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COORDINATION STRATEGIES IN ORGANIZATIONAL DEVELOPMENT PROGRAMS

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ABSTRACT

The complexity of services and products has driven organizations to utilize programs to manage different kinds of development tasks that are far too complicated to be organized through single projects. In the multi-project organizing frame, coordination between the participating actors is one of the key factors that distinguish successful programs from unsuccessful ones. This dissertation focuses on the coordination mechanisms between interdependent project teams in programs. The research question of the thesis is what kinds of coordination strategies enable effective coordination in complex and uncertain organizational development programs. The research question is approached by identifying the repertoires of coordination mechanisms utilized in programs, and by investigating how the components of complexity and uncertainty affect the utilization of these repertoires.

This study employs the inductive multiple case study method. The empirical part of the study includes analysis of 7 organizational development programs executed in 6 large and medium-sized Finnish organizations. The empirical material consists of 64 interviews, 48 interview-related questionnaire responses, documents, and templates.

The analysis of the empirical data results in the identification of three distinct strategies; centralized strategy, balanced strategy, and subordinate strategy that describe the logic through which inter-team interaction takes place in the case programs. In the centralized strategy the inter-team interaction is primarily based on the utilization of formal and informal inter-team group meetings. The balanced strategy is based on the utilization of a network of formal and informal ties, in which group meetings are complemented with localized coordination mechanisms, such as direct contacts, electronic mail, liaison persons, plans, and schedules. In the subordinate strategy inter-team interaction is rather rare, highly formalized and primarily based on hierarchical referral through the parent organization's chain of command.

The results of the study suggest that the utilization of distinct coordination strategies is related to three dominant antecedent factors: the number of projects, interdependency and task analyzability. The results suggest that a low number of projects, high interdependency, and low task analyzability are related to the utilization of the centralized coordination strategy. A low number of projects, high interdependency, and high task analyzability are related to the utilization of the balanced coordination strategy. A high number of projects and low interdependency are related to the utilization of the subordinate coordination strategy. In addition, the study reveals that the three identified coordination strategies if fit with the dominant antecedent factors are

equally effective and provide equal potential for learning and innovations. Moreover, the results suggest that if the utilized coordination strategy fits with the dominant antecedent factors, the effectiveness of the coordination is determined by the following constraining antecedent factors: task analyzability, task novelty, geographic dispersion, and the number of participating organizations. The results show that in the case of the centralized coordination strategy, a high number of participating organizations and geographic dispersion are related to better potential for learning and innovations. In the case of the balanced coordination strategy, high task novelty and high geographic dispersion are related to a lower effectiveness of the program. Finally, in the case of the subordinate strategy, high task analyzability is related to a better the effectiveness of the program and lower potential for learning and innovations.

This dissertation offers a contribution to the literature in the area of organizational coordination. In addition, the study contributes to the understanding of complex programs and multiple contingency theory. The findings have practical implications for organizational designers and managers responsible for the planning and management of complicated organizational change and development activities.

Key words: Coordination, coordination strategy, program, project, complexity, uncertainty, performance

TIIVISTELMÄ

Palvelujen ja tuotteiden monimutkaistuminen on heijastunut organisaatioiden sisäisiin rakenteisiin. Rakenteita on muutettu monimutkaisimmiksi, jotta palvelujen ja tuotteiden tehokas kehittäminen ja tuottaminen olisi mahdollista. Tämän kehityksen myötä erilaisten organisatoristen kehitystoimenpiteiden läpivienti yksittäisten projektien avulla on muuttunut haasteellisemmaksi. Organisaatiot ovatkin alkaneet lisääntyvässä määrin johtaa monimutkaisia kehitystoimenpiteitään useasta projektista koostuvien ohjelmien avulla. Ohjelmissa eri osapuolten välinen koordinaatio on pääasiallinen menestystekijä joka erottaa onnistuneet ohjelmat epäonnistuneista. Tässä väitöskirjassa keskitytään samassa ohjelmassa toisistaan riippuvien projektitiimien välisessä vuorovaikutuksessa käytettäviin menetelmiin - koordinaatiomekanismeihin. Väitöskirjan tutkimuskysymys on: Minkälaiset koordinaatiostrategiat johtavat tehokkaaseen koordinaatioon monimutkaisissa ja epävarmoissa organisaation muutosohjelmissa? Tutkimuskysymystä lähestytään tunnistamalla erilaisia koordinaatiostrategioita, joita käytetään usean projektin muodostamissa ohjelmissa ja analysoimalla miten monimutkaisuuden ja epävarmuuden eri osatekijät vaikuttavat erilaisten koordinaatiomekanismien yhdistelmien käyttöön.

Väitöskirjassa hyödynnetään induktiivista vertailevaa tapaustutkimusmenetelmää. Tutkimuksen empiirinen osuus sisältää seitsemän organisaation kehitysohjelman analysoinnin. Tapausohjelmat on toteutettu kuudessa keskikokoisessa ja suuressa Suomalaisessa organisaatiossa. Empiirinen materiaali koostuu 64 haastattelusta, 48 haastatteluun liittyvästä kyselylomakevastauksesta, dokumentaatiosta ja ohjeistoista.

Empiirisen datan analysoinnin tuloksena tutkimuksessa tunnistetaan kolme erityyppistä koordinaatiostrategiaa; keskitetty strategia, tasapainoinen strategia, ja alisteinen strategia, jotka kuvaavat eri projektitiimien keskinäisen vuorovaikutuksen toimintalogiikkaa tapausohjelmissa. Keskitetyssä strategiassa projektitiimien vuorovaikutus perustuu pääosin muodollisten ja epämuodollisten ryhmätapaamisien käyttöön. Tasapainoinen strategia perustuu muodollisten ja epämuodollisten verkostosuhteiden hyödyntämiseen, jossa ryhmätapaamisia täydennetään suorilla projektitiimien välisillä kontakteilla, sähköpostilla, yhteyshenkilöiden käytöllä, ja suunnitelmien ja aikataulujen käytöllä. Alisteisessa strategiassa projektitiimien välinen vuorovaikutus on harvaa, hyvin muodollista ja perustuu pääosin emo-organisaation komentoketjun kautta tapahtuvaa hierarkkiseen yhteydenpitoon.

Tutkimuksen tulokset osoittavat että erityyppisten koordinaatiostrategioiden käyttöä voidaan selittää seuraavan kolmen ensisijaisen määräävän tekijän avulla: projektien lukumäärä, projektien

väliset riippuvuudet, ja tehtävän selkeys Keskitettyä koordinaatiostrategiaa käytetään tapauksissa, joissa projektien lukumäärä on pieni, projektien väliset riippuvuudet vahvat ja tehtävä epäselvä. Projektien pieni lukumäärä, vahvat projektien väliset riippuvuudet, ja selkeä käsitys tehtävästä voidaan taas liittää tasapainoisen koordinaatiostrategian käyttöön. Alisteisen koordinaatiostrategian käytölle ensisijaisina määräävinä tekijöinä ovat projektien suuri lukumäärä ja heikot projektien väliset riippuvuudet. Lisäksi tutkimuksessa osoitetaan että kaikki kolme tunnistettua koordinaatiostrategiaa (jos yhteensopivia ensisijaisten määräävien tekijöiden kanssa) ovat kaikki yhtä tehokkaista ohjelman tavoitteiden saavuttamisen näkökulmasta ja tuottavat yhtäläisen potentiaalin oppimiselle ja innovaatioille. Tutkimustulokset paljastavat myös että jos valittu koordinaatiostrategia on yhteensopiva ensisijaisten määräävien tekijöiden kanssa, koordinaation tehokkuus määräytyy seuraavien toissijaisten rajoittavien tekijöiden perusteella: tehtävän selkeys, tehtävän uutuus, ohjelmaorganisaation maantieteellinen hajaantuneisuus ja ohjelmaan osallistuvien organisaatioiden lukumäärä. Tutkimuksen tulokset osoittavat että keskitetyn strategian tapauksessa osallistuvien organisaatioiden lukumäärä ja ohjelmaorganisaation maantieteellinen hajaantuneisuus on yhteydessä parempaan oppimis- ja innovointikykyyn. Tasapainoisen strategian tapauksessa tehtävän uutuus ja ohjelmaorganisaation maantieteellinen hajaantuneisuus näyttävät alentavan ohjelman tavoitteiden saavuttamisen tehokkuutta. Lopuksi, alisteisen strategian tapauksessa tehtävän selkeys parantaa ohjelman tavoitteiden saavuttamisen tehokkuutta ja huonontaa oppimis- ja innovointikykyä.

Väitöskirja luo merkittävästi ymmärrystä ohjelmissa, projekteissa muissa tilapäisissä organisaatioissa tapahtuvasta koordinaatiosta ja vuorovaikutuksesta. Lisäksi tutkimus lisää tietoutta monimutkaisista usean projektin ohjelmakokonaisuuksista ja laajentaa empiiristä ymmärrystä usean muuttujan kontingenssiteoriasta. Tutkimuksen tuloksilla on myös merkittäviä käytännön vaikutuksia henkilöille jotka ovat vastuussa monimutkaisten muutos- ja kehitysohjelmien käynnistämisestä ja läpiviennistä.

Avainsanat: Koordinaatio, koordinaatiostrategia, ohjelma, projekti, monimutkaisuus, epävarmuus, tehokkuus

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Perttu Dietrich

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DEFINITIONS

Coordination: linking together different parts of the organization in order to accomplish a collective set of tasks (Van de Ven et al. 1976; Hage et al. 1971)

Coordination mechanism: patterns of action, formal of informal, that enhance or facilitate information exchange and increase mutual understanding between the coordinated entities

Coordination mode: a category of individual coordination mechanisms that are to some extent similar in their logic of ensuring coordinated action

Coordination strategy: a logic through which coordination is exercised, including the repertoire of coordination mechanisms and modes applied and their relative importance

Program: a temporary organization composed of several interlinked projects and set up to produce a specific outcome that may be defined at high abstraction level

Program management: the coordination and management of a group of related projects with the intent of achieving benefits that would not be realized if they were managed independently

Project: a temporary organization to undertake an assigned endeavour

Organization: a system of interrelated behaviors of people who are performing a task that has been differentiated into several distinct subsystems, each sub-system performing a portion of the task, and the efforts of each being integrated to achieve effective performance of the system (Lawrence and Lorsch, 1967b)

Uncertainty: the difference between the amount of information required to perform the task and the amount of information already possessed by the organization (Galbraith, 1973; Daft and Lengel, 1986)

Complexity: the number of interrelated elements or sub-systems within the systems and the interdependency between them (Rivkin, 2001; Williams, 1999; Waldrop, 1992; Thompson, 1967)

1 INTRODUCTION

This chapter includes a description of the motivation for the study, the objectives and research questions of the study, and the structure of the thesis.

1.1 Motivation and background for the study

A growing number of corporations in the world utilize projects as mechanisms to introduce changes and thereby to leverage their capabilities and competencies (Meredith and Mantel, 2002; Pellegrinelli, 1997; Lord, 1993; Pellegrinelli and Bowman, 1994; Turner, 1999). Projects constitute building blocks in the design and execution of the future strategies of the organization (Cleland, 1999). It has been argued that the project-based mode of operating represents a new form of organizing, especially in emerging industries with flattened organizational hierarchies and emphasis on networking (Powell, 1990). The 'projectification' of organizations has started to take place, in addition to emerging industries, also in all other types of businesses. Even entire organizations are constructed around distinct projects. Nuclear power plants, paper mills, and telecommunication networks are examples of complex deliveries that often represent the primary business of many organizations and have a tremendous impact on the welfare of many individuals. These projects integrate people with different competencies, backgrounds and experience in order to develop complex, often innovative outcomes, in the form of either products or services (Prencipe and Tell, 2001; Sydow et al., 2004). Furthermore, project-based organizations have been suggested to represent a new logic of operating in different industries (Whitley, 2006; Gann and Salter, 2000; Arenius et al., 2002). This new organizing logic emphasizes a shift from traditional stiff hierarchical organizations towards a flexible, horizontal mode of action with decreasing importance of intra- and interorganizational boundaries and separation of different competence areas. The new project-based organizing makes it possible to integrate a variety of expertise and knowledge from different organizational units and organizations to complete complex tasks.

Even if projects seem to be an increasingly important frame for organizing in different industries, several authors have argued that the existing principles of project management methodology are based on the overly mechanistic management ideology that contradicts with the requirements of innovative, complex, uncertain, and ambiguous challenges that are characteristic for organizational development and innovations (Lycett et al., 2004, Thiry, 2002; Thiry, 2004; Matta and Ashkenas, 2003; Levene and Braganza, 1996). Traditionally, project management research has focused on studying single projects (Maylor et al., 2006; Evaristo and Van Fenema, 1999; Lycett et al., 2004). However, the management of single projects does not suffice in today's organizations. In many cases

single projects are not capable to cope with the increasing complexity embedded in new products and services (Hoegl et al., 2004; Gerwin and Moffat, 1997a; Mohrman et al., 1995). In addition, the existence of multiple simultaneous projects creates a set of managerial challenges that go beyond the ones related to management of single projects.

The managerial focus in organizations has extended towards simultaneous management of a whole collection of projects as one large entity (Maylor et al., 2006; Artto and Dietrich, 2004; Pellegrinelli et al., 2007). Programs represent vehicles that are increasingly used to develop and implement strategic organizational changes, too complex or vague in their objectives to fit into the traditional project management frame (Dietrich, 2006). For example, the implementation of strategic initiatives (Pellegrinelli and Bowman, 1994), the development of organizational capabilities (Pellegrinelli, 1997; Levene and Braganza, 1996), and the implementation of complicated information systems (Ribbers and Schoo, 2002; Kraut and Streeter, 1995) are examples of organizational changes introduced by programs (Pellegrinelli et al., 2007). Programs serve as organizational structures that link individual projects to a specific organizational goal. In addition, they provide managers with a tool to capture the overall picture of the whole collection of projects and thereby increase the controllability of the entity. In addition, through coordinating individual deliveries produced by projects, organizations are able to leverage the real business benefits beyond the direct outcomes (Lycett et al., 2004; Maylor et al., 2006).

