, the flexibility achieved using semi-structured interviews far outweighs the risk of missing some aspect or a question. Not only is the approach to asking questions crucial. The length of an interview is also important (Berg, 2001; Holloway, 1997). According to Berg (2001), no one correct answer can be given as to the most appropriate length of an interview. It has simply to do with the research questions and what the subject of the study is. The length of the interview is said not to give any evidence to the quality of the information given or the interview itself, it all depends on the specific case. Although Berg (2001) does not believe that respondents necessarily back out of an interview engagement because it is time consuming, our experience was that informants in general were not willing to spare more than one hour. Holloway (1997) determines that in such cases it is important follow the respondent’s wishes. Therefore, when calling to book the interviews we suggested the interval one to one and a half hour, and accepted the time given to us but still made room in our own schedule for an extended interview should the respondent be willing.

Patton (2002) argues that in order to keep the interviewee stimulated and interested during the interview, it is important to prepare simple and short questions and make sure that only one question is asked at any one time. We strove after asking questions one at a time and also to be encouraging during the conversation and motivating the respondent to give as extensive an answer as possible.

In order to optimize the collection and analysis of data during the interviews a tape-recorder was used. Carson et al. (2001), Easterby-Smith et al. (1999) and Ejvegård (2003) conclude that it often is a matter of preference, but using a tape-recorder helps the interviewer to concentrate on what the interviewee says (Patton, 2002; Holloway, 1997). However, recording might distract the respondent causing the answers to less comprehensive as they would without recording (Easterby-Smith et al., 1999; Ejvegård, 2003).

As mentioned earlier, MGT involves not only working with empirical data, but also the interplay between external theory and the evolving theory. This led us to gather information from existing research functioning as a source of knowledge to support and refine the emerging theory within the areas of importance emanating from the interviews. In order to gain acceptance for the generated theory, i.e. the finished guidelines for AI, it is necessary to have a better understanding of the MGT work process itself. The following sections will elaborate on the different component parts that make up MGT and our deployment of the method during our research.

2.2.1 MGT step-by-step

MGT is basically divided into three parts: theory generation, explicit grounding and research interest reflection and revision. The two initial parts require further explanation, however the last part is rather self-evident. The continuous reflection upon the focus of the study and revision of the emerging theories in accordance with new data has been a natural ingredient in the iterative work process, hence it will not be further elaborated on. Figure 2-3 illustrates the component parts and their relation to each other.
2.2.1 Theory generation

The work with theory generation is further divided into the following stages: inductive coding, conceptual refinement and building categorical structures. The last stage also involved theory condensation.

Inductive coding

According to (Strauss & Corbin, 1990; Lowe, 1996), the inductive coding phase entails the first attempt to highlight data, significant incidents such as events, issues, processes or relationships, and labelling those using respondent or researcher expressions, in this case practical actions in AI projects. The emerging concepts are then subject to systematically categorisation where the result can be further developed regarding the attributes and dimensions of the finds. Goldkuhl and Cronholm (2003) argues that it is important for the researchers to work inductively with an open mind and as free as possible from pre-categorizations, because it is harder to have an open mind later if one the researcher have explicitly used some pre-categories in the process of interpretation of the data.

Conceptual refinement

Conceptual refinement means that the research-
er should not take empirical findings for granted (Cronholm, 2004). It is essential to have a critical view towards the gathered data observed from respondents. By creating categories on unclear formulation will not render any valid theories. Goldkuhl and Cronholm (2003) describe a procedure for a critical category determination. Every category developed should be reflected upon concerning its ontological status i.e. what kind of phenomena is this? Where does this phenomenon exist? These ontological reflection and determination is complemented by a linguistic reflection i.e. is there an adequate correspondence between the category and its word form? Is this category a separate entity, or an attribute or a state of an entity, or some process?

Building categorical structure

Building categorical structures includes linking the categories from the inductive coding to each other. Building categorical structures can be performed by using a coding paradigm (a pattern) revealing the relation between different categories. A coding paradigm identifies the cause and effect of a related category (Hallberg, 1998). Strauss and Corbin (1998) argue that the paradigm should contain three aspects, the condition, the actions, and the consequences. The conditions answer the questions; why, where, how come and when the phenomena occurred? The actions answer the questions; which are the strategic responses made by the individuals or groups to issues, problems, happenings, or events that arise under those conditions? The consequences answer the question what happened as a result of those actions or the failure of persons or groups to respond to arisen situations. The concluding theory condensation aims to enhance the theory, leading to a few main categories (Goldkuhl & Cronholm, 2003).

2.2.1.2 Explicit grounding

There are three types of processes to explicit grounding: theoretical matching, explicit empirical validation and evaluation of theoretical cohesion.

Goldkuhl and Cronholm (2003) mean that grounding is an analysis and control of the validity of the evolving theory the researches are developing. Cronholm (2004) describes the three grounding processes to correspond to three kinds of validity claims: theoretical, empirical and internal validity.

Theoretical matching

Theoretical matching is a deductive process which matches the evolving theory in a way that it is compared and contrasted with other existing theories
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(Cronholm, 2004; Goldkuhl & Cronholm, 2003). This theoretical validation may render into three types of results. Adaptation of evolving theory i.e. existing theories found might contribute with insights which researcher have overlooked and therefore enhanced the evolving theory, Explicit theoretical grounding i.e. a theoretical validation of the evolving theory and comments/criticism towards existing theories i.e. researcher’s evolving theory may find existing theory obsolete (Goldkuhl & Cronholm, 2003).

**Explicit empirical validation**

Goldkuhl and Cronholm (2003) argue for explicit empirical validation i.e. empirical validation, which shift the focus to control and test of validity of gathered empirical data from the focus on theory generation in the earlier phases. Cronholm (2004) emphasis the need for a comprehensive and systematic check of the theory’s empirical validity.

**Evaluation of theoretical cohesion**

Evaluation of theoretical cohesion is an explicit internal grounding i.e. internal validation. At this stage the conceptual structure of the evolving theory is systematically investigated by checking the consistency and congruency within the theory itself (Cronholm, 2004). Both Cronholm (2004) and Goldkuhl and Cronholm (2003) suggest using a graphical illustration besides textual presentation to describe the conceptual structure of the evolving theory.

The next section will describe the sequence of the theory generation processes as it was conducted during the research.

### 2.2.2 The Theory Generation Process Put Into Action

The practical application of the theory generation process (see figure 2-4) was initialised by interviewing the R&D-manager at a local IT-consultant company. It helped us determined the research focus. We also conducted four other interviews (interview 1-4). Interviews 1, 2 and 4 were held with employees at the IT-consultant company, and interview 3 at Jönköping International Business School (JIBS). The respondent in interview 1 was the deputy Java team leader. Her position as a system developer lead to an interview with a technical focus. Interview 2 was conducted with another system developer, a Microsoft team member, with a more organisational focus on the discussion. The respondent during interview three was an associate professor of Informatics at JIBS. The discussion was focused on organisational and strategic issues in relation to AI. The last interview was held with a senior business consultant at the IT-company and was completely focused on organisational and managerial issues.

![Figure 2-4 The theory generation process](image)
The iterative work involved inductive coding of the empirical material. Afterward, terms and indicators were then abstracted, with an open mind, through grouping in different categories and subcategories for building a categorical structure. These categories where conceptually refined, i.e. both ontologically and linguistically challenged, and during the process some terms and categories were rejected. The result of the inductive coding and the developed categories can be found in appendices 2-3, 5-6, 8-9 and 11-12. During the development of the theories focus has been on illustrating the end result rather than presenting each version of the emerging theories. Therefore, only one version of the theory is presented after the empirical study.

After the theories were developed, the explicit grounding was conducted. During the first step of the explicit grounding, existing theories were brought in to get new input and ideas in relation to our intermediate results. After this, the empirical grounding involved thoroughly testing and validating the empirical data; the gathered material was reviewed several times to minimise the risk for misinterpretation of the respondents’ statements. The third and last step of the explicit grounding process entailed inspecting the structure of the evolving theories, looking for any inconsistencies and incongruence.

2.2.3 Structure of appendices

The appendices are categorised after the interviews and the appendices follow the chronological order. For each interview, an interview guide, the inductive coding of the interview, and the categorical structure is presented.

2.2.4 Illustrating the theory

When working with the thesis and MGT, we found it hampering not to have any good illustration technique. Goldkuhl and Cronholm (2003) mean that as researchers within the field of information systems, we are used to work with diagrams and tools for describing, explaining, and illustrating problems that we are studying. We feel that there is a need for more developed illustration techniques, hence we have been forced to outline our own rather basic way of illustrating the results from the theory generation process.

The rectangular textbox has been used to illustrate a category and its contents (figure 2-5). The numbers in the square brackets represents the interviews that were used to develop the theory.

The curved arrow and the rhomb are used to illustrate the outcome of categories (figure 2-6).

2.2.5 Trustworthiness and scope of results

It is important to discuss whether the conclusions in the thesis offer a good level of trustworthiness and cover the phenomenon we set out to study. Furthermore, can knowledge created be transferred to other situations or contexts and pass as valid there also? Traditional terms used to provide a measure of scientific quality are validity and reliability. According to Lundahl and Skärvad (1999), being able to distinguish between facts and values is a matter of great concern for the overall credibility of any study. Although complete research objectivity in social sciences is often perceived to be impossible, the highest possible degree of objectivity should naturally be strived for and relevant assumptions and perspectives should be thoroughly accounted for (Lundahl & Skärvad, 1999).

Lundahl and Skärvad (1999) describe reliability as “the absence of random errors in measurement”. This means that there should be few coincidences present having a negative affect on the measurement. Good reliability is signified by the fact that no matter who conducts any kind of measurement, findings or answers should remain the same. This indeed shows the close relationship between reliability and objectivity, i.e. being subjective is a certain way to influence the measurement process (Lundahl & Skärvad, 1999).

In order for us to ensure the highest degree of reliability possible, we took several measures. The first was that we followed the theory generation process, as described by MGT, as closely as we possibly could. We were also cautious not to ask any confusing questions, but rather made sure that the core of the questions was well understood. The various questions asked during the interviews were formulated in such a way that they should not influence the respondent towards a specific standpoint. Finally, we have also tried
to describe every step of the theory generation process in the thesis as clearly as possible in the method chapter. Putting all these measures together, we feel that we have done what is possible to achieve a high degree of reliability.

Furthermore, validity is also necessary for creating high quality theses. Lundahl and Skärvad (1999) describe validity as the “absence of systematical errors in measurement”. We have no reason to believe that neither the internal validity (i.e. measuring what is intended to be measured) nor the external validity (i.e. the measurement corresponds to the reality) should be deficient in any way. The research focus of the thesis was decided upon in cooperation with the system developer, thus we believed the respondents to have a good understanding for the subject matter at hand and also that they have had no reason for not answering truthfully.

We chose to interview people with extensive practical and/or academic knowledge. Furthermore, we wanted to get input from both business oriented as well as technical expertise. To increase conformity of data, all respondents were given the opportunity to study and comment upon gathered data from the tape-recordings. To minimise the level of disturbance and increase respondent motivation, we chose to conduct all interviews on-site in seclusion. The respondents were always given the room to explain and tell based on personal experiences, in order to decrease our level of influence. The purpose of the study and data handling were explained, and the respondent given the opportunity to remain anonymous.

Last, but not least, it is interesting to discuss whether the conclusions of the thesis can be projected on a larger population, i.e. the generalisability of the thesis. Lundahl and Skärvad (1999) mean that generalisability is hard to distinguish and discuss in a qualitative study such as ours. A quantitative study conducted in a sound manner on the other hand, entails a great deal of inherent generalisability. Repstad (1999) discusses the possibility to generalise the result of quantitative studies and argues that it is not possible to generalise such a study in a statistical sense, instead the result can be used to create theories and to find patterns. In our case, all but one respondent came from a local IT-consultancy company, somewhat hampering the possibility to generalise results.
3 Application Integration – Generated theory

This chapter presents the developed theories based on the empirical findings. At this point, the empirical part of MGT is virtually concluded and the underlying information used can be found in appendices 2-3, 5-6, 8-9, 11-12. The illustration (figure 3-1) shows the main categories that comprise the component parts of the empirically generated theories and that we have found to have an impact on the outcome of AI projects.

Integration governance
Project- ↔ structure level [3]
System independence [3]

Interview 1
Interview 2
Interview 3
Interview 4

Project management
Time estimation [1,2]
Compromises [2,3,4]
Strong project leader [4]
Business oriented project leader [2,4]
Project leader's understanding of the test environment [2,4]

Integration contents
Data format [1]
Data semantics [2,4]
Data conversion [2,3]
Documented data specifications [1]
Terminology [2,3,4]

Structure level
Project level

Context
Power balance [2,3,4]
Participating systems [1,2,3,4]
System responsibilities [3]

Testing
Joint testing [2,4]
Customer testing proficiency [2,4]

Affects

Figure 3-1 Application Integration - Empirical findings

Five different categories evolved during the analysis. Integration governance, Context, Project management, Testing, and Integration contents. We also determined that there seems to be important to approach AI at different levels; both at a strategic level (structure) and at an implementation level (project). A more detailed discussion explaining different categories of the theory is presented below.

Integration governance

The purpose of developing an Integration governance structure is to gain a holistic view on the organisation’s computer-based integration needs, and also to prevent single projects from creating unwanted dependencies between systems. This structure should not be based on the needs of a single integration project, but the structure should rather take the whole organisation’s integration needs into consideration. As a result of this, the integration governance structure must be developed prior to the launching of any specific integration projects. This implies that the structure must be elevated from a project level to a management level. The structure should also depict both a business and a technical perspective. The business perspective is necessary due to that the integration motives always are business related, meanwhile the technical perspective concerns guidelines for how systems shall interact, both possibilities and restrictions.

Project Management

The perspective of time when working with an integration project is different from that of an isolated software system development project. The difference is due to that integration projects involve multiple participants, multiple systems, different technologies and different organisational structures i.e. they are
more complex. Furthermore the complexity also affects the overall time for a project because lead-time is increased.

Integration project is often situation based and exist in various environments which often make adaptations necessary. These prerequisites can make a situation arise where discussions are required if business contract do not exist. When entering an integration project it is therefore important to have an open mind towards comprises. However, at the same time, one must have the original integration needs in mind.

An integration project has multiple participants which increases the risk for failure, which requires a strong and experienced project leader with the ability to delegate responsibilities and tasks. Although AI involves a lot of technical aspects, it is important to have a project leader with a business perspective because the integration needs are always business based and not technical.

Testing is important for the result of the integration project, therefore it is essential for the project leader to have knowledge and understanding of the test environment, this in order to work accordingly with coordination and planning of various test activities.

Context

AI projects, like other projects, are context dependent. It is important to understand in which context the present project is situated, in order to understand the project prerequisites. Furthermore, it is important to view integration both from a business perspective and a more technical perspective because the integration needs originate from the business but the implementation is of a technical nature.

Within the business perspective it is important to appreciate the power balance between the involved parties because it will determine who will be the driving force and who will have the power of decision making. Should the need for adaptation or comprises arise, this power balance might determine who will have too adjust.

Within the technical perspective it is important to map which systems that participate in the integration and what responsibilities these systems have to each other, in order to be able to produce the most efficient technical solution. This can be achieved by using a system map to illustrate the understanding and clarification of the responsibilities systems have to each other. It can also be abstracted with several layers such as business processes, responsibilities, messaging and hardware.