The question of how to manage programs effectively has been the focus of a four-year research project where I have been involved as a researcher and project manager. This four-year STRAP-PPO-research project has brought together, in addition to a group of enthusiastic academics, also six public and private sector organizations that have provided an opportunity to develop and reflect the ideas reported in this study[1]. Due to the evolvement of the STRAP-PPO-research project, and supported by several field interviews during the first year of the research I noticed that one of the key issues explaining the successful management of complex multi-project entities is effective coordination between different actors and activities involved. My preliminary observations in the field revealed that the capacity to share information, knowledge and understanding between the actors in a network of a multiple-project entity is directly related to the ability of that entity to be successful in meeting the goals, reacting to changes and producing new knowledge. In a similar vein, organization theorists have noticed that coordination is a critical element for organizational performance (Coase, 1937;

[1] For more about the research project see: http://pb.hut.fi/program_management.htm

Kogut and Zander, 1996; Mintzberg, 1979). For example Coase (1937) proposes that the main reason for an organization's existence is its capability to coordinate the resources more efficiently than price mechanisms in the market. According to Kogut and Zander (1996), organizations represent "social knowledge of coordination and learning". They argue that the efficiency of coordination in organizations, compared to market structures, comes from a shared identity that creates norms and practices to direct the behavior (ibid.).

Furthermore, different studies in the organizational field reveal that the coordination of interdependence between different tasks or activities often determines how effectively and efficiently the overall goals are achieved (Gittell, 2002). For example, in product development the way of how the work is broken down and coordinated has a significant impact on productivity, quality, and development time (Cohen and Regan, 1996; Allen, 1984; Clark and Fujimoto, 1991). Gittell (2002) notes that similar kinds of results have been achieved in apparel production (Albernathy et al., 1999), air travel (Gittell, 2001), and healthcare delivery (Argote, 1982). The ability to coordinate activities is especially important when the number of interdependencies between tasks increases, posing added complexity (Taxén, 2003; Malone and Crowston, 1994; Crowston, 1991). Among others, the studies of Lawrence and Lorsch (1967a,b) and Thompson (1967) show that coordination requirements in complex tasks differ from those of simple ones. In addition, it has been suggested that due to the tendency to develop more complex products and services, coordination becomes increasingly important (Hoegl et al., 2004). Complex development schemes employing hundreds of experts require division of development activities into smaller projects, as well as and coordination between the project teams, to be manageable (Wurst et al., 2001; Hoegl et al., 2004).

Within organization theory the studies of coordination largely focus on the coordination mechanisms between the different parts of "permanent organizational arrangements", more precisely coordination between formal work units or functional departments (Lawrence and Lorsch, 1967a; Hage et al., 1971; Van de Ven et al., 1976; Souder and Moenart, 1992; Griffin and Hauser, 1996; Moenart and Souder, 1996; Nihtilä, 1999). Another area of interest has been coordination in teams or groups (Gittell, 2002; Faraj and Sproull, 2000; Perlow et al., 2004; Pinto et al., 1993; Montoya-Weiss et al., 2001). In this area rather the interaction between different individuals than dependencies in workflow or dependencies between organizational units has been the focus of interest.

Even though coordination has been studied extensively within different kinds of organizations and in team and group arrangements, relatively little is known about coordination between project teams in complex multi-project entities, i.e. programs (Hoegl et al., 2004; Maylor et al., 2006; Weinkauf et al., 2004). Programs differ from "permanent" organizations through their temporally limited life, and

through their action orientation. In addition they are often far more complex than development teams and groups. Programs require the involvement of multiple individuals and the integration of knowledge from various disciplines (Blomquist and Muller, 2004), and are constantly subject to influences and development emanating from the external environment (Pellegrinelli, 2002). Consequently, programs are characterized by a substantial amount of complexity and uncertainty and thus require extensive internal coordination (Kerzner, 1998; Thiry, 2004; Packendorf, 1995).

The motivation for this study derives from the discussion above. First, the increasing interest in and the importance of the project type mode of organizing in different industries, and the emergence of more and more complex products and services justify the motivation to focus on programs. Second, the existence of the STRAP-PPO-research projects has created a practical opportunity and organizing frame to conduct a research on this particular contextual area of interest. Finally, guided by my observations in the field, and arguments from both organizational theory and state-of-the-art writings within rather practically oriented project and program management 'paradigm', I decided to focus on coordination as a phenomenon to be investigated further within the context on programs. Derived from the motivation, the objective of this thesis and the specific research questions are next elaborated further.

1.2 Objectives and research questions

The objective of this study is to explore inter-team coordination in intra-organizational development programs. More specifically, the objective of this study is first to reveal what kinds of (coordination) mechanisms are utilized to exchange information and understanding between different project teams in complex programs. Second, the study aims at categorizing the observed coordination mechanisms in order to reveal different underlying logics in how the coordination takes place in the case programs. The underlying logics through which the coordination is exercised, including the repertory of applied coordination modes and their relative importance in the coordination are in this study referred to as coordination strategies.

Moreover, the study aims at revealing how the utilization of the identified coordination strategies is related to the generally acknowledged contingency factors, complexity and uncertainty. Furthermore, the objective of this study is to unveil the relation between the utilization of the identified coordination strategies and performance of programs. In order to meet the objective of the research, the following research question is posed:

"What kinds of coordination strategies enable effective coordination in complex and uncertain organizational development programs?"

The research question can be reduced to the following detailed sub-research questions (RQ1-RQ4):

RQ1: *What kinds of coordination mechanisms can be applied in organizational development programs?*

This research question has been set up to explore what kinds of actual practices are applied, specifically in organizational development programs, to exchange information and understanding between different project teams. The overall literature review of coordination mechanisms in a wider organizational context provides guidelines that help to interpret and analyze the data from the case programs. In-depth analysis of empirical data from seven case programs is used as the source of knowledge in this explorative-oriented question.

RQ2: What kinds of coordination strategies can be identified on the basis of the use of different coordination mechanisms?

This research question provides knowledge on the repertoire of the specific coordinative actions applied in each case program. The expected answer for this research question goes beyond the exploration of individual coordination mechanisms. The aim of the question is rather to identify the logic of each repertoire of coordination mechanisms in each case, and based on this, to provide new knowledge on specific strategies to coordinate interaction between project teams in organizational development programs.

RQ3: How is the utilization of different coordination strategies related to concept complexity and uncertainty?

This research question has been placed to provide knowledge on how concept complexity and uncertainty are related to the identified coordination strategies. The question is answered through analyzing the differences and similarities among well categorized cases. Moreover, the results of the analyses are used to induce general propositions for the phenomenon. The knowledge contribution related to this research question is rather explanatory.

RQ4: What kinds of performance effects does the use of different coordination strategies have?

Based on research question RQ2, the objective of this research question is to provide knowledge on the relations between the adoption of the identified coordination strategies and the performance of the case programs. The expected knowledge contribution related to this research questions is, as in RQ3, explanatory. The question is answered through careful comparison of the utilization of different coordination strategies in the seven case programs and the evaluated performance of these case programs.

1.3 Structure of the thesis

The study contains six sections. Chapter 1 presents the background and motivation for studying coordination in the organizational development program context, introduces the research objectives and the related research questions, and describes the research context – organizational development programs – in the light of current literature.

Chapter 2 introduces and discusses the key concepts the study builds on: coordination, complexity, uncertainty, and performance. The exploration of extant literature on coordination includes the examination of barriers for coordinated work, mechanisms that enable coordination and definition of and introduction to contingency theory. In addition, the concepts coordination mode and coordination strategy are introduced. The chapter also includes a discussion on the concept of performance and clarifies its relation to coordination. The concept of complexity is analyzed from the general organizational theory perspective as well as from that of the project paradigm. In a similar vein, the theoretical basis for the concept uncertainty is presented through reviewing the organizational literature and existing studies on projects and multi-project entities. Finally, the content of the chapter is summarized through a model that integrates the introduced concepts and serves a guideline for the empirical research.

Chapter 3 presents the research methods employed in the empirical part of the study. The chapter starts with a description of the researcher's methodological positioning in the academic field in this study. Next, the research approach and research design for carrying out the study are presented. Moreover, the procedures of data collection and analysis are explained.

Chapter 4 introduces the seven case studies, following the central concepts elaborated on in chapter 3. In each case study, the background, including the objectives of the program and the organizational context of the case are presented. In addition, characteristics of structural complexity and uncertainty are described in each case program. Moreover, the case studies include a description of the identified coordination mechanisms.

Chapter 5 contains the cross-case analysis. The chapter presents the logic and process of the formation of coordination strategy clusters based on the empirical data. Moreover, the content of the three identified coordination strategies are elaborated. Furthermore, the identified three distinct coordination strategies are compared to each other from complexity, uncertainty, and program performance perspectives.

Chapter 6 concludes the findings of the study and discusses their relevance from the theoretical and practical points of view. In addition, the validity of the research is discussed. The chapter also

includes discussion on the managerial implications of the study and suggestions for future research based on the findings of this study.

1.4 Description of the research context

Multiple project programs constitute a contextual environment of this study. Programs are used by a growing number of world corporations, and their management is seen as a core competency (Meredith and Mantel, 2002). They are utilized for instance to implement or support the realization of corporate strategy by coalescing organizational intentions and translating them into concrete objectives for individual projects (Pellegrinelli, 2002). Programs serve as vehicles for organization to introduce large scale changes, such as changes in organizational structure, development of new businesses or enterprise resource planning implementation, and thus are strategically important mechanisms for organizations (Pellegrinelli et al., 2007; Pellegrinelli and Bowman, 1994; Lord, 1993; McElroy, 1996). Some of the most typical situations in which programs are used in organizations to introduce business changes include: changes in the service delivery approach, major initiatives for producing and implementing facilities, services or property, adoption of new policies, development of new organizational forms through mergers or acquisitions, changes in supply chain structure, and organizational responses to emerging opportunities and challenges (OGC, 2003).

1.4.1 Definition of a program

Several definitions of program and program management exist in the literature. It has been argued that there is a clear disagreement among academics and practitioners about the concepts of program and program management, and there is lack of consensus and anything that could be called a body of knowledge (Vereecke et al., 2003). The existing confusion and lack of commonly accepted definitions has led researchers and practitioners to use the terms program, multi-project, meta-project, super project, and portfolio in different and similar meanings (Gray, 1997; Vereecke et al. 2003; Pellegrinelli, 1997; Elonen and Artto, 2003 ; Blomquist and Muller, 2004; OGC, 2003; Turner 1999). An in-depth definition and analysis of the differences between these concepts is out of the scope of this study. Instead, the concept of program is considered more thoroughly.

A program is generally conceived as a group (Turner and Speiser, 1992; Gray, 1997), a framework (Ferns, 1991; Pellegrinelli, 1997), or a collection (Murray-Webster and Thiry, 2000) of either projects or change activities that are often temporal and goal-oriented. Turner (1999) and Pellegrinelli (1997) emphasize that the projects in a program are a coherent group that is managed in a coordinated way for the added benefit. Programs usually represent entities that have a determined purpose, predefined expectations related to the benefit scheme, and an organization, or at least a plan for organizing the

effort. A program is set up to produce a specific outcome that may be defined as a high abstraction level of a 'vision'. Ferns (1991) defines program as a group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually.

In some occasions, project management and program management are treated as synonyms. In others, project management is seen as a subset of program management and occasionally even vice versa (Turner, 1999). Even if the program concept is somewhat similar to projects concept some significant differences between them exist. While a project is often conceptualized as a process for delivering a specific outcome within specified time limit, a program is rather seen as an organizing framework in which the time horizon may be ambiguous and the objectives may evolve gradually in line with business needs (Pellegrinelli, 1997). In addition, rather than focusing on the management of single delivery like in projects, a program may involve the management of multiple related deliveries. Furthermore, programs are often focused on meeting strategic or "extra-project" objectives making programs more strategically oriented schemes than that of a single project (Pellegrinelli, 1997).

Programs are in some industry contexts used as semi-permanent organizing frames for the management of the continuous flow of development projects and activities. Aerospace industry and pharmaceutical industry represent traditional application areas in which programs are used to organize development related to the specific product or technology. These types of development programs resemble rather permanent parts of the organizations with relatively well-established role in the organizational hierarchy. In addition, they may be directly funded by the organization head and even represent the principal way of organizing tasks, and allocating resources. Even though programs may include characteristics from both projects and permanent organizations, it can be distinguished as a special case of a temporary organization with often different goal structure, time dimension, boundaries, actors and control mechanisms. The key differences between project, program, and "ordinary" organization are summarized in Table 1.

While the essence of projects is on delivering required and well defined outcomes as efficiently as possible, the essence of programs is on organizing and management of possibly unclear and abstract visions that are subject to internal and external environmental changes. The focus from a program manager's perspective is on coordination of numerous deliveries and interaction between various managers.

Table 1 Differences between project, program and ordinary organization[2]

	Project	**Program**	**"Ordinary" organization**
Goal structure	Only one main task	May have multiple goals consisting of several tasks	A broad set of goals
Time dimension	Delimited time	Finite or infinite	Unlimited, eternal
Boundaries	Given by the task, defined in distinct project plans	Defined by the need of parent organization(s) (e.g. strategic organization's structure renewal program) or/and legal agreements (e.g. delivery of new power implant)	Legal boundaries
Actors	Team members chosen	Team members and members with the permanent organization(s)	Members with different but permanent functions
Control	Especially for task by the way of a plan and subsequent revisions	Control defined by the way of a plan and subsequent revisions and by requirements emanating from the "ordinary" organization	By annual statements and/or evaluation

The objectives of project teams under the same program are often interdependent (Platje et al. 1994). The interdependencies between the project teams might result from the architecture of the product that makes the workflows of different teams independent (Gerwin and Moffat, 1997a,b). In addition, the projects within the same program may be dependent on each other through a common attribute, such as client, customer, provider, technology, or resource. The interdependencies between the projects may result in conflicts due to divergent perceptions of the same situation, goal incongruency, or asymmetry of information, leading to rework and emergence of crisis (Loch and Terwiesch, 1998; Kazanjian et al., 2000) and additional development costs due to delays (Dutoit and Bruegge, 1998). In addition, strong emerging disharmony between different actors is found to correlate positively with project failures (Souder, 1981). Therefore, coordination between the project teams represents one of the key issues in successful management of programs.

1.4.2 Description of a program organization

Programs are often seen as hierarchical entities or structures above projects, which integrate organizational intentions defined at top management level, and operational level activities realized in projects (Gray, 1997; Turner, 1999). The key actors that constitute the program organization are: a program director, who is the owner of the program and has overall responsibility for the program, a

[2] Modified from Lundin and Steinthorsson (2003)

program manager, the person who runs the program, and a business change manager, who is responsible for benefits realization (Lycett et al., 2004). In addition, literature reconizes other roles or actors in program organizations, such as program or project office (Dai and Wells, 2004), management boards for the program and projects (Artto and Dietrich, 2004), and customers of the program (Pellegrinelli, 1997). Furthertmore, programs often have linkages to permanent organizations through their goals and resources (El-Najdawi and Liberatore, 1997). Therefore, representatives from the functions or business, representing the client of the progam or the owners of the resources are often part of the program organization (Pellegrinelli, 1997; Lycett et al., 2004). The general characteristic of the program structure is that the program manager sits at the level above the projects, implying a direct reporting relationship (Lycett et al., 2004). In addition, the literature reports on a sponsoring group or management board above the program manager, including a director for the program and senior business managers who often have the overall responsibility and accountability for the program (PMI, 2006; Lycett et al., 2004; OGC, 2003). The sketch of a program organization with program steering group, project director, program manager, project steering groups, project managers (PM's), and project teams is depicted in Figure 1.