Integration Contents

The complete understanding of the information being exchanged between systems and its implication in the integration context is crucial. Since different organisations use different terminology it is vital to develop a uniformed way of communicating, if an integration is to be successful. However, it is perhaps unnecessary to develop a complete standardisation of the communication, rather it is enough to standardise the communication between the interacting firms’ processes.

Data that is exchanged in an integration solution can exist in a number of different formats (numerical and alfa-numerical, domains and names). Therefore it is important that the chosen format of data is agreed upon and documented. The documentation can also make it easier for developers to detect any malfunction and at the same time it is a warrant for both parties when disagreements occur. It is also important to reach a consensus about the data semantics; what does the data in the message mean?

In addition to reaching a consensus about the data format and its semantics, the partners must also agree on how the data in the message shall be converted to the agreed format i.e. who is responsible for the conversion.

Testing

An integration solution cannot be fully tested in an isolated environment; it rather demands testing the integration between involved systems. To enhance the efficiency, joint testing should be performed by the interacting partners. This enables direct feedback from the interacting systems, meaning that lead-time will be reduced and resulting in a more effective testing. These joint testing activities should be planned initially, and if technically possible, be carried out at the same location.

In resemblance with development of traditional software (isolated software), integration projects demand active customer testing participation. However, it is often difficult to determine whether end-customer testing reaches the level of proficiency, required for the final solution to function in accordance with the initial specifications.

However, often the customer does not test the solution as thoroughly as the supplier expects. This can be a result due to three causes, the supplier has not
been successful in communicating the importance of the customers actively participation, the customer has insufficient interest in testing the solution or the customer does not think that testing is its task and responsibility.

This chapter has presented the most important empirical findings and in the next chapter the findings will be discussed and compared in relation to existing theory.
4 Application Integration – Explicit Grounding

The last step prior to presenting the conclusions of the thesis, is the explicit grounding process in MGT. As mentioned earlier, the components of this part are theoretical matching, explicit empirical validation, and evaluation of theoretical cohesion. The chapter focuses on the deductive process of matching the evolving theory in such a way that it is compared and contrasted with other existing theories. We have felt that the empirical validation has been an iterative work of controlling and testing the validity of empirical data, and thus is present already in the empirically generated theory.

Integration governance

The empirical findings point towards the importance of developing an integration governance structure is to gain a holistic view on the organisation’s computer-based integration needs, and also to prevent single projects from creating unwanted dependencies between systems. Field and Keller (1998) acknowledge that projects do not take place in isolation: they exist in an environment which gives birth to them and with which they interact for the rest of their lives. Therefore, it is important to structure the implementation of projects, both internally and externally, in order to set the direction and route for formulating strategies for computer based integration at a macro level, the responsibility of which should fall on should be the board of directors or perhaps the chief information officer (CIO) (Field & Keller, 1998). Moreover, the generated theory indicates that the integration governance structure should be developed prior to the launching of any specific integration projects. This implies that the structure must be elevated from a project level to a management level. According to Linthicum (2004), the work on the strategic level of a company’s computer based integration needs enables it to define common business process models that address the sequence, hierarchy, events, execution logic, and information movement between systems residing in multiple organisations, in the future. What Linthicum (2004) refers to as Business Process Integration-Oriented Application Integration (BPIOAI) provides a control mechanism of sorts that defines and executes the movement of information and the invocation of processes that span many systems to fulfil a unique business requirement.

Furthermore, Linthicum (2004) argues that moving into a digital economy, where business runs within and between companies and computers, integration is of little use if it is not quickly deployed, not correct in operation, and if it is not able to adjust as quickly as business needs change. In light of this, the way in which problem domains are approached, the architecture employed, and the technology leveraged has everything to do with the value of the AI strategy going forward (Linthicum, 2004). As the technology moves forward, integration control will not be exercised through information exchange, but through the modelling and execution of a business process model that binds processes and information within many systems, both intra- and/or inter-organisationally (Linthicum, 2004).

Project Management

The empirical results show that when entering integration projects it is important to have an open mind towards comprises. However, at the same time, one must have the original integration needs in mind. Coordinating organisations in attaining a goal of common interest is recognised as a necessary ingredient in an information sharing project (Azad & Wiggins, 1995; Lundin & Söderholm, 1995). Pinto and Nedovic-Budic (2002) acknowledge project implementation in multi-participant settings as a complex process involving various organisational functions, tasks, resources, motifs, interests, and goals – i.e. a continuous process of discussion and agreement on joint activities. Pinto and Onsrud (1995) argue that the success of inter-organisational integration primarily depends on the participants’ willingness to negotiate and compromise. The establishment of trust, general quality of the relationship, and commitment to sharing are other vital components (Meredith, 1995).

Engaging in a sharing arrangement demands that companies prepare to undergo modifications and adapt to the situation. Azad and Wiggins (1995) mean that the extent to which the organisational autonomy is affected determines the probability of even establishing a relationship with the purpose of information sharing. Therefore, organisations that by their very nature require a collaborative environment to implement projects are more likely to continue to engage in whatever sharing activity (Meredith, 1995).

The perspective of time when working with an integration project is different from that of an isolated software system development project, according to the empirical findings. The difference is due to the fact that integration projects involve multiple participants, multiple systems, different technologies and different organisational structures i.e. they are more complex. Furthermore the complexity also affects the overall
time for a project because lead-time is increased. Field and Keller (1998) clearly distinguish between turnkey projects where a client places and order and the contractor in due course delivers the goods – like delivering a car – and the client then turns the key and drives away, and asking a contractor to under take a more extensive project. In the latter, Field and Keller (1998) define areas where close liaison with the client is needed, such as exchanging technical information and reporting progress. While these are fairly self-evident, others are not. According to Field and Keller (1998) establishing mutual confidence and a cooperative climate is imperative amongst the involved parties, since unforeseen problems are bound to arise and each organisation will require the cooperation of the other to solve them. This is also a contributing factor to increased project lead-time when several parties must agree on changes. Furthermore, Field and Keller (1998) mean that despite the best of efforts, it is unlikely that the project will have been perfectly specified at the time of signing the contract. As the project unfolds, dialogue will be needed, not just to clarify uncertainties in the original requirements but also to cater for any kind of changes. According to Field and Keller (1998), change poses a great risk to the project and is the point where the project manager must exercise caution and possess diplomatic skills to prevent the project from being sunk in quick sands because of well-intentioned improvements.

Our findings point to the fact that since integration projects have multiple participants, the risk for failure increases, which requires a strong and experienced project leader with the abilities to delegate responsibilities and tasks. Sahlin-Andersson (2002) means that projects present somewhat of a double identity, in the sense that they associated with something planned, rational and ordered, and at the same time with flexibility, change and adventure. This double identity presents a dilemma to project managers: there must be a balance between freedom and control. According to Sahlin-Andersson (2002) and Field and Keller (1998) both aspects – controllability and unpredictability – follow from the possibility of delimiting a project. An important factor in handling complex projects, is to use an explicit work breakdown structure. This entails dividing a situation into smaller pieces, or even projects, each of which appears controllable. Sahlin-Andersson (2002) argues that by organising an operation within a complex project as a series of individual tasks of limited time spans and involving specific people with specifically allocated resources, control appears achievable.

Linthicum (2004) agrees that letting various information systems interact sounds mainly like pure technology play, the resulting information and process flow provides enterprises with a clear strategic business advantage, namely the ability to do business in real time in an event-driven atmosphere and with reduced latency: the business value of this is apparent. The need for a business perspective from the project leader, and indeed all actors involved in working with inter-organisational AI is also stressed by Linthicum (2004) as the understanding of how computer based integration can support strategic business initiatives, such as participating in electronic markets, supply chain enablement, and increase Internet visibility is the key to truly benefit from the possibilities offered by new information technology.