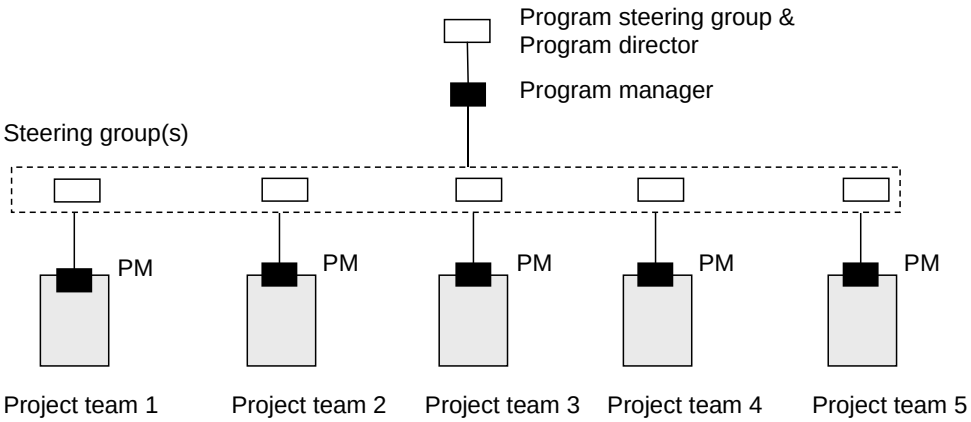


Figure 1 Program organization

In product development programs the project team structure of the program reflects the architecture of the new product (von Hippel, 1990; Henderson and Clark, 1990). Product architecture refers to the hierarchical configuration of the subsystems within the product. Respectively, in concurrent engineering, a separable project team is often allocated to the development of each of these subsystems (Gerwin and Moffat, 1997b). In some cases the project team structure of the program may reflect the product architecture. This is not, however, the only way to organize the development work. In some cases the project team structure in the program may also reflect different stages in the development process or functional areas of the parent organization. In any kind of hierarchy of

collaborating project teams, however, the interdependencies between tasks of different project teams is the issue that makes the program organization challenging to be managed.

1.4.3 Characteristics of programs

Programs represent a special form of a temporary organization. Goodman and Goodman (1976) have defined a temporary system or temporary organization as "a set of diversely skilled people working together on a complex task over a limited time". A temporary organization represents an organized (collective) course of action aimed at evoking a non-routine process and/or completing a non-routine product (Packendorf, 1995). In addition, temporary organizations have a predetermined points-in-time or time-related conditional state when the organization and /or its mission is collectively expected to cease to exist. Usually, specific criteria are established to evaluate the performance of these kinds of organization (ibid.). Ernst (2002) has reviewed several success measures that have been used to evaluate the performance of programs and individual projects within the new product development literature. Overall sales impact, the profitability of the program (Cooper and Kleinschmidt, 1996), market performance, project performance (Atuahene-Gima, 1995), product quality, and process quality are examples of the performance criteria used in programs and projects (Ernst, 2002). Even though the criteria for performance evaluation may be explicit and clear, the goals are often ambiguous and uncertain due to organizational and technological complexity and the unique nature of the task. Therefore the evaluation of performance is not simple and is subject to interpretational differences and controversies, depending on the perspective and point of reference taken. In addition to specific performance criteria, temporary organizations are distinguished from spontaneous self-organizing groups by the complexity in terms of roles and the number of participants, which requires conscious organizing efforts (Packendorf, 1995).

There are four specific reasons why temporary organizations are used. First, the tasks to be accomplished may be extremely complex, and there is no way to perform them autonomously without concurrent interrelation of the members. Second, the tasks may be unique and because of that there are no ready-to-use procedures to accomplish them in the organization. Third, the task is often critical to the permanent organization and that is why it is often isolated from other activities. Fourth, specific goals determine the task itself and the time limit for it, so that it is possible to say when the temporary organization ceases to exist. (Goodman and Goodman, 1976)

The characteristics of temporary organizations are often examined through the current knowledge on permanent organizations. Packendorf (1995), for example, has proposed that, compared to permanent organizations, in a temporary organization the goals are usually more specific, the personnel often

possesses task-specific competencies, and are that way more likely to be recruited, and the group is often more isolated from the environment. Generally, temporary organizations such as programs, projects, and more informal action groups have four distinct characteristics through which they differ from their permanent counterparts: time-related conditional states, task and action orientation, team structure, and change orientation (Lundin and Söderholm, 1995).

Time-related conditional states

First, temporary organizations have a predetermined point in time or time-related conditional state when the organization and/or its mission is collectively expected to cease to exist. This time-related existence partly differentiates temporary organizations from permanent ones because the time horizon for permanent organizations is often eternal and survival, rather than time, is a central concept. The difference in the conception of time between temporal and permanent organizations is well described as follows:

" For firms whose future is perceived as eternal, the future will naturally continue to be seen as eternity: the result of subtracting any finite number from infinity always leaves infinity. For the temporary organizations, on the other hand, time is always running out since it is finite from the start…"(Lundin and Söderholm, 1995)

In addition, the life of the temporal organization can often be sequenced into distinct phases that indicate what actions are important in each specific moment of time. Some authors argue that programs can be described through distinct phases or sequences with decision points after each sequence or step (see e.g. PMI 2006; Lycett et al. 2004; Thiry 2004; Thiry, 2002). According to Pellegrinelli (1997), the temporal advancement of a program can be described through five relatively discrete phases: initiation, definition and planning, project delivery, renewal, and dissolution. Lycett et al. (2004) argue that the generic phasis in the lifecycle of a program are identification, definition, execution, and closure. Thiry (2004), instead, desribes the program lifecycle through phases of formulation, organization, deployment, appraisal and dissolution. The models presented by various authors differ in the number of phases and their characteritics. However, all the models include the idea that the program organization evolves as a function of time. The current activities and organizational form reflect the evolutionary phase of the organization. Some authors have also recognized that in practice different phases may occur in parallel, and the program process (order of phases) is actually iterative and cyclical (Pellegrinelli, 1997; Thiry, 2004).

Task and action orientation

Second, temporary organizations are dependent on a very limited number of tasks that provide a reason of existence for the temporary organization. Thus, as permanent organizations are often defined through their goals, temporary organizations are defined through the tasks and related action (Lundin and Söderholm, 1995). The emphasis on tasks and action represents an alternative interpretation of organization to the traditional decision-making perspective. Tasks are not seen as instrumental consequences of decisions, but rather as a separate concept from decisions (ibid.). This view emphasises that action may occur also before decisions, and no logical connection between decision and action can be shown (Thompson, 1967; Lundin and Söderholm, 1995). According to Lundin and Söderholm (1995), tasks can be divided to unique and repetitive ones. If the tasks are rather unique and novel, nobody has immediate knowledge on how to act. These kinds of situations call for visionary, flexible, and creative actions instead of mechanistic and normative work routines (Lundin and Söderholm, 1995). These flexible and creative actions that purely rely on mutual adjustments between the team members are often referred to as an organic perspective on management (Burns and Stalker, 1961). The organic perspective relies on lateral, team-based organizational design with an incomplete and overlapping definition of roles (Van Fenema, 2002). In addition, as a consequence of the unfamiliar and unique tasks, there is often need for periods of intensified effort which alternate with periods of unproductive waiting time (Goodman and Goodman, 1976; Thiry, 2002). The formulation of tasks and their development is a social process that is constructed by the participants (Lundin and Söderholm, 1995).

The contrasting view to the organic perspective is a mechanistic orientation. The mechanistic perspective is grounded for detailed planning executed in the apex or the organization (Burns and Stalker, 1961). A work-breakdown structure, through which individual work packages are assigned to the actors (Globerson, 1994), and the critical path method that through scheduling and analysis of interdependencies optimizes the order to execution and potential bottle necks, represent examples of mechanistic planning techniques. According to the mechanistic perspective, the resulting plans are communicated through the hierarchical route to individual actors to be executed (Van Fenema, 2002). This mechanistic perspective, unlike the organic perspective advocates consistency between the actors and therefore increases the controllability of the organization.

Some authors have questioned the existence of a polar distinction between the mechanistic and organic perspectives on temporary organizations. For example, Eisenhardt and Tabrizi (1995), and Brown and Eisenhardt (1997) report on forms of organizing that integrate both structural elements and fluid interaction between individuals, referred to as semi-structures. Eisenhardt and Tabrizi

(1995) argue that organizing in highly uncertain situations might not be based on organic processes, but merely calls for improvisational processes combining learning via design iterations, and testing the ideas with the help of milestones and powerful leaders.

Team structure

While permanent organizations are often described through their working organization, temporal organizations are explained through the team concept (Lundin and Söderholm, 1995). A team refers to a social system including at least three people, a system which is embedded in an organization, whose members perceive themselves as such, and are perceived as members by others, and who collaborate on a common task (Wurst et al., 2001). The concept of team relates individual actors to a collective task though commitment building. In addition, the team concept represents a structure that legitimises the actions of the team in the surrounding environment. Accordingly a team in a temporary organization is established to complete some specific task or some part of it (Lundin and Söderholm, 1995).

Prior research on hierarchical team structures has acknowledged the autonomy of the team as an important determinant of team performance (Hoegl and Parboteeach, 2006b; Gerwin and Moffat, 1997a, 1997b). For example, Hoegl and Parboteeach (2006b) found that in innovative projects, the external influence of the project team on project decisions has a negative affect on the quality of the teamwork. In addition, their results reveal that in innovative projects the team members shared joint decision-making is positively related to teamwork quality. Gerwin and Moffat (1997b) examined cross-functional product development teams and found that withdrawing the teams' autonomy is negatively correlated with its performance.

In the case of complex programs, a single project team is seldom autonomous from the other teams within the program organization. This is due to the fact that the activities of the complex product or service can not often be differentiated into truly independent parts (Levitt et al., 1999). This inherent interdependency between the activities increases the required coordination. Activities allocated to distinct project teams to be performed create a need to exchange information and knowledge between the responsible actors and project teams to proceed in the development, assess changes and resolve emerging conflicts (Galbraith, 1973).

In addition to the interdependency of the tasks, the team structure of programs is often characterized by a goal incongruency of the actors (Levitt et al., 1999). The goals of individual actors may differ within the project teams and also between teams. The existence of incongruent goals may lead to the adoption of divergent incoherent patterns of behaviour and sub-optimization, which will decrease the

effectiveness of the multi-project entity and may even jeopardize the achievement of the overall goal of the program. Goal incongruency thus increases a need for coordination between the project teams, and unlike in vertical information sharing, typical for functional organizations, extensive amount of horizontal information exchange is required between the operating project teams. Horizontal information exchange becomes essentially relevant in cases where the tasks of individual project teams are highly interdependent on each other and when the information exchange between the teams is frequent and not possible through vertical channels. This may be the case for example in new product development where the manager of the team does not possess sufficient expertise to deliver the necessary information and understanding between the teams.

Change orientation

Fourth, temporary organizations aim at producing transition or change in their institutional environment, for instance a permanent organization. Permanent organizations, instead, often aim at surviving in the competitive environment (Lundin and Söderholm, 1995). These goals are distinct and also interdependent. To be able to survive, permanent organizations need to fight against inertial forces by introducing changes through temporary organizations. Again this need to introduce changes serves as the reason for existence for temporal organizations. This kind of dependence in which one organization's output serves as the input for another is also called symbiotic interdependence (Pfeffer and Salancik, 1978). The concept of transition refers to actual change between "before" and "after" produced by the temporal organization. The changes produced to the permanent organizations can be categorized into different classes according to the amount of change produced. For example, existing literature distinguishes between incremental changes and radical ones (see e.g. Dunphy and Stace, 1988; Shenhar et al., 2001; Wheelwright and Clark, 1992b).

Even though the existence of a temporary organization is justified by the transition, the measurement of success in achieving the desired transition or in managing the temporal organization itself is relatively complicated (Goodman and Goodman, 1976). This is because the success depends on the reaction of the environment. In addition, the goals often emerge when the task is performed. Furthermore, there is often complex interdependence between task accomplishments. Changes in one part or variable in a system lead to adjustments in many other variables. The complexity in these temporary task situations is often beyond the limited analysis capabilities and data processing capabilities of the management. In a temporary organization, because of extensive amount of dependencies and complexity, not speciality or viewpoint is optimised. Rather, the management is forced to keep the system alive by resisting different interests and pressures emanating from both inside the team and from the environment (Goodman and Goodman, 1976).

1.4.4 The context of organizational development

Projects and programs are always initiated to create some kind of change, whether the objective of the project or program is to develop a new product, establish a new production process, or create a new organizational structure (Shenhar et al., 2001). Depending on the type of the change, different perspectives are proposed in the literature (By, 2005). Generally, product development and innovation management have been the focus of researchers in the project paradigm (e.g. Griffin, 1997a; Griffin and Page, 1996; Cooper and Kleinschmidt, 1996; Dougherty, 1992; Wheelwright and Clark, 1992; Tatikonda, 1999), whereas organizational development is traditionally examined from the change management perspective.

Organizational change management literature has proposed several different types change strategies or frameworks through which the organizational change can be accomplished. Kanter et al.'s (1992) Ten Commandments for executing change, Kotter's (1996) Eight-stage process for successful organizational transformation, and Luecke's (2003) Seven steps, are examples of managerial frameworks that provide step-by-step descriptions of how the change should take place in organizations.

The weakness of these otherwise practical and well-describes strategies is that they represent universal solution to the problem of how to introduce organizational changes, and do not consider enough the situational factors, which depending on the situation set different requirements for the model and related change activities (Dunphy and Stace, 1993). Another weakness of the change models proposed in the literature is the lack of solid empirical research that would relate the models with the concept of success (By, 2005). In addition, it is argued that most of the existing change management studies provide too abstract perspective on change activities. Even if it is argued that organizational change management literature generally focuses on large scale organization level changes and takes the macro-level approach (King and Anderson, 2002), some studies have, however, approached organizational development and change from more micro-level, project perspective.