Field and Keller (1998) mean that an important issue for the project leader is monitoring and maintaining quality throughout the execution of the project. In AI projects, this means that the project leader must concentrate on the interfaces between the units to ensure that they work correctly together, since this is the core of AI quality. The understanding of the process of coordinating test activities and the follow up of results is a key to quickly discovering any mismatches between what different units expect from each other, and ultimately achieving a reliable and working AI solution.

Context

The developed theory shows that it is important to be aware of the context in which the present project is situated, in order to understand the project prerequisites. Linthicum (2004) agrees to this and argue that it is vital that an understanding of the enterprise and the problem domain is obtained when performing integration. The problem domain must be studied both freestanding and in the context of the enterprise.

Within the business it is important to appreciate the power balance between the involved parties since it will determine who will be the driving force and who will have the power of decision making. Should the need for adaptation or comprises arise, this power balance will determine who might have to adjust. Pinto and Nedovic-Budic (2002) present the problem of organisational and behavioural objections and argue that the very act of sharing data across organisational boundaries may fly in the face of established cultural norms and create political- and power imbalances. This is not precisely the same issue that is presented in our theory, but still, the existing theory of Pinto and Nedovic-Budic (2002) shows that power structures is
something that must be considered when inter-organisational application integration is developed.

The developed theory also shows that it is important to map which systems that participate in the integration and what responsibilities these systems have to each other. According to the theory this can be achieved by the use of a system map which can illustrate and clarify these relationships. Such a map should also be abstracted with several layers, e.g. business processes, responsibilities, messaging and hardware. Linthicum (2004) writes that it is important to map the information movement from system to system, i.e. what data element or interface the information is moving from, and where that information will ultimately move. In short, Linthicum supports idea of participating systems and its responsibilities.

Integration Contents

The developed theory shows that it is vital to develop a uniformed way of communicating if the integration is to be successful, due to that different organisations use different terminology. However, it is not necessary to develop a complete standardisation of the communication, rather it is enough to standardise the communication between the interacting processes. Goldkuhl and Röstlinger (1988) supports this theory and argue that it can be useful to develop a common terminology when performing a business analyse. Mainly to explain the meaning in the concepts that is used. However, it is not necessary to define all concepts, but rather the ones that are perceived as necessary due to the risk of misunderstandings (Goldkuhl & Röstlinger, 1988). Although that Goldkuhl and Röstlinger (1998) understanding for concepts that can be misunderstood. This is very much in line with our developed theory although that we argue that it is enough to develop a common understanding of concepts that is necessary for the integration process.

The developed theory presents the importance of agreeing upon the data format and also to document these agreements. Guptill (1994) supports this statement and identify that in information exchange, data standards must be agreed upon as soon as possible. Setting standards to facilitate sharing is considered to be the crucial factor that can reduce costs of sharing data and increase its effectiveness (Rushton & Frank, 1995). According to Morgenthal and la Forge (2001) the human resources that represent the applications exchanging data must agree on the data format before the exchange can take place. Long-term, successful data exchange applications eliminate the need for the receiving application to make assumptions about the specified data format. Morgenthal and la Forge (2001) identify that XML has become a popular format for data exchange, in contrast to comma-delimited format (figure 4-1, no. 2) because it provides even more information about the data (data semantics) and adds the dimension of structure (figure 4-1, no. 3). The importance of reaching a consensus about the data semantics is also presented in our developed theory, what does the data in the message mean? McGrath (1998) XML documents describes themselves and by that decreases the need for separate documents describing the data semantic.

![Figure 4-1. Three different ways of presenting data in a file](image)

As figure 4-1 shows, the positional address file (no. 1) does not say anything about the data itself. It is im-

<table>
<thead>
<tr>
<th>1. Positional address file:</th>
</tr>
</thead>
<tbody>
<tr>
<td>BertilJohansson19451020</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2. Comma-delimited file:</th>
</tr>
</thead>
<tbody>
<tr>
<td>FName, BName, BYear, BMonth; BDay</td>
</tr>
<tr>
<td>Bertil, Johansson; 1945; 10, 20</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3. XML file:</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;Person&gt;</td>
</tr>
<tr>
<td>&lt;FName&gt;Bertil&lt;/FName&gt;</td>
</tr>
<tr>
<td>&lt;LName&gt;Johansson&lt;/LName&gt;</td>
</tr>
<tr>
<td>&lt;BYear&gt;1945&lt;/BYear&gt;</td>
</tr>
<tr>
<td>&lt;BMonth&gt;10&lt;/BMonth&gt;</td>
</tr>
<tr>
<td>&lt;BDay&gt;20&lt;/BDay&gt;</td>
</tr>
<tr>
<td>&lt;/Person&gt;</td>
</tr>
</tbody>
</table>
Our findings describe that an integration solution can critical, or security critical application problems. A system have had one or more safety critical, business processes. Not conducting testing can, in worst case, result in that erroneous information appears within the application. Watkins (2001) agrees to that and discusses that it is also essential to document the system requirements through modelling methods and tools. Linthicum (2004) also emphasises the importance of a test plan, because of the high complexity with integration solution projects. Watkins (2001) means that the size and complexity of the testing depends on factors such as, size of the company, the geographic distribution of offices, and the balance of software developed/extended in-house, developed under contract by third party, and bought-in as commercial off-the-shelf products.

One of our findings discusses the customer’s participation in the testing of the integration solution. We found that in resemblance with traditional system development projects, integration projects also demands an active customer participation. Field and Keller (1998) want to warn participants in such a project to not be too naïve on there view toward projects, thinking that the customer specifies what is wanted and the contractor build the solution. This view will make it almost impossible for the contractor to execute the project, instead the customer should be active and provide the contractor with constructive input for the benefit of the project. Holland, Light and Gibson (1999) share similar thoughts and advice that the organisation should have a good and close relationship with vendors and consultants to easier resolve system problems.

In our study we found that the general opinion was that many end-customers do not have the proper level of testing proficiency required for the final solution to function in accordance with the initial specifications. According to Field and Keller (1998) the client will be held responsible to develop the testing and also provide details of the tests in good time for the contractor, so they can be able to in advance ensure that each deliverable will be passed. Field and Keller (1998) also emphasise that these tests should be conducted in a collaborative way, giving the developer every opportunity to anticipate problems that could arise in testing, or else the project will be delayed every time the client discovers some variance from expectations. This correspond with our findings where as testing can be more efficient when interacting partners perform a

Our evolved theory shows that in addition to reaching a consensus about the data format and its semantics, the partners must also agree on how the data that is to be exchanged shall be converted to the agreed format, i.e. who shall perform the conversion? Linthicum (2004) supports this theory and identify that it is good to get an idea about how the data moving between the systems will be transformed. Further Pinto and Nedovic-Budic (2002) writes that it is vital that individual responsibilities, including clear roles are developed and circulated as soon as possible. The structure of an inter-organisational relationship is defined by specifying roles and obligations used in the relationship. In short, the existing theories of Linthicum, and Pinto and Nedovic-Budic support our developed theory.

Testing

Testing is an expensive and time consuming endeavour (Linthicum, 2004). However, if an integration solution is not properly tested problems might occur. For example important data can be overwritten, or worse that erroneous information appears within the application to disastrous consequences. Watkins (2001) share Linthicum’s opinions and mean that the cost for not conducting testing can, in worst case, result in that the company goes out of business, particularly if the system have had one or more safety critical, business critical, or security critical application problems.