For example, Linde and Linderoth (2000) and McElroy (1996) argue that it is characteristic for project type work which aims at producing intra-organizational development that the results are often intangible. The objectives and scope may not be precisely known at the outset and the costs might be difficult to estimate (Linde and Linderoth, 2000). It has also been claimed that the exact criteria for evaluating the output of organizational development programs and projects are hard to define and measure because of their abstract nature (McElroy, 1996).

Adler and Shenhar (1990) emphasize that every organizational change effort requires adaptation in the organizational structure, strategy, culture, processes and human skills. Therefore, organizational development is rarely isolated from its environment, but rather continuously interacts with its context (Linde and Linderoth, 2000; McElroy, 1996). So, not only is the goal of organizational development work intangible by nature, it is also a moving target, which makes the evaluation of development through projects challenging. These issues increase the uncertainty of internal development programs drastically. Such uncertainty is probably one fundamental reason for resistance to change, which is one of the central issues in the literature which discusses internal development efforts through projects (Salminen et al., 2000). Thus, it can be said that the attitudes, motivation and behavior of all the people involved are critical to success in intra-organizational development (McElroy, 1996).

Fuzziness is a normal state in the project process for business-focused organizational development projects (Verwey and Comninos, 2002). Organizational and technological complexity and continuous shifting of the objectives typical for intra-organizational development (Linde and Linderoth 2000) call for flexible management processes (Crawford et al. 2003). For example Kaufmann (1992) reports findings of case studies on process improvement, where he found that important factors determining success in managing operational improvement programs include a non-authoritarian management style with participative management efforts, and aligning individuals' incentives with the program's goals. The findings by Dietrich et al. (2004) also support this argument. They compared the managerial practices related to product development and intra-organizational development projects in 288 public and private sector organizations. The results revealed that the decision-making processes were more formal with product development than with intra-organizational development projects.

The specific characteristics of organizational development, complemented with the distinguished traits of multiple-project programs as temporal organizations, make the selected research context demanding and interesting to study. The above mentioned characteristics, such as time-related states, action orientation, team structure, and change orientation make the behavior of the actors unstable, and related management complex and demanding. Respectively, the existing theories on permanent organizations or groups may not directly apply in these complex multi-project settings. The models and frameworks suggested in the change management literature, again, are overly abstract, fail to take situational qualities into account, and do not provide adequate explanation between the suggested frameworks and success of the change programs. Success considerations should, however, been one of the major concerns in organizational change and development. For example, the study of Balogun and Hailey (2004) reveals that 70 percent of the initiated change programs fail.

In this study I have decided to approach the management of programs from the coordination perspective. Respectively, the existing state-of-the-art in coordination is reviewed in the next chapter as the starting point for the empirical examination of the phenomenon.

2 LITERATURE REVIEW

This chapter introduces the theoretical basis for the four key research concepts of this study: coordination, complexity, uncertainty, and performance. The research concepts provide a guiding frame that helps in analyzing the empirical data.

2.1 Theoretical basis for the concept of coordination

2.1.1 Definition and characteristics of coordination

It has been argued that all activities that involve more than one actor require the activities to be divided between different actors, and the management of interdependence between the activities (March and Simon, 1958; Lawrence and Lorsch, 1967b). These two issues, division of task and management of interdependencies, constitute the two key functions of organizational design (Lawrence and Lorsch, 1967b). The division task includes the consideration of how to organize each sub-task in a way that enables effective performance of that sub-task. Successful completion of the overall task also requires management of the interfaces between the subtasks. This managerial challenge includes the consideration of what kinds of mechanisms are appropriate to achieve enough collaboration between the subtasks (Galbraith, 1973). Of these two functions of organizational design, division and management of interdependencies, this thesis focuses on the latter, which is often also called coordination.

The term coordination has various meanings in different contexts, e.g. in economics, operations research, organization theory and biology. Accordingly, different definitions are given according to the purpose of application area. Malone and Crowston (1994) provide an extensive list of different definitions of coordination, including the following:

- The operation of complex systems made up of components
- The emergent behavior of collections of individuals whose actions are based on complex decision processes
- Information processing within a system of communicating entities with distinct information states
- The joint efforts of independent communicating actors towards mutually defined goals
- Composing purposeful actions into larger purposeful wholes
- The integration and harmonious adjustment of individual work efforts towards the accomplishment of a larger goal
- The additional information processing performed when multiple, connected actors pursue goals that a single actor pursuing the same goals would not perform

- The act of working together

In addition, coordination has been defined as: "individuals' efforts toward achieving common and explicitly recognized goals" (Blau and Scott, 1962), and "the integration or linking together different parts of the organization to accomplish a collective set of tasks" (Van de Ven et al., 1976; Hage et al., 1971). In organization theory, the term coordination is also paralleled with collaboration (Trist, 1977), cooperation (Pinto et al., 1993; Griffin and Hauser, 1996) and integration (Ettlie, 1995; Gupta et al., 1986; Lawrence and Lorsch, 1967a). Each of these terms, even if labeled differently, share a common idea of joint behavior toward some goal of common interest (Pinto et al., 1993). For the purposes of this study, I have adopted the commonly accepted definition by Van de Ven et al. (1976) and define coordination as: "*linking together different parts of the organization to accomplish a collective set of tasks".*

Coordination is an information processing activity and closely related to communication and shared meaning. For example, Goldkuhl and Röstlinger (1998) point out that: "*A practice is coordinated through communication. Different linguistic actions are necessary in order to coordinate actions so that the intended results can be produced. This is necessary in practice in which several producers cooperate*" (In: Taxen 2003). Also Melin (2002) emphasizes the importance of communication as a source of establishing common understanding in coordination situations. Moreover, March and Simon argue that: "*The capacity of an organization to maintain complex, highly interdependent pattern of activity is limited in parts by its capacity to handle the communication required for coordination*" (March and Simon, 1958). Furthermore, several researchers have explained coordination requirements and the use of different coordination mechanisms through the concept information (Tushman and Nadler, 1978; Galbraith, 1973; Daft and Macintosh, 1981; Daft and Lengel, 1986; Keller, 1994). Within this study I have adopted the view that coordination is primarily an activity that includes an exchange and sharing of both information and knowledge. In addition, coordinating actions are in this study closely related to communication. Moreover, it is assumed that coordination may be either formal and generally acknowledged as well as based on informal ad-hoc patterns of behavior that enable information processing among different parts of the organization. For example, Larsson (1990) argues that the general emphasis on formal coordination mechanisms complemented with the disconnection to its social aspects have led to a lack of examining the informal coordination emerging from the repetitive interaction between the members. Aligned with this view, this study focuses on actual patterns of coordination reported by the informants, distinct from the generally acknowledged formally recognized coordination mechanisms.

Crowston (1991) proposes that "coordination problems" are caused by various elements of a situation which constrain how particular tasks are performed. In order to model the dynamics of coordination problems he identifies two principal elements: object and task. Objects represent everything that is affected by actions. Actors doing the action represent the object as well as the result of the action itself. Task, instead, refers to both achieving goals and performing actions. Crowston (1991) justifies this by the notion that both goals and actions are descriptions of the task to be undertaken. Using this categorization Crowston (1991) proposes that interdependencies between pairs of items can be divided into dependencies between a task and subtasks, between different tasks, between tasks and objects, and finally between different objects. The dependencies in the three first mentioned groups may be easily understood e.g. by considering tasks as projects in a program, subtasks as subprojects, and objects as resources utilized in the projects. Then the dependency between the tasks represents interdependency between different projects in a program (e.g. through their goals), the dependency between a task and a subtask respectively refers to hierarchical dependency between a project and a subproject, and dependency between the task and the object refers to the dependency of the project on some resource. The fourth dependence between different objects is more demanding. Crowston (1991) explains that if two tasks use objects that are dependent, then the tasks can be regarded as dependent as well. Regarding the level of decomposition of an object, it can be considered to consist of two or more interdependent parts. Then, if different tasks use different parts of the object, the use of the object is restricted by the interdependence between the parts.

Zlotkin (1995) proposes that there are three basic kinds of dependencies between activities arising from resources related to those activities: flow, sharing, and fit. These dependencies are presented in Figure 2. First, flow type dependencies between activities exist when the resource is created by one activity and used later by another one. This kind of dependence between activities can also be seen as a temporal interdependence and at the organization's unit level corresponds to sequential interdependence in Thompson's (1967) categorization. In many cases the produced resource that is to be used by another activity is information.

Malone and Crowston (1994) have proposed that in the case of flow-type dependence between activities, different kinds of additional requirements may occur. First, it is common that the activity that produces the resource that is to be used by a second activity, must be completed before the second activity can start. Second, there might be a need to transfer the resource produced by the first activity to the second activity before the second activity can happen. For example, if the resource is information, the transfer refers to communication. Third, the resource produced by the first activity must often be usable by the activity that receives it. If we again take information as an example of a

resource produced by the first activity, it must be understandable and accurate enough to be usable by the second activity.

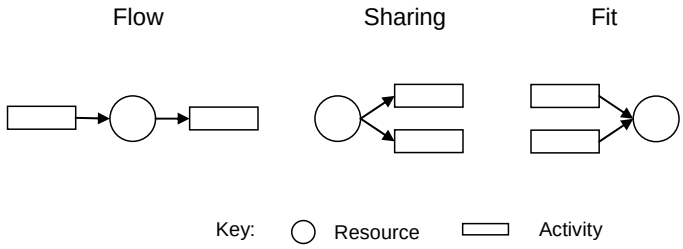


Figure 2. Dependencies among activities[3]

Second, sharing refers to a situation where the same resource is used by different activities at the same time. The problem of sharing a scarce resource also depends on the nature of the resource. Crowston (1991) proposes that the resources (objects is Crowston's study) used or produced by different activities can be divided into three different categories: sharable resources (resources that can be used by multiple actors or activities simultaneously, e.g. information), non-sharable and reusable resources (resources that can be used by multiple actors or activities but at different points in time, e.g. tools), and non-sharable and consumable resources (resources that can only be used once, e.g. raw materials). Thus, based on the type of resource, different kinds of needs to manage dependencies may emerge. Third, fit-type dependency means that multiple activities produce a common resource. In this case it possible that more activities than just one will produce the same outcome (or resource) or may specify different aspects of the resource (Crowston, 1991).

Furthermore, coordination activities through which the coordination problems are assessed exist at different levels in the organization (Alexander, 1998). Thus, the type of coordination that is observed by the researcher depends on the level of particularity of the system to be studied (Crowston, 1991). For example Alexander (1998) makes a distinction between coordination at meta level, meso level and micro level. Meta level coordination mechanisms consist of communalities with shared goals, values to market-oriented mutual adjustment, and mandated hierarchical organization with defined authorities. Meso level coordination includes interorganizational networks, such as interlocking board membership and industrial associations. Finally, coordination at micro level includes interpersonal contacts at meetings, correspondence and information sharing, overlapping board membership, and ad hoc meetings. Coordination at micro level is often organized through an informal liaison or boundary spanner, through inter-organizational groups such as steering committees, boards, through a

[3] adopted from Zlotkin (1995)

coordinator or integrating manager, who are in some organizations called project managers, or through coordinating units such as a project office. In this study I will focus on coordination between project teams within a program. Thus, the perspective on coordination in this study is rather intra-organizational and exists at the micro level.

In this study I will acknowledge the factors listed above, which enable theorizing from the observed data. However, the analysis is primarily based on inductive reasoning resting on observed facts, rather than letting existing ideas in the state-of-the-art to guide the analytical reasoning process extensively.

2.1.2 Barriers for coordinated action

Multiple studies have explored the questions of what prevents the coordinated action of individuals and groups in organizations (Saxberg and Slocum, 1968; Carroad and Carroad, 1982; Lucas and Bush, 1988). For example, inherent personality differences related to goals, needs, and motivation have been proposed to hinder the cooperation between different parts of the organization (Griffin and Hauser, 1996). Challenges in coordination have also been explained through differences in culture between different organizational functions or departments. Differences in culture and way of acting result from different training and background of individuals (Griffin and Hauser, 1996). For example, marketing and R&D functions differ from each other from the cultural perspective through diverse time orientations, tolerance of ambiguity and bureaucracy, and loyalty to the profession (Lorsch and Lawrence, 1965; Gupta et al., 1986; Dougherty, 1992). These differences lead to difficulties in understanding the other party's goals, solutions, and tradeoffs. The different ways of thinking may also lead to emergence of language barriers. For example, the R&D personnel favors quantitative, exact and detailed language characterized by technical specifications and performance, whereas people representing the marketing department may focus on qualitative, richer language focusing around product benefits and a perceptual position (Griffin and Hauser, 1996). The inherent differences in terminology and use of language might result in difficulties related to inter-group communication and eventually lead to challenges in coordination.

Organizational barriers preventing cooperation emerge as a result of different task priorities and responsibilities. It has been reported that measures generally used to evaluate functional success ignore the importance of integration, leading to a lack of top management's support towards cooperative action between functions (Dougherty, 1992; Souder, 1977; Souder and Sherman, 1993; Griffin and Hauser, 1996). In addition, physical barriers, such as geographical separation complicate coordinated action. The separation of actors geographically from each other decreases the possibility for ad hoc meetings and informal face-to-face discussions. This has been proposed to develop

communication barriers between the separated groups (Allen, 1970). Furthermore, it has been suggested that differentiation leads to the emergence of overly emphasized group identity and thus causes goal incongruence between the group and the parent organization (Hoegl et al. 2004; Brown and Williams, 1984; Ashforth and Mael, 1989).

Wurst et al. (2001) argue that dysfunctional conflicts are one of the reasons that may create organizational boundaries by destroying cohesion and open communication between individuals in organizations. They propose that conflicts in multi-team projects (or programs) emanate from divergent and conflicting team objectives and priorities, frequent changes in team goals, strategies, and management, lack of a team's willingness to meet the needs of the other team, communication barriers and attitudinal differences, geographical separation, complex reporting relationships, and competition for resources.

2.1.3 Coordination mechanisms

Organizational research has shown that several barriers prevent the groups and individuals from acting together in a coordinated manner. Respectively, the achievement of coordinated action within an organization requires the adoption of mechanisms that support interaction and information exchange between the actors. Several models have been suggested to explain what kinds of different mechanisms can be used for coordinating interdependent tasks or groups (e.g. March and Simon, 1958; Hage et al., 1971; Galbraith, 1973; Van de Ven et al., 1976; Mintzberg, 1979; Simons, 1995; Tsai, 2002). For example, March and Simon (1958) and Hage et al. (1971) propose that coordination in an organization can be accomplished through programming or through feedback. Coordination by programming refers to the use of plans, schedules, policies, and procedures as the means to coordinate activities, and presents a bureaucracy-like mechanistic coordination strategy. Coordination by feedback, instead, refers to the use of mutual adjustment among individuals and groups through vertical and horizontal communication.