Our findings describe that an integration solution cannot be fully tested in an isolated environment; it rather demands testing the integration between involved systems. Watkins (2001) agrees to that and discusses that an integration affects departments and groups within the participating organisations and it is important for the existing staff to be able to participate in the testing process. Our developed theory also states that to be able to enhance the efficiency of testing, joint testing should be performed by the interacting partners. This enables direct feedback from the interacting systems, meaning that lead-time will be reduced and resulting in a more effective testing. The joint testing activities should be planned before project start, and if technically possible, be carried out at the same location. Wee (2000) supports our theory and find that it is important, at the beginning of the project phase, to plan the software development, testing and troubleshooting. The initial planning will avoid further reconfiguration at every stage of the implementation. Scheer and Habermann (2000) concluded this too and discusses that it is also essential to document the system requirements through modelling methods and tools. Linthicum (2004) also emphasises the importance of a test plan, because of the high complexity with integration solution projects. Watkins (2001) means that the size and complexity of the testing depends on factors such as, size of the company, the geographic distribution of offices, and the balance of software developed/extended in-house, developed under contract by third party, and bought-in as commercial off-the-shelf products.

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joint testing. This will enable direct feedback from the interacting systems, meaning that lead-time will be reduced and resulting in a more effective testing.

The last finding we found in the area of testing is that the customer often does not test the solution as thoroughly as the supplier expects. This can be a result due to three causes, the supplier has not been successful in communicating the importance of the customers actively participation, the customer has insufficient interest in testing the solution or the customer does not think that testing is its task and responsibility. We could unfortunately not find existing theory to either support or contradict the last finding of testing theory, however we argue that the theory is relevant and that it states essential facts for testing.

**Outcome of explicit grounding**

According to Goldkuhl and Cronholm (2003) the theoretical matching can work as a validation of the evolving theory. This has been the case for most of the evolving theories, existing literature has supported the issues brought up in the evolving theories. Goldkuhl and Cronholm (2003) also write that the theoretical matching can enhance an evolving theory by contributing with new insights. In one of the evolving theories this was the case, the theory about data format, documentation and data semantics where existing theory stressed that XML was a good way to mark-up the data. The customer testing proficiency theory has not been validated through existing theory since no matching theory has been found. The consequence is that that specific evolved theory cannot be validated through theory and thereby is somewhat less certain that the other theories.
5 Conclusions - Finalised Guidelines for AI

As we conclude, inter-organisational AI is clearly a complex problem but one that is in no way insurmountable. As with most complex problems, once broken down to its component parts, the solution merely becomes the aggregation of its parts. We try to provide a set of guidelines that will help solidify and alleviate decisions related to AI. There are five main areas discovered in the thesis that impact AI: integration governance, project management, context, integration content, and testing. The illustration below (figure 5-1) depicts a difference in operational and strategic level of the guidelines. Although we cannot really say which category might have the biggest impact on AI, based on the rather limited extent of our study, we present the guidelines in a chronological order, i.e. the order in which we argue that the problem areas should be addressed. However, we believe that one of the factors potentially having the greatest implications is the separation between implementing AI in projects and developing a structure describing the business’ interaction needs (Integration governance).

Context

- Power balance

Be aware of the projects power balance. The power balance between the involved partners will determine who will have the power of decision making. Should the need for adoption or compromises arise, this power balance will determine who will have to adjust.

- Participating systems & its responsibilities - system map

Map the systems that participate in the integration solution and each systems responsibilities to other systems. This holistic view can be obtained by the use of a system map which can illustrate and clarify these relationships. Such a map should also be abstracted with several layers, e.g. business processes, responsibilities, messaging and hardware. This is necessary since it is important to have an holistic view of the entire solution.

Project management

- Time estimation

Since AI is likely to involve multiple participants, systems, technologies, and organisational structures, consider how the inherent lead time impacts overall AI project completion time.

- Compromise

Integration project requires an open mind towards comprises but also attaining a goal of common interest. Prepare for a continuous process of discussion and agreement on joint activities since despite the best of efforts, it is unlikely that the project will have been perfectly specified at the time of signing the contract.

- Strong project leader

Figure 5-1 Difference in operational and strategic level of the guidelines presented in a chronological order

Integration governance

- Structure - project level

Develop a structure for the entire organisation’s computer-based integration needs, depicting a business and a technical perspective, prior to launching any specific integration projects. Basing AI-integration on the needs of a single project means running the risk of creating unwanted system interdependencies; hence the structure must be elevated from a project level to a management level (board of directors or CIO).
Employ experienced and strong project leaders for AI projects and with ability to both balance between freedom and control and to delegate responsibilities and tasks.

- **Business oriented project leader**
  
  Although AI is mainly a technical feature, never overlook the fact that the need for computer based integration always stems from the business. Thus the project manager must understand how AI can support strategic business initiatives – this is the key to truly benefiting from possibilities offered by new information technology.

- **Project leader’s understanding of test environment**
  
  The project leader must coordinate and plan joint test activities. The follow up of test results is also a key to quickly discovering any mismatches between units and achieving a reliable AI solution.

### Testing

- **Joint testing**
  
  Conduct joint testing when working with AI-solution. However, before the actual testing occurs the joint testing activities should be planned initially and, if possible, be performed at the same location.

- **Customers role**
  
  Emphasis the importance of testing and also the customer’s participation during testing for the customer. It is also essential to have an open dialogue between the interacting parties, where constructive inputs are shared for the benefit of the project.

  Have an understanding of the customer’s proficiency level for conducting a test. If the customer’s proficiency level is not satisfying this should be taken into consideration.

### Integration content

- **Terminology**
  
  Develop a common understanding for concepts used in the integration. Since all organisations use different terminology, it is important to develop a uniformed way of interpreting the concepts used in the integration. Note that it is only the concepts that affect the integration that needs to be uniformed, it is not necessary to define all concepts used by the organisations.

- **Data format, Documentation & Data semantics**
  
  Establish an agreement regarding the data format and data semantics as soon as possible after the start-up of the project. To minimise the documentation and the risk of misunderstandings, the XML-standard can with advantage be used to design the messages that is to be exchanged.

- **Data conversion**
  
  Reach a consensus regarding who of the partners participating in the information exchange, the sending or the receiving partner, that will handle the data conversion of specific messages.
6 Final Discussion

So, as the end draws near, it is of course interesting and important to reflect upon whether the purpose of the thesis really was fulfilled. The presented guidelines in the previous chapter indicate certain important aspects that one might need to consider when discussing AI-projects or AI-strategy issues. Hence, we have fulfilled the purpose of the thesis. Furthermore, one might ask how well our guidelines will work and what practical application they might have. We argue that this boils down to the environment in which the study was set and how the study, i.e. collection of empirical data was conducted.

The empirical data was collected by interviewing four respondents. Two of these respondents had a more technical background while the other two had a more organisational background. These different backgrounds have increased the trustworthiness of the thesis since we were able to interview the respondents with the best knowledge of each perspective. We also believe that we have reached a high degree of data saturation in the interviews, i.e. we were able to collect the empirical data needed to develop the theories. However, it would have been interesting to interview customers/buyers who perhaps could have contributed with yet another perspective and interesting thoughts.

To further increase the trustworthiness of the thesis and to be able to generalise the results to a more confident degree, it would have been good to interview respondents from other IT-firms. Still, we believe that our conclusions can be generalised to a certain extent due to that we have found literature that supports many of the issues discussed in the developed theories. Repstad (1999) discusses the possibility to generalise the results of qualitative studies and argues that it is not possible to generalise such a study in a statistical sense, instead the result can be used to create theories and to find patterns, which we have done in this thesis.

Our sample consisted of expertise practitioners and academics, providing the study with well founded empirical data. We strongly believe that this fact improved the applicability of its usage and the overall applicability of the results. In our opinion a necessary step to ensure that no misinterpretations of data were present, and increasing the conformity of the empirical data, was the process of respondent revision. No major correction needed to be made afterwards, indicating a high level of conformity. Finally, the choice to conduct all interviews in the respondents’ natural habitat, increased motivation to give extensive answers to our questions. It decreased any level of inherent anxiety one might feel when being faced with an interview. All in all, we believe we have worked actively trying to achieve the highest level of trustworthiness possible. It is therefore our sole perception that the results offer a high level of applicability to different practitioners as well as academic scholars who wish to continue research within the field of inter-organisational AI. We also believe that the guidelines can be of a practical use to IT-firms working with AI and that they can be used to improve their existing procedures for handling AI. We also hope that customers will find the guidelines for IT-strategy useful and that these guidelines can contribute to their existing IT-strategies. To simplify both IT- and customer firms understanding of the guidelines, we have formulated them advisory.

Method discussion

MGT has been the method used during the writing process of the thesis. It has directed the work to a large extent. If the method is suitable for the subject studied it could be very useful to strictly follow a method. At the same time, there is also the risk of limiting the research freedom and creativity. When looking back on the theory generation process, we feel that MGT was a suitable research method, it has undoubtedly helped structure the work and define various important issues to address, and hence we mean that the trustworthiness of the thesis has been improved. Further, we do not feel that MGT has restricted our freedom or creativity.

The choice of research approach, i.e. qualitative versus quantitative, has been very suitable for our purpose. A quantitative study could never have given us the same depth in the empirical observations as did the qualitative approach. We strongly believe that the notation techniques used for illustrating different categories, appendices, theories etc. are rather limited. The apparent lack of standardised or at least good examples of notation for MGT has negatively affected the transparency of our study, and probably also the reader’s ability to understand all material.

As mentioned earlier, a tape-recorder was used during the interviews, and it is our joint belief that neither data collected from individual respondents nor the quality of the thesis in general were affected negatively by the use of a tape-recorder. Furthermore, we made room for each respondent to comment on the empirical findings, should we have misinterpreted any statement.
Further research

Based on the thesis’s subject, conclusions generated, and the shortcomings of the MGT, we can identify a number of suggestions for further research. *The first* suggestion is to perform a similar study but with the purpose to test our conclusions with a quantitative approach to see whether our conclusions can be generalised statistically to a larger population. *The second* proposition is to study whether there is a relation between project outcome and the number of participants in the project. *The third* suggestion is to identify if the findings in this thesis can be transferred to the intra-organisational perspective; are all or some of the guidelines applicable there too? *The forth* proposal for further research concerns to study whether any differences exist between small and large firms regarding AI. *The fifth* suggestion concerns the research method MGT itself. We believe that developing a tool aiding in the process of documenting and illustrating the theory generation process and its results would contribute greatly to future studies conducted using MGT.
References


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Sahlin-Andersson & A. Söderholm (Eds.), *Beyond project management* (pp. 108-126). Malmö: Liber Ekonomi.


Appendix 1 – Interview guide – interview 1

Questions:

• What should be included in a specification of requirements?

• How do you work to be able to approve the demand on the data exchange?
  o Data types
  o Domains
  o Logic in data

• Is it difficult to establish the customer’s demand on an application integration solution?

• What do you think is the major problem with application integration?

• Have you experienced any flaws in your method for system development and application integration?

• Have you experienced that the customer have expressed there opinion towards your working process?

• How do you work to establish specification of requirements?

• How do you handle application integration when there are multiple parties involved? E.g. customer’s customer and supplier.

• Do you experience it difficult for a third part to leave necessary data and information for the beneficial of the whole project?

• When you create a specification of requirements, do you consider it important to also define the goals with the application integration?
Testing

- Underestimation of the time it takes to test the developed integration. This is complicated by the fact that the bug can exist on both sides of the integration.

Mutual understanding

- Documentation
  - Different parts in the project specifications for different interested parties. Documentation is important for both the customer and for PDB; is a mistake is made there exist a possibility to control who is responsible in the documentation.
  - Workshop
    - Description of data format.
    - Documenting data specification

The human factor

- The human factor is a significant cause to mistakes regarding the integration.

Work structure

- Consultants lack a structured procedure for handling integration.
- Map covering the system affected by the integration.
- The documents are not used fully throughout the organisation due to that the method is quite new.
Appendix 3 – Building categorical structures – Interview 1

Testing the integration

- Underestimation of the time it takes to test the developed integration. The solution is to not underestimate the time for testing the integration. The result is that a more stable integration can be delivered to the customer.

Mutual understanding

- Documentation
  - A specification can be difficult to read for different parties of the integration, e.g. customers can have problems with reading data specifications. The solution is to construct an abstracted specification. The result is a specification which can be understood by the different parties.
  - If a problem arise with an integration it can be hard to decide who is responsible for the problem. This can be solved by documenting specifications throughout the project. By this, the documentations can tell who is responsible for the problem.
  - If an integration is performed with several IT-suppliers intervened, there can be a problem with specifying the data format and what data that shall be sent. This can be solved by a workshop where the IT-suppliers participate with the aim of establishing a consensus regarding the data. The result is that all partners are in agreement concerning the data that is to be sent.

The human factor

- During an integration bugs can arise due to the human factor (the format of the data is wrong due to that the programmer has misread the description or entered the wrong values; phenomenon). These kinds of faults can be avoided by not underestimating the time it takes to test the integration, but instead allocate time to carefully test the integration before it is used in the business environment. The result is that a more stable integration can be delivered to the customer.

Work structure

- If integration is performed without the use of a structured procedure there is a risk that the integration won’t be as expected. This can be solved by using a structured procedure such as a method. The result is that the integration will be as expected.
- When integration is developed it can be hard to gain an understanding of the different systems that is affected by the integration (where data is collected and sent; phenomenon). This can be solved by developing a map which covers the affected systems. The result is that a good understanding of the affected systems is generated.
- If established documents are not used fully throughout the organisation there is a risk that the integration will be developed with an ad hoc attitude. This can be solved by clearly defining which documents that shall be used when performing integration. The result is an integration with a complete set of documentation.
Appendix 4 – Interview guide – interview 2

Questions

Testing:

• How do you work with testing of application integration solutions?
• Is there a test plan for application integration solutions?
• Is testing a part of the work process when working with application integration solutions?

Mutual understanding:

• Around which parts is it important with mutual understanding when working with AI?
• What is important to document when working with AI?
• How should the documentation be structured when you have several parties involved?
• How do you work to obtain a mutual understanding with each of the participants in the project?
• How is the project affected when involving multiple participants?
• Do you experience it difficult for a third party to leave necessary data and information for the beneficial of the whole project?
• How should you document specification for data?
• How far is it interesting to follow the data at the opposite party?
• What is your thought about developing a common term of definition for the participating parties?

Goals:

• Are the motives behind the integration needs discussed, i.e. what have generated the need for AI?
• Is it difficult to establish the customer’s demand on an application integration solution?
• When you create a specification of requirements, do you consider it important to also define the goals with the application integration?

Human Factor

• What is the most major influence on the result when working with an integration application project?