Weinkauf et al. (2005), Grandori (1997), and Martinez and Jarillo (1989) have all provided an in-depth literature review on coordination mechanisms proposed in the literature. The extensive conceptual study of Weinkauf et al.'s (2005) focuses on inter-team coordination. Grandori (1997) has created a model for inter-firm coordination modes based on a literature review, and Martinez and Jarillo (1989) have made on extensive literature review on coordination mechanisms in multi-national corporations. In this thesis I have adopted the model suggested by Weinkauf et al. (2005) and used it as a frame to provide an overview of the coordination mechanisms acknowledged in the literature. The model differentiates between the following coordination mechanisms: formalization and

standardization, plans and schedules, output and behavioral control, reward systems, information technology, co-location, integrating instances and lateral relations, workplace rotation and interdisciplinary training, and socialization. A summary of the model with related literature is depicted in Table 2.

Formalization and standardization

Coordination through formalization and standardization consists of the use of written policies, rules, job descriptions, and standard procedures that specify the necessary behavior in advance. Having each actor (individual or group) to adopt the appropriate behavior produces an integrated pattern of behavior (Galbraith, 1973). The key advantage of using rules and standard procedures to coordinate activities is that they remove the need for excess communication. The use of rules and procedures increases the stability of the organization's activities and operations, and serves as an "organizational memory" to handle routine type situations (Galbraith, 1973). In addition, the use of formal management processes can lead to improved development outcomes (Cooper and Kleinschmidt, 1987) and reduce the time required for the development (Griffin, 1997a). Mintzberg (1979) proposes that there are three basic ways for standardization. First, the standardization of work processes refers to the specification of the contents of the work. Second, the standardization of output means that the results of the work are specified. Third, the standardization of skills refers to specifying the type of training needed in task accomplishment. Galbraith (1973) argues that standardized and a formalized action are limited into situations that are highly predictable. Formalization and standardization, are, however, extensively used for example in product development, which is commonly recognized as unpredictable and unanalyzable. Phase-review processes, stage-gate processes, the product and cycle-time excellence model (PACE), and quality function deployment are examples of standardization and formalization in coordinating R&D and marketing activities in organizations (Griffin and Hauser, 1996).

In the development context, coordination through standards is often dependent on the temporal phases of a project or program. For example Nihtilä (1999) has revealed that in the early phases of product development projects, coordination by standardization and formalization takes place through the use of product concept review documents, description of the new product development process, and quality function deployment reports. In a similar vein, Adler (1995) has found that in the pre-project phase (activities that precede the initiation of a given development project), coordination through standards includes the use of compatibility standards, but during the product and process design phase the coordination through standards includes the use of explicit design rules or tacit fit knowledge.

Finally, in the manufacturing phase, coordination by standards refers to the adoption of manufacturing flexibility (ibid.).

One form of coordination through standardization and formalization are routines. Routines make it possible to take advantage of previous experience without "reinventing the wheel" (Levitt and March, 1988). Organizational routines decrease the need for interaction between actors, and are thus a relatively cost-efficient way for coordination (Gittell, 2002). In addition, routines can be used to transform individual competencies into organizational capabilities, and they constitute a potential source of competitive advantage (Nelson and Winter, 1981). Research has proved that routines, even if cost-effective, do not work well in situations of high uncertainty. For example the studies of Van de Ven et al. (1976) and Keller (1994) show that routines work best in low-uncertainty situations. In a similar vein, Argote (1982) reports the effects of uncertainty as decreasing the effectiveness of routines.

Plans and schedules

Coordination through plans is based on the idea of establishing schedules to guide the work of interdependent work groups or units, and managing interdependencies between the work groups through schedules (Thompson, 1967). The use of plans and schedules is commonly related to coordination in an environment or situation in which the use of formalization and standardization as the coordination device is not appropriate because of the uncertainty related to individual tasks. In other words, the groups or individuals do not posses the requisite information in advance to standardize the action needed to perform a task. Thus, instead of specifying the desired behavior through rules or procedures, the organization determines the targets to be reached and permits individuals or groups to choose the appropriate behavior to achieve the set targets (Galbraith, 1973). A commonly used form of plans are schedules that are established in advance and specify what tasks will be conducted and when (March and Simon, 1958). The use of plans reduces the need for excessive inter-group communication if the groups are able to operate within the planned targets (Galbraith, 1973). In addition, the process of setting plans reduces equivocality and after the plans have been set they serve as data processing devices (Daft and Lengel, 1986). For example, Ketokivi and Castañer (2004) have studied the use of strategic planning as an integrative device in 164 manufacturing plants. Their study revealed that participation in the strategic planning process and communication of the resulting priorities decreased the tendency to subgoal pursuit over organizational goals. In other words, their study shows that participatory strategic planning and communication seem to make interdepartmental and hierarchical conflicts less likely and thus decrease excessive need for additional coordination efforts.

Planning has gained special interest as a coordination mechanism in the project context. Planning and process specification have been used as a starting point in developing several techniques to coordinate project work. The developed techniques are often based on the idea of breaking projects down into smaller parts or components and establishing timelines as milestones to guide the work of each element, making coordination among the elements easier (Moenart and Souder, 1990; Von Hippel, 1990; Wheelwright and Clark, 1992a; Cooper, 1996). Several authors in the new product development research field have argued that careful planning and process specification can increase the performance of projects (Cooper et al, 1999; Cooper and Kleinschmidt, 1996, Sicotte and Langley, 2000; Ernst, 2002). Others have focused on the negative effects of strict planning, such as slowing down the phase of product development (Eisenhardt and Tabrizi, 1995) or constraining the creative process of innovation (Mintzberg, 1994).

Output and behavioral control

Coordination and control are closely intertwined concepts in the classic organization theory (Parker, 1984). Fayol (1937) defined control as "examination of results". The act of controlling is related to ensuring that "all operations at all times are carried out in accordance with the plan adopted – with the orders given and with the principles down" (Fayol, 1937). This definition relates control inherently with the use of plans as coordinating mechanisms. Plans define the targets to be achieved and control is placed to ensure that the developed plans are carried out.

Ouchi and Maguire (1975) argue that two different types of control can be distinguished in organizations: behavioral control that is based on direct personal surveillance, and output control that is based on the measurement of outputs. They show through analyzing 197 departments of 5 stores that the two forms of control are independent from each other. In addition the results of their study reveal that the use of behavioral control is positively related to tasks in which the manager has clear understanding on means-ends relationships. Moreover, the use of output control is more expected when the manager needs to "provide a legitimate evidence of performance increases" (Ouchi and Maguire, 1975).

Some authors claim that control takes place in organizations through formal and informal formats (Jaworski, 1988; Ramaswami, 1996; Kirsch, 1997). Formal control refers to written manifestations that are initiated by the management in order to ensure that the behavior of employees or groups will support the placed objectives. Informal means of control, instead, represent "unwritten, worker-initiated mechanisms that influence the behavior of individuals or groups…" (Jaworski, 1988). The above mentioned output and behavior control represent formal control, whereas informal control

includes control through common values, benefits and philosophy (clan control), and through self assessment and self monitoring (Kirsch, 1997). Informal control is categorized into socialization as means for coordination in this study and is discussed more in the "socialization" sub-chapter. Kirsch (1997) studied control modes in four large information system projects. She found the following illustrations of the use of behavior and output control in the case projects to control the behavior of project leaders: managerial walk through including monitoring of progress, use of technical documentation to scope the planned targets, reporting the progress of the projects, use of project plans, and system testing.

Coordination through outcome or behavioral control seems to be closely related to and partly overlapping with coordination through standardization and formalization, and planning. Even if it may be challenging to make a distinction between the use of the mechanisms empirically, they certainly constitute research streams of their own. Thus, they are presented in this study as separate mechanisms.

Reward systems

Reward systems are used to align the priorities of individuals and groups, and thereby to ensure the achievement of the common goal. The use of reward systems is expected to increase the collaboration between the members of the organization or group, and thereby serve as a means to coordinate interdependent tasks. For example, Menon et al. (1997) studied interdepartmental connectedness and conflict in 222 business units, and found that the greater the use of market-based reward structure, the greater the interdepartmental connectedness, and the lower the interdepartmental conflict. Griffin and Hauser (1996) propose that performance evaluations that recognize interrelated rewards decrease the barriers between organizational functions. In addition, they increase cross-functional decision-making and provide incentives for conflict resolution. In other words, the studies suggest that if the reward structures of the specialized groups are interrelated, it leads to increased amount of cooperation between the groups. In the new product development the increased amount of cooperation, again, has proved to enhance the success of new products (e.g. Cooper and Kleinschmidt, 1987; Dougherty, 1992; Pinto and Pinto, 1990; Souder, 1988).

The studies of reward systems have revealed that organizations use at least two different kinds of strategies to reward employees; individual-based reward approaches and aggregate pay incentives (Gomez-Mejia and Balkin, 1989, 1984). Individual-based rewards are based on the reflection of an individual employee's performance. The aggregate incentive strategies, instead, are based on remunerating several actors participated in achieving common goals. In other words, while the base

of the reward in the former strategy is solely on an individual's performance, the latter strategy focuses more on evaluation of the achievement of a common goal (of a group or organization), and neglects the evaluation of individual performers per se (Gomez-Mejia and Balkin, 1992). Empirical study in the R&D environment shows that the aggregate reward strategy is related to higher pay satisfaction, withdrawal cognition, and project performance (Gomez-Mejia and Balkin, 1992). Other studies, however, have shown different results. For example the meta analysis of relationship between CEO compensation and organization performance reveal that the compensations of the CEOs can be mainly explained through the size of the organization, and the performance of the firm explains only marginal parts of the differences in CEOs' compensations. These findings indicate that the organizational performance can not be explained through CEOs' compensations (Tosi et al., 2000). In addition, Poskela (2007) studied top management control in the innovation context, and found that controlling through a reward structure had a negative effect on the performance of product innovations. This can be explained through suboptimal behavior and risk avoidance of the actors who aim to achieve the reward.

Using reward systems as a way to coordinate work might involve some challenges as well. Projects and programs are examples of work entities or organizational groups that have to some extent noticed to be problematic areas to apply rewards in. Wilemon and Cicero (1970) argue that most often, even if the project manager is responsible for producing the planned outcome with the allocated resources, he might not be in a position to directly reward the members of his team in means of promotions, salaries, or merit increases. Thus, even if they spend most of their time in projects, their performance is evaluated by the responsible function or department manager who may not have sufficient knowledge to apply the rewards.

Information technology

The development of information technology has created a potential for faster and cheaper communication, and opened a possibility to extend the scope of the information network (Dean and Snell, 1991; Hitt et al. 1993, Fulk and DeSanctis, 1995; Sicotte and Langley, 2000). The fast development in information technology has claimed to have major impacts on how coordination takes place, especially in cross-functional and distributed tasks such as globally distributed projects (Markus, 1994; Van Fenema, 2002). Technologies, such as electronic mail, voice mail, fax, decision support systems, computer aided design (CAD)/computer aided manufacturing (CAM), and electronic data management are examples of mechanisms that facilitate the coordination task in organizations. For example Adler (1995) has shown that the use of CAD/CAM technology enables coordination task in design and manufacturing interface. In addition, Fulk and DeSanctis (1995) argue that electronic

communication facilitates the communicative behavior across intra- and inter-organizational boundaries, decreasing the need for physical proximity. Moreover, Sicotte and Langley (2000) have shown that the use of information technologies (electronic mail, voice mail, fax, electronic document management, access to external databases, CAD, and computer aided engineering) are positively related to project performance.

Van Fenema (2002) lists some of the advantages that information technology gives in facilitating coordination work. Some of the advantages are related to coordination through organizational rules and procedures. First, the use of IT in coordination enables collection, analysis, and sharing of accumulated know-how (see also Adler and Borys, 1996). Second, it makes it possible to tailor organizational rules and procedures to cope with the needs of individual employees. For example, login to database and expert systems enables the creation of a user-dependent system. Third, the use of information technology allows participation of individuals from different locations. In this type of distributed work environment the information system serves as a coordination mechanism between the activities performed. Information technology enables also inter-personal coordination in a number of different ways. Some authors have proposed that even if newer information technologies such as electronic mail and voice mail serve as effective means to information distribution, they do not provide a possibility to exchange as rich data as would be possible through personal and group meetings (Hinds and Kiesler, 1995). In addition, it has been argued that the development of information technologies may create problems related to the compatibility of different information systems (Taylor, 2005). The incompatibility of information systems between the companies is even been shown to lead to major strategic disadvantages for companies and hamper the diffusion of innovations (ibid.).

Co-location

Co-location or physical proximity has been shown to have impacts on the interaction between individuals within and between the groups in an organization. Co-locating people creates a possibility to informal face-to-face discussions and informal information sharing. Davis (1984) argues that physical distance decreases spontaneous contacts between the employees in the organization. Keller and Holland (1983) studied communicator and innovator roles in R&D organizations and found that physical propinquity facilitates the communication on task accomplishment between employees in communicator and innovator roles. It has also been argued that organizational proximity creates an opportunity and psychological obligation among people for face-to-face interaction (Monge et al., 1985).

Some researchers have studied the relation between physical proximity and project outcomes (Keller, 1986; Pinto et al., 1993). The empirical evidence on the effects of physical proximity on project outcomes suggests a positive correlation between these two constructs. For example, Keller (1986) examined 32 project groups in a large project organization and found weak support for the hypothesis on a negative relationship between physical distance and a project group's performance. Also other studies suggest that co-location has a direct effect on performance. For example the studies of Griffin and Hauser (1996), and Griffin (1993) propose that co-location of cross-functional product development team correlates positively with marketplace success.

It has also been claimed that reducing the physical distance between the actors results in more frequent communication, which again, is directly related to higher performance. Pinto et al. (1993) studied project teams in the health care industry and found a positive relationship between physical proximity and cross-functional cooperation. In addition, cross-functional cooperation was found to be positively related with both perceived task outcomes and psychosocial outcomes. Van den Bulte and Moenart (1998) performed a quasi-experimental research on the effects of R&D team co-location on communication patterns among R&D, marketing and manufacturing. Their results revealed that co-location of R&D teams increased the communication between them. However, increased distance between R&D and marketing did not affect communication frequency between these functions. These results may indicate that there are also other effective ways than co-location to maintain or create high communication frequency between the actors. It has also been argued that the expected benefits from co-location may be illusory (Rafii, 1995). The informal contacts between the individuals, unless well-planned, may be time-consuming and distracting (Hauptman, 1990). Co-location of development team may also lead to its separation from the rest of the organization and slow down the development of functional skills (Rafii, 1995). Furthermore, global separation, especially in the project environment, results in challenges in the co-locating development team. However, recent developments in information technology have created an opportunity for people to create a virtually co-located environment.

Integrating instances, lateral relations

Informal lateral relations are based on voluntary and personal modes of coordination. Informal lateral coordination "often occurs naturally, but can be fostered through inter-social arrangements" (Tsai, 2002). In addition, lateral coordination is related to increased level of knowledge sharing within organizations (Tsai, 2002). Galbraith proposes that lateral relations increase organization's ability to process information by "increasing discretion at lower level of organization" (Galbraith, 1973). He states that lateral forms of coordination include the following mechanisms: direct informal contacts

between managers, creation of liaison roles, creation of temporary groups called task forces, creation of permanent interdepartmental teams, creation of integrating roles, creation of a linking-managerial role, and matrix designs.

Direct informal contacts between managers or employees represent the simplest form of personal modes of coordination (Galbraith, 1973). In the literature on coordination, direct informal contacts are also called mutual adjustment that refers the coordination of work by a simple process of informal communication (Mintzberg, 1979). Coordination through mutual adjustment includes transmission of new information (Thompson, 1967). In a similar vein, it has been proposed that direct contacts often utilize rich media, which allows actors to exchange their views and reduce ambiguity (Daft and Lengel, 1986). Souder and Moenart (1992) argue that in innovation projects the use of informal direct face-to-face contacts is associated with a higher probability of success in the early development phase. However, in the later development phase, direct informal face-to-face contacts may cause dyadic divergence from the goals of the task group. .

Of the proposed mechanisms, the use of liaisons, integrators, or linking managers represent coordination through having individuals in a position in which the boundaries of different organizational units cross. These all are designed to facilitate communication between the interdependent units or groups in the organization (Galbraith, 1973). The use of liaisons or integrators in coordination takes different forms in organizations, depending on the context. For example, Nihtilä (1999) and Dean and Susman (1989) report on a production planner or integrator who works in a liaison role, communicating the strategic objectives of the production function to the R&D team. In a similar vein, Lawrence and Lorch (1967a) argue that the integrator's role is to transmit data, but also to reduce disagreement among the coordinated entities and thereby lessen the ambiguity related to the goals, interpretation of issues, and course of action taken.

Of the three integrative positions, liaisons represent the most informal, least permanent and the most inexpensive, whereas the establishment of a linking managerial position is the most permanent, most formal and most expensive form of coordination (Galbraith, 1973). Coordination through different types of integrating individuals is especially important in the project context, because the organization (of the projects) usually involves fluid interaction of highly skilled people representing various expertise areas and various organizational levels. For example Wilemon and Cicero (1970) emphasize the role of the project manager as a boundary spanner in complex projects, including a dense network of horizontal and diagonal interdependencies.

The creation of temporary groups such as task forces, teams or committees represent well known mechanisms for coordination, especially in situations where the level of equivocality is high (Daft and

Lengel, 1986). Group meetings enable the participants to exchange opinions and perceptions face-to-face, and thereby reach collective understanding and agreement on the issues. Van De Ven et al., (1976) found that the group mode of coordination, such as scheduled meetings or unscheduled meetings, is positively related to perceived task uncertainty and work flow interdependence. Adler (1995) proposes that the use of a team as coordination mechanism is suitable especially for highly novel projects. Prior literature has also emphasized the role of cross-functional teams as an effective means to improve project performance (Zirger and Maidique, 1990; Brown and Eisenhardt, 1995). Some researchers, however, have shown that there are potential disadvantages related to the use of lateral relations and horizontal structures in coordination. For example, Barker et al. (1988); Ford and Randolph (1992), and De Laat (1994) report on ambiguity in responsibilities, and conflicts between project managers and functional managers related to priorities of the projects, schedules, and resources.

Workplace rotation and interdisciplinary training

Workplace rotation, and more specifically, human movement between functional groups is acknowledged as one of the most influential forms of decreasing functional isolation in an organization (Griffin and Hauser, 1996). Edsrtröm and Galbraith (1977) studied the transfer of managers in multinational organizations from the control and coordination perspective and argued that:

"*Transfer (of managers) can increase knowledge of the network (of actors), develop multiple contacts within it and increase the likehood that these contacts will be used in collecting information to support local discretion*" (Edsrtröm and Galbraith, 1977)

The results are in line with Pfeffer and Leblebici (1973) who studied the role of executive recruitment in the development of inter-firm organizations. Their study reveeled that the movement of executives between firms was positively related to the creation of coordinated structures of inter-organizational behavior. Workplace rotation within an organization increases the contextual understanding among the different functions or departments of the organization. Griffin and Hauser (1996) argue that this is especially important in projects that lack formal documentation of the progress. Thus, the movement of persons in organizations is supposed to decrease the technical uncertainty related to projects by integrating understanding from different disciplines. In addition, workplace rotation decreases differentiation between the groups caused by cultural and lingual differences (Griffin and Hauser, 1996; Lawrence and Lorch, 1967a). In addition, workplace rotation has been argued to have effects on organizational performance. For example Ettlie (1995) studied coordination in manufacturing

organizations and found that firms that emphasize the job rotation and mobility of employees as their principal integrating mechanism seem to have higher sales per employee.

Coordination through interdisciplinary training refers to the use of individuals who employ trans-specialist understanding in order to facilitate mutual understanding between different parts of the organization. Trans-specialist understanding can be defined through the term specialist understanding, which means "*the ability of the experts in a given domain to solve problems in their domain*" (Postrel, 2002). Trans-specialist understanding is defined to include "*means by which members of one speciality assess how effective another speciality is likely to be when faced with a given problem*" (Postrel, 2002). In other words, trans-specialist understanding increases the awareness of a specialized group of other groups.

The lack of interdisciplinary training and understanding is reflected in organizations as problems in communication. Especially, communication that happens across specialty boundaries might be problematic because of conflicting conceptual categories and semantic ambiguities (Kogut and Zander, 1996). This kind of situation is evident in project-type work, which includes a number of individuals representing different specialty areas and a need of intense communication between the individuals.

Socialization

Organizational socialization refers to the process through which individuals learn the values, norms, and required behavior which allow them to participate as members of an organization (Van Maananen, 1976; Van Maananen and Schein, 1979). Socialization enables creation and maintenance of organizational culture and values, which direct the behavior of the participating individuals (Pascale, 1985). Organizational values are used both to provide boundaries that restrict the individual actor from taking actions towards undesired directions, and to encourage taking actions towards desired directions (Hart, 1992; Hart and Banbury, 1994). Louis (1980) argues that socialization is especially significant in reducing the amount of surprises related to organizational changes and novel situations. Organizational socialization practices are used to help individuals to cope with new events and respond those successfully (Martinsuo, 1999). In other words, socialization creates a unified interpretation system among the participants, which prevents the emergence of organizationally inappropriate behavioral responses.

Coordination through socialization takes the form of commonly agreed goals and values behind the goals, which aim at harmonious behavior of the actors, with the purpose to achieve the common goal

of the organization. Ouchi (1980) describes the function of socialization as a coordination mechanism as follows:

"Common values and beliefs provide the harmony of interests that erase the possibility of opportunistic behavior. If all members of the organization have been exposed to an apprenticeship or other socialization period, then they will share personal goals that are compatible with the goals of the organization." (Ouchi, 1980)

Explicit sets of shared beliefs that constitute the principal part of the socialization are often reinforced and communicated in organizations through formal documents, such as mission statements, vision statements, credos, and statements of purpose (Simons, 1995; Artto et al., 2004). Thus, even if coordination through socialization is not directly based on formal documents and statements that define the collective set of coordinated actions, formal documents may be used to reinforce coordinated behavior by having interdependent actors internalize common values.

Table 2 Summary of the most common coordination mechanisms in the literature

Coordination mechanisms	Logic behind the mechanism	Authors
Formalization and standardization	Accomplishment of a collective set of tasks ensured through the use of written policies, rules, job descriptions, and standard procedures that produce integrated patterns of behavior	Galbraith (1973), Mintzberg (1979), Adler (1995), Nihtilä (1999)
Plans and schedules	Establishing schedules to guide the work of interdependent groups or units in order to ensure the accomplishment of a collective set of tasks	Thomspson (1967), Galbraith (1973), March and Simon (1958), Daft and Lengel (1986), Ketokivi and Castañer (2004), Moenart and Souder (1990), Von Hippel (1990)
Output and behavioral control	Harmonious pattern of behavior and accomplishment of a collective set of tasks ensured through controlling the behavior of actors or delivered outputs	Fayol (1937), Ouchi and Maguire (1975), Jaworski (1988), Ramaswami (1996), Kirsch (1997)
Reward systems	Reward systems are used to align the priorities of individuals and groups, and thereby to ensure the achievement of the common goal. The use of reward systems increases collaboration between the members of the organization or group, and thereby serves as a mechanism for coordination	Menon et al. (1997), Griffin and Hauser (1996), Gomez-Mejia and Balkin (1984, 1989, 1992)
Information technology	Information technologies such as electronic mail, decision support systems, CAD/CAM, and electronic data management facilitate information delivery between the different parts of the organization, and serve as a linkage mechanism enabling the achievement of a collective set of tasks	Adler (1995), Van Fenema (2002), Adler and Borys (1996), Markus (1994), Hitt et al., (1993)
Co-location	Co-locating individuals creates a possibility to informal face-to-face discussions and information sharing. This enables creation of linkages between organizational parts and enhances the accomplishment of a collective goal through direct communication	Keller and Holland (1983), Pinto et al. (1993), Keller (1986), Griffin and Hauser (1996), Griffin (1993)
Integrating instances and lateral relations	Coordination through integrating instances and lateral relations refer to the use of individuals or groups to share and deliver information and reduce disagreement between different parts of the organization in order to ensure that the organizational goals are achieved	Galbraith (1973), Mintzberg (1979), Thompson (1967), Souder and Moenart (1992), Nihtilä (1999), Dean and Susman (1989), Lawrence and Lorch (1967a,b), Van de Ven et al., (1976), Ancona and Caldwell (1992)
Workplace rotation and interdisciplinary training	Workplace rotation and interdisciplinary training decrease functional isolation by facilitating the development of multiple contacts in a network of actors and thereby facilitating information exchange between the different parts of the organization and the accomplishment of common goals	Griffin and Hauser (1996), Pfeffer and Leblebici (1973), Ettlie (1995), Postrel (2002), Moenart and Souder (1996)
Socialization	Coordination through socialization takes the form of commonly agreed values behind the goals that aim at harmonious behavior of actors, with purpose of achieving the common goal of the organization	Van Maananen (1976), Van Maananen and Schein (1979), Pascale (1985), Ouchi (1980), Simons (1995), Gittell (2002)

2.1.4 Coordination modes

Coordination modes represent logical classes of different coordination mechanisms that are from some perspective similar within the same mode and different between the modes. Coordination mode refers to a category of individual coordination mechanisms that are to some extent similar in their logic of ensuring coordinated action. The concepts coordination mechanism and coordination modes are intertwined and partly overlapping within the current literature, and much of what is written about coordination mechanisms could be also be interpreted to represent coordination modes.

Previous research has shown that coordination mechanisms differ for instance in their information processing capacities, level of personal involvement required, formality, and technologies required (Daft and Lengel, 1986; Daft et al., 1987; Rice, 1992; Lind and Zmud, 1991, Van de Ven et al., 1976; Kraut and Streeter, 1995). The capacity of coordination mechanisms to process either rich or lean information have been explained through distinct criteria, such as capacity for immediate feedback, the number of cues and senses involved, personalization, and language variety (Daft and Lengel, 1986; Daft et al., 1987; Rice, 1992). Rich coordination mechanism are said to provide an opportunity for immediate feedback, include a high number of cues and senses, to be personalized by nature, and provide an opportunity to use natural language to convey understanding of a broader set of concepts and ideas. Thus, utilization of rich coordination mechanisms enables an actor to overcome different frames of reference and provides a capacity to process complex subjective messages (Daft et al., 1987; Daft and Lengel, 1986; Rice, 1992). Coordination mechanisms characterized by low richness in information processing include fewer cues and are limited in their capacity to provide immediate feedback. In addition, coordination mechanisms with low richness are impersonalized by nature and do not allow the utilization of natural language (Daft and Lengel, 1986).

In addition to information processing qualities, coordination mechanisms have also been categorized accoording to whether the coordination mechanisms rely on programmed, codified action or mutual adjustments and feedback (March and Simon, 1958). For example, Van de Ven et al. (1976) have categorized coordination modes into impersonal mode coordination, group mode of personal coordination, and individual mode of personal coordination. The impersonal mode of coordination is related to coordination through programming and enables codified blueprint of action that is impersonally specified. It can be exemplified through such mechanisms as pre-established plans, schedules, forecasts, formalized rules, policies, procedures, and standard information and communication systems. Group modes of personal coordination include coordination mechanisms through which mutual adjustments occur in a group of occupants (more than two) in meetings.

Scheduled or unscheduled committee meetings and decision making boards serve as examples of the group mode of personal coordination. The individual mode of personal coordination includes mechanisms in which individual role occupants make mutual task adjustments through vertical or horizontal communication (Van de Ven et al., 1976). In previous studies, the individual mode of personal coordination has been observed to happen through hierarchical roles, such as line managers and unit supervisors (Thompson, 1967), through individuals designated in less hierarchical positions, such as integrating persons or liaison persons such as project managers, project expeditors or coordinators (Galbraith, 1973; Lawrence and Lorsch, 1967a), and through boundary spanners aiming to create legitimacy for the groups they are assigned to (Ancona and Caldwell, 1992; Tushman and Scanlan, 1981; Levina and Vaast, 2005).

Kraut and Streeter (1995) differentiate between five distinct coordination modes; formal impersonal procedures, formal interpersonal procedures, informal interpersonal procedures, electronic communication, and interpersonal network. In their categorization, formal impersonal procedures correspond to what Van de Ven et al. (1976) call impersonal mode of coordination. In addition, Kraut and Streeter (1995) distinguish between formal and informal interpersonal coordination mechanisms that require actual physical interaction between individuals through different types of meetings. Moreover, electronic communication has been separated from the other modes as a distinct category because information exchange through electronic mail does not require actual physical proximity of the coordinated parties, the coordination is not necessarily based on concurrency of information exchange, and the delivery of information does not require face-to-face interaction, as is often case in formal and informal interpersonal procedures. Coordination through electronic communication, however, is not based on codified blueprint of action or change of information that is low in richness, which is characteristic for the impersonal mode of coordination. In addition, among other technological advancements the use of e-mail as a coordinating mechanism has been given much attention in recent academic research (e.g. Markus, 1994; Carlson and Zmud, 1999; Cramton, 1997; Järvenpää et al., 1998, Dabbish et al., 2005). Finally, the interpersonal network mode of coordination refers to coordination through contacts external to organization of the project. Coordination through interpersonal networks, such as personal relations may occur in an unusual situation when problems need to be solved (Kraut et al., 1999). The interpersonal network has been acknowledged as a distinct and important coordination mode, especially in studies on inter-organizational coordination (Kraut et al., 1999; Granovetter, 1985; Uzzi, 1997).