Work process:

• If you would suggest a work process for an application integration project, how would it look like?
• How does the working structure for AI look like?
• How do you look at responsibility question concerning AI?
Appendix 5 – Inductive coding – Interview 2

Time estimate

- Does not take calendar time into account, integration solutions takes more time to develop than traditional isolated system development.
- Multiple participants always mean more lead-time which affects the planned calendar time.
- All involved parties generally have too much to do on the side, this affects the time.
- Calendar time vs. Effective time

Relations

- Integration is about compromises between parties.
- The business contract sometimes directs how different parties have to adapt to the integration.
- Close relationship with the integration partner simplifies the integration project, because with a close relationship the parties have a clear understanding of the partner’s business activities.
- When the integration work does not come to terms it is often a question of discussion about where an adaptation should take place.
- Close relationship
- Compromises

Data contents

- The hardest part, nowadays, is still to decide about the content of the integration.
- What do we need to be able to handle an order.
- Data semantic
- Data format

Terminology

- Integration is a multi faceted term.
- Difficult to get an overview of the demands when the parties talks by each other.
- Different line of businesses has different kinds of terminology and this is important to take into consideration when working with integration.
- Definition of terms

Testing

- Testing in integration project takes more time then when working with traditional system development.
- When testing in an integration project a different approach must be made. The parties should initially discuss how time to testing should be planned together i.e. make time to test at a same time.
- A test scenario or a test protocol should be created.
- If it is technically possible the parties should be geographically situated at the same place and conduct the tests together to save time.
- The time for testing an integration project is more difficult to estimate and it is seldom a calendar time judgement.
- Customer does not take the testing phase seriously sometimes and the system deliverer sometimes presumes that the customer will conduct an testing thoroughly.
- Important that the project leader early indicate the importance of the customers roll during the testing phase in the project.
- Joint planned testing
- Customer testing responsibility
- Time underestimation for testing

Documentation

- Lack of documentation of central terms.
- Documentation on several abstraction levels
- Data contents are not specified in a homogeneous way.
- Seldom does a thoroughly documentation occur.
- Develop a system map with several layers, overview, technical and protocol over participant systems.
- A comprehensive project responsibility for standardised documentation.
- It is difficult to find a common form of documentation, since there are multiple actors involved.
- System map with layers
- Data specification

Context awareness

- Important to have a helicopter perspective when working with integration, the purpose is to have an entire overview
- Many organisations have integration strate-
gies, one internal and one external. Internally certain techniques are used while a different technique is used externally. For example integration engines. An exception is integration solutions based on web services which tend to be similar.

- It is important that the project leader has a business perspective rather than a technical perspective when working with integration. Often technicians will be connected.
- Integration project is more complex than other project, because more parties are involved, customer, customer’s customer and customer’s supplier.
- It is difficult to overview the total solution when working with a integration project.
- It is also important to follow the whole process of ”the other system”
- Integration consists of a flow that needs to be followed.
- It is difficult to use a general method for integration, however using a checklist might work as a support for the integration work.
- The planning of the work should firstly be to meet and talk “the same language”, find the goals and purpose, with all involved. Try to achieve a good level of the participants (technicians, business people, users and more)
- **Business perspective (chopper-view)**

**Other**

- Today the technical possibilities are available to work effectively with integration.
- Integration is very situation based and therefore difficult to generalise.
- It is important to understand how data is received and manipulated on “the other side” of an integration solution.
- The factors behind the customer needs are not discussed.
- It is about to come to terms with the partners on the design of the specification. Is it interesting and usable to create a common specification for every involved part?
- Critics towards workshop, it has happened that customer does not want to leave out information if there are other suppliers involved.
- The checklist should consist of: date format, numerical/alpha numerical, message sorting in XML.
Appendix 6 – Building categorical structures – Interview 2

Time estimate

- **Calendar time vs. Effective time**
  When working with integration projects, the time is often estimated in effective time, which also is usually sued when working with isolated system development. The complexity with integration projects (multiple participants) and long lead-time leads to that the estimated effective time is spread out on an unpredictable and long calendar time. The risk for misjudgement in time estimation can be lowered by taking the complexity and lead-time into consideration when planning for the project. The result will be a more accurate estimation of the time for the integration i.e. a date for finishing the project.

Relations

- **Close relationship**
  It can be difficult for the consultant to know and understand the customer’s business activities and therefore know how to accomplish the integration project as successful as possible. If the consultant have prior experience with the customer from earlier projects, the integration project can be facilitated and be more effective.

- **Compromises**
  Integration project is often situation based and exist in various environments which often make adaptations necessary. These prerequisites can make situation arise where discussions are required if business contract does not exist. An important factor for a successful integration work is a positive attitude towards compromises. This result in a project environment where participants understand that compromises are essential for the success of the project.

Data contents

- **Data semantic**
- **Data format**
  Integration project reaches over different kinds of business which have different demands on the information shared. This means that there is no general way of designing the messages, furthermore each integration solution has their unique way of message sharing. Therefore, it is important to reach a consensus about the data format and data semantic when information is exchanged.

Terminology

- **Definition of terms**
  The field of integration is imprinted with lots of terms. The term integration is often defined differently for different parties. In the area of IT numerous terms exist and within different branches different business linguistics exists. To be able to make the integration work easier, it is important to develop and document a common understanding of the terms used to minimise the risk for misunderstanding between the different parties.

Testing

- **Joint planed testing**
  An integration solution cannot be isolated tested, it require integration with participating systems. This demands a higher level of joint planed testing activities, the testing should be conducted at the same time. This result that the data transferred in a system immediately generates feedback, which makes the testing more effective. If it is technical possible to let the people responsible for each participant system to geographically be located at the same place when testing it will further enhance the communication and decrease the lead-time for testing.

- **Customer testing responsibility**
  In similarity with other system development projects, an integration project also demands an active role from the customer when testing. However, sometimes the system deliverer have to high hope on the customer’s willingness to engage in testing i.e. the customer does not test the integration solution as thoroughly as the system deliverer expected. This can be a result of three factors, the system deliverer has not succeeded to communicate the importance of an active participation from the customer, the customer does not have an interest in the testing or the customer does not find that the testing is there responsibility.

- **Time underestimation for testing**
  The time to do a test of an integration solu-
tion is often underestimated. This is because an integration solution might include multiple participants which can result in longer lead-time and that error can exist in several systems. This can be avoided by initially emphasize the importance of joint testing.

Documentation

- **System map with layers**
  To create an illustration of the integration context, a system map can be used. It is favourable if the system map can be abstracted in several layers, whereas the information need varies depending on who is reading it. Example of layers could be: business processes, area of responsibilities, message exchange and technical overview.

- **Data specification**
  The data that is exchanged in an integration solution can be of various formats (alpha numerical/numerical, domains and such) therefore it is important to document the data format which are going to be used and at the same time also work to guarantee the quality of the documents. The purpose with the documentation is to facilitate the work for system developers and also to be used as a referential library in case discussion of responsibility occurs.

Context awareness

- **Business perspective (chopper-view)**
  To be able to conduct a successful integration it is important to not just have a technical understanding of the related interacting systems. Instead one should gather a overall understanding for the business context which the integration project is in.
Appendix 7 – Interview guide
– interview 3

Questions:

Before the start of the interview, explain for the respondent that our viewpoint on AI is inter-organisational.

• Do you think that there is a difference between traditional system development (the system as an isolated being) and application integration development?

• What is the most major influence on the result when working with an integration application project?

• How important do you think it is to get an understanding about the system environment and how an AI-solution affects involved systems?

• How do you look at responsibility question concerning AI?
  o How do you define who is responsible for what?
  o How can you document the responsibility?

• If you would suggest a work process for an application integration project, how would it look like?

• How do you work to obtain a mutual understanding with each of the participants in the project?

• What is your thought about developing a common term of definition for the participating parties?

• What do you find most important, a technical- or business-oriented project leader?

• We have up to now identified ability to collaborate and a will for compromises as important factors when conducting application integration. How can you prepare involving parties for these findings?
Appendix 8 – Inductive coding – Interview 3

Preparatory work

- Integration is not a project level question, instead it is a planning level question, and it should be conducted before the actual project.
- Before we start the project, new form, new technology. Which are the integration needs? How can we handle the integration? Which rules should be applied? How should we conduct it?
- More important to find a preparatory work to the project than a part of the system development process.
- A good structure has the largest effect on a successful system integration. It is not the separated projects factual matter, it is instead a question of structure on a higher level. Whereas the strategy for integration should be planned.
- **Integration strategy**

System structure

- To make a difference between project level and structure level.
- How is the structure? Catch the structure! Describe the structure! Describe the project’s role in the structure! Describe my role in the structure! What should the project do for its environment?
- When a project is implanted it is important that if the implementation have consequences on the overall structure that this is documented and brought back to the structural level.
- The needs for integration are business related and not technical related. Therefore, it is of importance to make a difference on business- and technical aspects in an integration project.
- It is not possible to discuss integration between systems with only one system in mind. There is not ONE system’s needs that should be satisfied, it is rather that the integration needs should be realised.
- When it is time for an integration solution to be implemented, it is the project’s responsibility to make it happened.
- In a inter-organisational perspective it is important to keep system independency.