2.1.5 Coordination strategies

The existing research on coordination has covered the use and impacts of individual coordination mechanisms and different coordination modes. The utilization of distinct mechanisms and modes is explained through task uncertainty, equivocality (Adler, 1995), task frequency, task heterogeneity, causal ambiguity (Zollo and Winter, 2002), task interdependence, and goal conflicts (Andres and Zmud, 2001), to mention some. While many of the studies provide in-depth and valid knowledge on the effects of situational factors on the use of specific coordination mechanisms or modes, there is a lack of holistic understanding on how coordination takes place in the organizational system. In other words, many of the existing studies fail to describe the variety of different ways through which coordinative actions take place in the organizational setting, and the relative importance of the different coordination mechanisms or modes in a specific organizational setting. Coordination strategy provides a useful concept to assess the variety and complexity of different coordination practices and their importance in different organizational settings. McCann and Galbraith (1981) state that coordination strategies can be analyzed along three distinct dimensions in organizations; formality, cooperativeness, and centralization. The formality dimension distinguishes between utilization of vertical or horizontal communication channels, cooperativeness is related to the extent of shared decision making, and centralization can be defined through the locus of decision making autonomy. Andres and Zmud (2001), following the guidelines by Burns and Stalker (1961), differentiate between organic coordination strategy that consists of informal, cooperative and decentralized actions, and mechanistic coordination strategy that emphasizes formality, controlling and centralization. In addition, coordination strategies have also been differentiated on the basis of the different formats and timing of information exchange between interdependent tasks (Terwiech et al., 2002). It is evident that the coordination strategies observed by the researchers are dependent on the theoretical perspective taken to the phenomenon. For the purposes of this study, I define coordination strategy as a logic of action through which coordination is exercised, including the repertory of coordination mechanisms and modes applied and their relative importance. This definition is open enough to allow the researcher to find new logics of action complementing the existing ones. The concepts of coordination mechanism, coordination mode, and coordination strategy and their relations are illustrated in Figure 3.

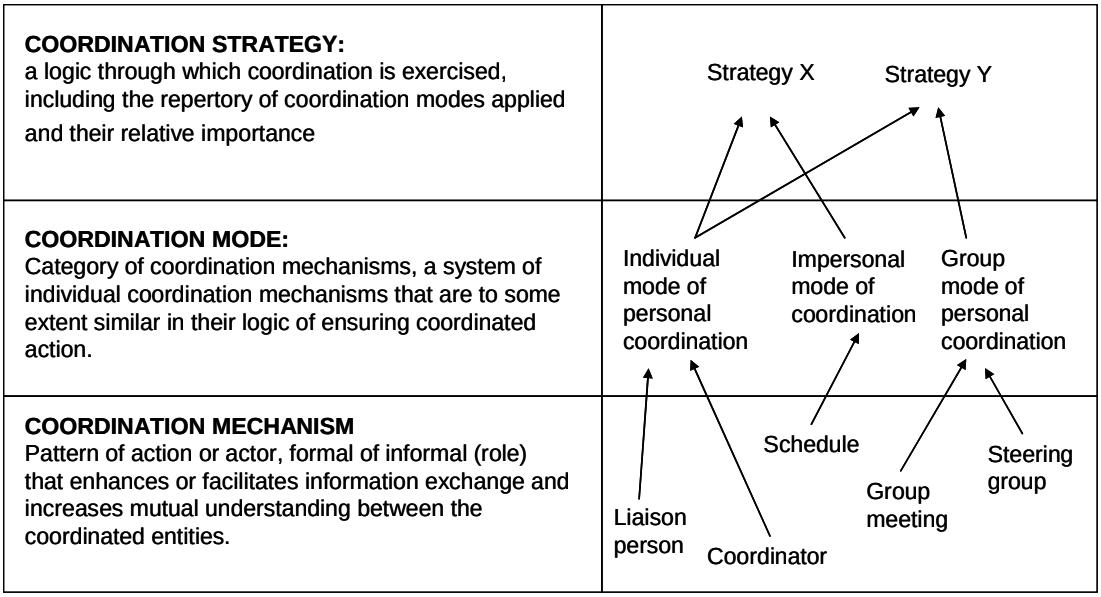


Figure 3 Illustration of the concepts coordination strategy, coordination mode and coordination mechanism

The concept of coordination strategy may be defined as an intended, purposeful plan of action that specifies the key mechanisms through which the information and knowledge exchange between the interdependent project teams is ensured, and practices that support the utilization of these mechanisms. On the other hand, coordination strategy may also refer the actual patterns of action through which the information and knowledge exchange occurred. This type of conceptualization integrates both intended and emergent perspectives of strategy. The latter, gradually emerging strategy is the focus of this research. By adopting the emergent perspective on coordination strategy this study aims to respond to the insufficient variety of different forms of organizing, that is claimed to be characteristic for studies of coordination and governance (Grandori, 1997). This actualized, post hoc constructed perspective on strategy enables the researcher searching solutions that go beyond the ones we have used to see. For instance, clan governance structure was identified post hoc on the basis of the empirical observations of organizational solutions, which differed from the both market and hierarchy structures (Grandori, 1997).

Coordination strategy can be understood through the coordination mechanisms and their importance in coordination. Coordination mechanisms generally refer to all of those mechanism that enable actors to act toward a common goal. Reward systems, co-location of the actors, use of plans and schedules are examples of such systems (for more see Table 2). In this study I have limited the analysis on information and knowledge exchange between the project teams and therefore defined

coordination mechanisms as patterns of action that facilitate the exchange of information[4]. These mechanisms involve actors to the interaction process with other actors. In addition, they are directly observable through the empirical investigation. Coordination modes, instead, represent different categories of coordination mechanisms that share some common qualities, in this study to information sharing properties. For example, group mode of personal coordination includes coordination mechanisms that enable face-to-face interaction of more than two persons. Mechanisms such as formal and informal group meetings and co-location of actors are examples of coordination mechanisms that belong to group mode of personal coordination category. Coordination modes are necessary in order to understand the coordinative actions from the holistic, coordination strategy perspective. Coordination modes create theoretical frames for analyzing coordination, and enable comparison of fairly different pattern of action between the empirical cases. In the empirical part of the study I have focused on the four distinct coordination modes: group mode of personal coordination, individual mode of personal coordination, electronic mode of coordination, and impersonal mode of coordination. These coordination modes enable categorizing coordination mechanisms based on the type of interaction related to the use of specific coordination mechanism. The type of interaction, again, is related to the different information processing qualities of interaction situation (Daft and Lengel, 1986). In this study coordination strategy describe the overall structure of the coordinative system that is embedded both in the managerial activities and practices that take place at the program level and in the actual work activities that take place in the belonging projects. Coordination strategy also includes the relative importance of different coordination modes. The importance reflects the actual coordination needs and the usage of the different types of mechanisms in place. The concept of importance can also be interpreted as a proxy of value of different types of coordination mechanisms. The concept of value, again, is related to benefits of the utilization of different types of coordination mechanisms and costs of the use of these mechanisms. Thus, coordination strategy, in addition to describing the portfolio of coordination mechanisms utilized, also reveals which types of the mechanisms are the most valuable ones in order to achieve sufficient level of coordination.

2.2 Coordination in programs

The research on coordination in organization theory has focused mainly on relatively permanent organizational settings rather than temporary contexts, such as projectS and programs (Nidumolu,

[4] Similar definition see Crowston (1997)

1996; Bryman et al., 1987). Current research on programs and projects is still relatively young and lacks an established theoretical basis (Shenhar, 2001). Most of the studies and literature on program management mention coordination (Pellegrinelli, 1997; Thiry, 2004; OGC, 2003; Turner, 1999; Gray, 1997), integration (Lycett et al., 2004), or management of interdependencies (Blomquist and Müller, 2004) as a focal issue in program management. Many of these studies, however, are descriptive or conceptual and only few of them focus on coordination issues in detail.

Programs or large projects are often characterized by a combination of uncertainty and ambiqioty related to goals and tasks, and complexity emanating from large size and numerous dependencies between different activities and the environment. Thus, the coordination mechanisms and techniques used in routine production environments may not suffice (Kraut and Streeter, 1995). While coordination in permanent organizations is primarily arranged through vertical management structures, coordination in programs and projects call for horizontal organizing (Kerzner, 1998). In a similar vein, Bechky (2006) argues that temporary organizations, unlike traditional hierarchical ones, resemble networks of relations rather than lines of authority. These arguments seem to be somewhat contradictory with the principles which most of the techniques in project management are based on. For example Gray (1997) notes that many project management techniques, such as the critical path method or PERT, rest on the idea that lateral dependencies and conflicts between different projects, sub-projects, or work packages are managed through a clear vertical dependency structure. In many cases, however, the vertical structure is weak and the management of horizontal dependencies is based on self organized interaction between different actors. In these cases the level of success in managing the interaction is often dependent on individuals' commitment and the amount of available information (Gray, 1997). This notion is supported by group theorists who argue that coordination is essentially a process of interaction between the actors (Gittell, 2002). In addition, it is characteristic for time-bound settings, such as programs, that the degree and type of interdependence between activities change as different phases of the work unfold. As a consequence, the needed coordination mechanisms might not be constant over time (Adler, 1995).

The existing empirical studies on coordination in the temporal organization context, such as programs, projects, and teams, can be divided, on the basis of the focus of the research into the following three distinct areas; studies focusing on inter-project coordination, intra-project coordination, and boundary spanning. The three research areas, their focus and examples of authors within each area are summarized in Table 3.

Table 3 Three research areas related to coordination in project and team contexts

Research area	Focus of the research	Authors
Inter-project coordination	The methods of information and knowledge sharing (coordination) between interdependent project teams, the antecedents of the use of the methods, and their respective performance effects	Hoegl et al. (2004), O'Sullivan (2003), Van Fenema (2002), Ribbers and Schoo (2002), Wurst et al. (2001). Nobeoka and Cusumano (1993)
Intra-project coordination	The methods of information and knowledge sharing (coordination) between actors within a single project team, the antecedents of the use of the methods, and their respective performance effects	Liberatone and Wenghong (2004), Andres and Zmud (2001), Sicotte and Langley (2000), Nidumolu (1996), Adler (1995), Kraut and Streeter (1995), Pinto et al. (1993), Clark and Wheelwright (1992), Keller (1986), Fidler and Johnson (1984);
Boundary spanning	The roles and activities of individuals at the organizational boundaries, the intent and consequences of the respective boundary spanning activities	Kellogg et al. (2006), Balogun et al. (2005), Druskat and Wheeler (2003), Ashforth et al. (2000), Yan and Louis (1999), Ancona and Caldwell (1992), Ancona (1990), Tushman and Scanlan (1981), Aldrich and Herker (1977); Leifer and Delbecq (1977); Keller and Holland (1975);

2.2.1 Inter-project coordination

When the development efforts become complex enough in an organization, single teams are not sufficient to deal with the related development work. Rather, the responsibility of the development is divided between smaller project teams (Hoegl et al., 2004). The differentiation between smaller teams, however, creates a need for coordination, because the project architecture often resembles the interrelated modules of the product or outcome (ibid., von Hippel, 1990; Kazanjian et al., 2000). In dynamic organizational settings, such as projects, lateral interaction between the project teams is especially significant (Mohrman et al., 1995) and lack of coordination between teams may induce delays, need of rework and additional development costs (Loch and Terwiesch, 1998; Kazanjian et al., 2000). In addition, coordination with other teams has been shown to be positively associated with team performance (Hoegl et al., 2004).

Only a few empirical studies, however, have directly focused on coordination between project teams. Recently, Hoegl et al. (2004) studied inter-team coordination in multi-team R&D projects. They focused on lateral collaborative processes occurring at the inter-team level. The study design was longitudinal and the sample consisted of 39 project teams in a large product development project in the European automotive industry. They found that inter-team coordination (e.g. constructive discussions) has a positive effect on the overall team performance. Inter-team coordination was seen

particularly critical in the case of a high number of technical interfaces. In addition, the study revealed that inter-team coordination was positively correlated with teamwork quality, and overall commitment to the project. The study of Hoegl et al. (2004) provides valuable information on the effects of inter-team coordination and justifies its necessity. However, the study does not provide in-depth understanding on how the coordination actually takes place between the project teams.

Van Fenema (2002) studied coordination between project teams in globally dispersed software projects. The study comprised in-depth analysis of coordination and control between different project teams in two software projects. The results show that geographically differentiated teams, complemented with cultural and infrastructural differences, lead to distinct patterns of coordination. Information and knowledge transfer between the teams is based on liaisons, impersonal means of coordination, such as requirements documentation, implementation standards and procedures, common base of expertise, regular managerial visits, multiple contact linkages and outlining plans. In addition, remoteness emphasizes the use of asynchronous media, such as e-mail, in the coordination.

Ribbers and Schoo (2002) studied coordination in large software implementation programs and found that successful programs operating in a complex environment were characterized by a complete program organization including a program manager, steering committee, program sponsor, user representative, coordinator over projects, coordinator with external suppliers, coordinator for efficient implementation process, as well as independent quality assurance, and a loose budget policy, in terms of time and cost restrictions, in the innovation phase. In addition, they found that in successful programs an increase in the number of elements and their interrelations led to an increased number of parallel projects. Moreover, they observed that a high level of integration complexity, that is a need to integrate the result of the program into existing business processes and systems, led to a strategy of implementing organizational changes and technical changes together.

O'Sullivan (2003) studied dispersed collaboration in a multi-firm, multi-team product development project. The results of the in-depth case-study revealed several mechanisms that allowed the resolution of task interdependencies. The mechanisms included standardization of work content through formalized design outputs, and synchronization of workflow through several different types of frequent meetings. Nobeoka and Cusumano (1993) studied multi-project management in automobile product development, and found that the adoption of different coordination structures, matrix organization, project coordination, functional coordination, and the combination of project and functional coordination, is dependent on the cross-functional interdependency within the project, as well as inter-project interdependency. The study, however, did not directly address the issue of how the interdependencies between the projects or within the projects were managed, but rather provided a

meta level examination of coordination of projects within the parent organization. In addition to the fact that prior empirical studies of coordination between projects teams are scarce, they seem to be focused on product development, information systems development and implementation, leaving organizational development unexplored.