- Structure and project level
- Illustrate the structure
- Keep system independent

Technology

- It is dangerous to work with an access perspective instead of an transfer perspective when working with integration when this can lead to short-term thinking and that it could create dependencies between the systems.
- Infra-structural questions are of importance when looking into system integration, purely technical, however it is still a question on a structural level.

Responsibility

- Responsibility issues concerning integration have both a business perspective and a technical perspective.
- Each participants have to give out the information which is needed.
- It is important to standardise the integration. A standard is created for the transfer of information and who that should convert and adapt to be able to follow the standardisation. At this point, a companies dominating position can decide which part that must adapt.
- Each IS have two missions. Support the organisation and interact with other systems.
- **System responsibility**
- **Agreement of transfer, who convert and who adapt**
Appendix 9 – Building categorical structures – Interview 3

Preparatory work

- **Integration strategy**
  When working with integration it is important for the customer to have a prepared integration strategy to be able to avoid a situation where different integration solutions are used without anyone knowing how they are related. In the long run this will create a confusion of how the systems are connected and a dependency will be created between the systems.

System structure

- **Structure- and project level**
  When working with integration it is important to make a difference between project- and structure level, because without a structure level it is difficult to govern how the integration work should be conducted in an organisation. The structure level aims at creating an holistic view over all of an organisation’s integration projects. The project level only concerns the integration project.

- **Illustrate the structure**
  It is important to get a structural understanding of the system which participate in the integration and which responsibility each system has towards each other. This understanding can be obtained by describing the structure of a system and the roles each system plays.

- **Keep system independence**
  It is important to keep the system independence when working with inter-organisational integration. This can be achieved by using a transfer perspective instead of an access perspective. This will result in that the system which participate in the integration might keep there independency.

Responsibility

- **System responsibility**
  When working with integration it is important to initially create good conditions for information sharing. This can be done by make it clear that each participating system has a responsibility to leave information which the other systems need. The result will be good conditions to use the transfer perspective which furthermore can be use to create integration without dependencies.

- **Agreement of transfer, who convert and who adapt**
  It is important when working with integration project that the participating parties has come to a consensus about the design of the message. How should, for example, date be formatted? This can be achieved by agreement on the format and which party who takes responsibility to format the data to correct format. Should it be done on the sending or receiving part?
Appendix 10 – Interview guide – interview 4

Questions:

Before the start of the interview, explain for the respondent that our viewpoint on AI is inter-organisational.

- Do you think that there is a difference between traditional system development (the system as an isolated being) and application integration development?

- What is the most major influence on the result when working with an integration application project?

- Do you make a difference between technical question and business-related questions?
  - Research argues that it is important to distinguish between technical and business-related parts in an application integration project.
  - What do you find most important, a technical- or business-oriented project leader?

- If you would suggest a work process for an application integration project, how would it look like?
  - Research shows that it is important to establish a structural description of the computer-based system integration. It is not possible to discuss integration between systems with just one system’s aspects in mind. It is not just one system’s aspects that needs to be satisfied, it is the integration needs that should be realised.
  - How do you do when you enter a project? Do you discuss the integration needs on a higher level i.e. what role does the specific integration needs play in the larger perspective?

- In a inter-organisational perspective it is important to maintain system independence i.e. to have a long-term view, focused on transfer technology than access technology toward the system. How longrange does the discussion with the customer go before an application integration.

- Infrastructural questions are of importance when viewing application integration technically. However it is also a structural question. If the project involves these questions, on what level do you discuss it with the customer? Is it to solve the needs for a project, or for the whole organisation’s integration needs?

- We have up to now identified ability to collaborate and a will for compromises as important factors when conducting application integration. How can you prepare involving parties for these findings?
  - Is good customer relationship more important in an application integration project then other projects? Should more resources be placed on customer relationship in contrast to “normal” projects?

- There are probably a bigger risk to encounter problem in an application integration project in contras to a development project, is this discussed initially?
  - How do you define who is responsible for what?
  - How can you document the responsibility?

- Is the question about the customer’s responsibility to conduct a proper testing and actively participate in the testing discussed?
  - How is, generally speaking, the customer’s attitude towards testing?

- What do you think about creating a common term of definition for every involved part?
  - It is important to normative integration, you create a standard for transfer and you define who should convert and adapt to be able to follow the standard, however, is it necessary with an all embracing term of definition?
Appendix 11 – Inductive coding – Interview 4

Project leader

- It is important with a strong and experienced project leader with a good technical understanding
  - The project leader have to be clear when he delegates work within the project group
  - The consultant has to adapt to the project leader at the customer, however it can be sensitive to do it with the customer
- The project leader at the customer should be business oriented, because integration needs are business related.
- The project leader must understand the importance of the testing environment at an integration project.
- Strong project leader
- Project leader and testing environment
- Project leader – business oriented

Power balance

- The power balance in the cooperation influences the conditions for the integration project.
  - Which party actually drives the project?
- It is often the driving party that makes the other participants adapt to them.
- Power balance

Customer responsibility

- The customer’s knowledge about integration varies from project to project and this affects the consultant’s role significantly i.e. an integration project is very case depended
- The consultant does not deliberately separate the customer relation and how they work with it before an integration project in comparison with a traditional project.
  - Important with openness towards compromises, however in the same time one must have the original needs in focus.
- The customer usually accept the role as tester, however often the customer lack the proficiency to conduct the testing in a professional manner
- It is often that the participants get confused about the different terms used.
- The consultant does not have anyone that standardise the integration.

Specification

- It is important to carefully examine the specification of requirements when working with integration.
- The discussion about format, terms and content in an integration is implicitly understood, can this be a source for problem?

Structure

- When the customer have a firm understanding of what should be done, the consultant does not discuss overall questions instead they focus solely on the solution.
- Infrastructural question seldom is discussed with customer.
- A complete understanding of the information exchanged and the semantic in the information is of outmost importance.
- The overall understanding for the projects role in the company is important to be able to dimension the right solution for the integration.

Testing

- Joint testing in the implementation phase.
- To thoroughly plan and guide joint testing activities is a success factor.

Other

- There is a clear trend to establish a long term flexibility in the systems.
- Many integration projects are born from the thought that they do not want to create dependencies instead more effort and resources is place for a good integration.
- It is probably more important to understand the motives behind a integration project than a traditional isolated project.
- Technical aspects is of lesser importance
Appendix 12 – Building categorical structures – Interview 4

Project leader

- **Strong project leader**

Integration project consist of many different parts and a lot of overhead i.e. meetings, cope with different business culture, organisational structures. To decrease the risk for a failed project a strong and experience project leader with a good technical understanding is needed.

- **Project leader and testing environment**

When working with an integration project there are different demands concerning testing in contrast with traditional system development projects. The difference is multiple participants and more involving systems. To be able to conduct an effective testing it is important that the project leader have an understanding to jointly plan and direct the testing.

- **Project leader – business oriented**

When working with an integration project it is important that the business needs are focused upon so that they form the fundamental goals for the integration. To be able to extract the business needs it is of essential that the project leader has a good understanding of the business activities.

Power balance

- **Power balance**

An integration project consists of multiple parties. These parties have different level of power through there market position, there size or if they have a buyer- or seller role. This power balance has a significant influence on who will be the driving force in the integration project and also who will decide who must adapt and compromise. The project leader must have a clear understanding of how this power balance is and also understand the implication this will have on the project.