2.2.2 Intra-project coordination

The studies on intra-project coordination, even though not addressing core of coordination between project teams, may serve as a valuable asset for the understanding coordination between teams. Thus, some of the studies focusing on intra-project coordination are reviewed here. For example, Andres and Zmud (2001) studied the effects of task interdependence, coordination strategy, and goal conflict on the success of 40 software projects through a laboratory experiment. The study distinguishes between a mechanistic coordination strategy including centralized structure, formal communication, and unilateral decision making, and an organic coordination strategy consisting of decentralized structure, informal communication and cooperative decision making. The results reveal that the organic coordination strategy provided higher productivity than the mechanic coordination strategy. In addition, the organic coordination strategy was found to be especially effective when highly interdependent tasks where included in the project.

Kraut and Streeter (1995) examined coordination techniques in 150 software development teams. They define five categories for different coordination techniques. First, formal impersonal coordination procedures refer to written requirement documents, modification request tracking and data dictionaries. Second, formal interpersonal coordination techniques mean requirement review meetings, status review meetings, and code inspection meetings. Third, informal interpersonal procedures refer to unscheduled group meetings or co-location of requirements and design staff. Fourth, electronic communication, such as electronic mail and electronic bulletin board are classified as one distinct coordination technique. Finally, interpersonal networks refer to coordination through individuals' interpersonal contacts outside the projects. The results of Kraut and Streeter's study reveal that the use of formal impersonal procedures and formal interpersonal procedures correlates positively with the size of the project. The study also shows that informal interpersonal procedures were used especially in the planning stage of the project. In addition, the results reveal that electronic communication was used more when the project was dependent on other groups in the organization. Finally, the use of interpersonal networks correlated positively with the project's small size, certainty and dependency of input from other groups.

Nidumolu (1996) has shown how requirement uncertainty and coordination mechanisms affect of the performance of information system project. The study was based on a survey of 64 software development projects from banking and other industries, and focused on mechanisms coordinating the activities of information systems staff and users. Two different coordination mechanisms are defined: vertical coordination and horizontal coordination. Vertical coordination is determined in the study as the extent to which the coordination is undertaken through decisions by authorized entities, such as project managers or steering committees. Horizontal coordination, instead, refers to mutual adjustments and communication. The concepts of vertical and horizontal coordination correspond to the concepts of vertical means of personal coordination, and personal and group means of coordination presented by Van de Ven et al. (1976). The study of Nidumolu (1996) reveals that vertical coordination enables project teams to reduce project risk and project uncertainty, and horizontal coordination is correlated with improved project performance.

Liberatore and Wenghong (2004) have studied the effect of project uncertainty, vertical coordination, horizontal coordination, and trust on project performance through a survey of 25 system implementation projects. According to their study, vertical coordination was generally considered more important than horizontal coordination in projects. In addition, they found that neither vertical nor horizontal coordination is directly correlated with project performance. However, there was a strong correlation between trust (among different stakeholders of the project) and project performance. Moreover, they observed that there was an indirect positive relationship between vertical coordination and project performance through trust. Sicotte and Langley (2000) have examined the linkage between the use of different coordination mechanisms and R&D project performance. Their study shows that there is a positive relationship between the use of formal leadership, planning, and process specifications, and project performance.

The study of Pinto et al. (1993) shows that within project teams, coordination through superordinate goals, physical proximity, and project team rules has a direct positive effect on cross-functional cooperation, which has a positive effect on the perceived task outcomes and psychosocial outcomes of the project. In addition, the study shows that superordinate goals and project team rules have a direct positive effect on the perceived task outcomes of the project. Keller (1986) has shown that beyond the pure application of coordination mechanisms, the qualities of the project team structure may have an effect on success of a project. The results of his study unveil that project team cohesiveness, job satisfaction, and innovative orientation are positively correlated with project success. Keller's study of 32 project groups in R&D organizations also reveals that physical distance between the project team members has direct negative effects on the success of the project team.

Sherman (2004) studied the coordination deficiencies and modes of coordination in 24 interrelated project offices and laboratories in the defense industry. The results of the study suggest that even if the adoption of optimal modes and levels of coordination will result in optimal patterns of information processing, it will not necessarily minimize the coordination problems. In his empirical study, Sherman observed 16 different groups of coordination deficiencies, and analyzed the occurrence of these deficiencies both in organizations possessing an optimal level of integration and in organizations possessing a sub-optimal level of integration. The results did not reveal any significant differences between the occurrences of deficiencies between these different cases. This fact seems to suggest that there is a gap in our current understanding of the factors that are required to achieve effective coordination.

Fidler and Johnson (1984) have studied communication and innovation implementation. They distinguish between interpersonal and mediated communication channels. Interpersonal channels are those that include primarily face-to-face modalities, whereas mediated channels refer to ones which are interposed in some way between the source and the receiver. In their theoretical article they propose that the more complex the innovations are, the more effective means for communication the interpersonal channels provide, and conversely, mediated channels become more efficacious with decreasing innovation complexity.

Adler (1995) has studied coordination mechanisms through 13 interdepartmental product development projects. He defines four different coordination classes used in projects: standards, schedules and plans, mutual adjustment, and team coordination. In addition, he divides the use of different coordination mechanisms into three temporal phases in the lifecycle of a product development project: coordination in the pre-project phase, coordination in the design-phase, and coordination in the manufacturing phase. The distinct coordination mechanisms characteristic for the product development context that Adler observed in his study include compatibility standards, capabilities development schedules, coordination committees, joint development, design rules, tacit knowledge, producibility design reviews, joint teams, exception resolution plans, and transition teams. The results reveal that the use of coordination mechanisms is contingent on task analyzability and task novelty. Adler found that decreasing analyzability in the projects requires more coordination effort in the later phases of the project, and increasing novelty in the projects requires use of more interactive coordination mechanisms, such as mutual adjustment and team coordination.

2.2.3 Coordination between the project team and the environment

Coordination between the team and its operating environment has been an area of interest inspiring many researchers for empirical studies and increasing our understanding of coordination. This research area is generally labeled as "boundary spanning" literature. According to Ashforth et al. (2000), the concept boundary refers to a physical, temporal, emotional, or relation limit that defines and separates different entities from each other. Tushman and Scanlan (1981) explain that communication boundaries emerge through the interaction of idiosyncratic coding schemes or language, as well as development of local conceptual frameworks. To overcome these boundaries, special boundary spanning individuals and activities are needed. The need of boundary spanning activities is also explained through the information requirements that decision makers face when making decisions under uncertainty (Leifer and Delbecq, 1978). Respectively, organizational size, differentiation, heterogeneity of the environment and the rate of environmental change have been suggested to increase uncertainty and the required amount of boundary spanning (Aldrich and Herker, 1977). Leifer and Delbecq (1978) recognize that boundary spanning individuals may work in different roles in organizations, e.g. as gatekeepers, regulators, liaisons, and change agents. The common nominator for these roles is that the boundary spanning activities of these individuals represent an informal process of environmental monitoring and transferring the information across the boundary (Keller and Holland, 1975).

On of the most acknowledged studies on boundary spanning is the one by Ancona and Caldwell (1992). The study includes analysis different strategies to manage dependencies between organizational teams and their environment. Ancona and Caldwell have identified four different activity clusters, each including various boundary activities. The first cluster is named as "ambassador" and it includes activities to protect the team from outside pressures and lobby resources by frequent communication with individuals above them in the hierarchy. The second cluster, "task coordinator" refers to coordination of technical and design issues between teams. The third cluster, "scout" is related to collecting ideas and information from the environment. Finally, the fourth cluster involves activities that are used to prevent information flow from outside the team. This cluster is named as "guard". Moreover, Ancona and Caldwell (ibid.) studied the dependence between use of the different activity clusters and team performance. They found that team performance was positively associated with ambassadorial activity and task coordination activity. A negative relation was found between prolonged scouting activity. This they explain by the notion that teams must in some point move beyond the pure exploration phase and proceed towards implementation.

A recent study of Druskat and Wheeler (2003) focuses on the boundary spanning activities of team leaders in a manufacturing plant. Basing their reasoning on the intent and consequences of observed boundary spanning activities, they identify four different types of behavior by team managers: relating, scouting, persuading, and empowering. Relating refers to building social and political awareness and relationships within the team and in a wider contextual environment. Scouting is related to search and analysis of information in order to understand the needs of the team members. Persuading is related to influencing team members and other individuals to align their priorities and objectives to support the overall goals of the organization. Finally, empowering refers to delegation of power in order to create self confidence for a team on its ability manage itself.

Also other empirical studies have provided evidence on boundary spanning activities and their importance in the team and project context (Kellogg et al., 2006; Balogun et al., 2005; Ancona, 1990; Yan and Louis, 1999). These studies go beyond the instrumental perspective of utilizing boundary activities to transfer information to the actors. These studies explain the behavior of the boundary spanning individuals through their attempts to influence the power distribution and emergence of trust between the actors. The studies provide a valuable addition to the current understanding on group behavior and coordination in the temporary context. Most of the studies within this specific research area are, however, rather descriptive by nature and fail to establish a link between the observed behavior and its performance effects. In addition, the studies are often to a great extent context-dependent, and do not explicate the situational factors that would favor the use of the observed practices for favorable outcomes. The studies, however, reveal the existence of boundary persons and boundary spanning activities in many different organizational contexts and their value in facilitating the information exchange between the different units, as well as resolving emerging conflicts caused by divergent value systems and institutional perceptions.

2.3 Coordination and performance

Coordination between different organizational parts is often critical for the accomplishment of the common goal and therefore an important factor that explains organizational performance. The relation between performance and coordination has been the focus of several studies, especially in new product development, where the critical interface occurs between the R&D and marketing departments. For example Souder (1988) found in his empirical study of 56 consumer and industrial firms that the greater the harmony between marketing and R&D, the greater the likehood of success. In a similar vein, Cooper (1984) found in his study of 122 firms that management strategies that balance marketing and R&D were related to a higher percentage of new product success. Pinto et al. (1993) argue that cross-functional cooperation is important for the successful execution of projects

and the effective performance of an organization as a whole. Their study on cross-functional cooperation in 131 hospitals reveals that cooperation between organizational units correlates positively with the effectiveness of goal achievement and psycho-social outcomes, such as participant's satisfaction. In addition, the study of Menon et al. (1997) shows that interdepartmental connectedness has a positive impact on product quality. It has also been shown that functional integration in the product development process has a positive effect on organizational performance (Ettlie, 1995), as well as productivity, quality, and development time (Cohen and Regan, 1996; Allen, 1984; Clark and Fujimoto, 1991). A number of other empirical studies have proven that communication between different organizational units plays a significant role in product development performance (for reviews see Griffin and Hauser, 1996; Ernst, 2002).

Even though a positive relation between coordination and performance has been verified in several empirical studies, research has also shown that coordination has distinct cost effects, depending on the level and type of coordination exercised (Tushman and Nadler, 1978; Rice, 1992). Coordination costs emanate from the activities pursued to enhance the exchange of information and resolve conflicts between interdependent actors. Coordination can be considered to be effective if the advantages of coordination (e.g. faster development, reduction of ambiguity and conflicts) exceeds the costs of coordination. In other words, coordination is effective when it increases the performance of the entity or the system. Previous research suggests that the effectiveness of coordination mechanisms is often contingent upon certain acknowledged situational factors such as uncertainty, ambiguity, task interdependence, size etc. (Daft and Lengel, 1986; Daft and Macintosh, 1981; Galbraith, 1973). Thus, much of what has been written about coordination in organizations utilizes the well known contingency theory.

2.3.1 Contingency theory and coordination

At the most general level, the contingency theory states that "the effect of one variable on another depends upon some third variable, Z. Thus, the effect of X on Y when W is low differs from the effect of X on Y when W is high" (Donaldson, 2001). In the organizational context the contingency theory states that organizational effectiveness results from fitting organizational characteristics, such as coordination mechanisms to contingencies that reflect the situation of the organization. Thus, the contingencies determine which characteristics produce high levels of effectiveness for the organization (ibid.). The essence of the contingency theory can be summarized in two conclusions drawn from empirical studies (Galbraith, 1973):

1. The best way to organize does not exist

2. All way of organizing are not equally effective

The contingency theoretic interpretation of coordination implies that there is no single best way or structure for coordination in organizations, rather it is contingent upon the type of activities coordinated and on what environmental demands the organization confronts. The contingency theory has provided a stimulus for the emergence of a large amount of conceptual and empirical work on the use of different coordination mechanisms and the contingencies that explain their use in organizations (Thompson, 1967; Galbraith, 1973; Lawrence and Lorch, 1967a; Tushman, 1978; Van de Ven et al., 1976; Randolph, 1978; Daft and Lengel, 1986; and Rice, 1992, to mention some). Some of the most influential, which have had a major impact on increasing our understanding on coordination, are reviewed here.

One of the seminal studies that has explained the idea of requisite coordination (or integration) is Lawrence and Lorch's (1967) comparative study of differentiation and integration between organizational units within six organizations. They found that the greater the differentiation between the organizational departments, referring to differences in goal orientations, time orientations, formality of structures and interpersonal orientations, the more integration between them was required. Lawrence and Lorch distinguish between different integration devices due to different levels of integration needed. The higher levels of integration require more sophisticated devices, which in order of increasing sophistication are: hierarchy, rules, integrating individuals, and integrating departments (Lawrence and Lorsch, 1967a).

Thompson (1967) explains the use of different coordination mechanisms in organizations through different technologies associated with three different kinds of task interdependencies. Respectively, these different types of task interdependencies require the adoption of different type of coordination mechanisms. First, pooled interdependence refers to the situation in which organizational actors work independently from each other, each, however, contributing to the achievement of the common goal of the organization. In the case of pooled interdependence, the rules and procedures provide a sufficient means to guarantee coordination. Second, sequential interdependence refers to the situation in which the output of one task is the input for a second. When there is sequential interdependence between tasks, also schedules and plans in addition to rules and procedures are needed to coordinate the tasks and their sequence of execution. The third form of interdependence is called reciprocal interdependence. It refers to the situation in which the output of each actor serves as an input for others. Coordination of reciprocally interdependent tasks requires in addition to rules and procedures, and schedules and plans, also mutual adjustment. Mutual adjustment involves the delivery of new information during the process of action. The teamwork setting provides a good example of a

situation where the work inputs to the transformation process are acted upon simultaneously by the members of the work team. The results of the study by Van de Ven et al. (1976) support the findings of Thompson (1967) by revealing that the level of interdepartmental communication is positively related to interdependence among the participants.

Galbraith (1973) explains the requisite coordination in organizations from the information processing perspective. He argues that uncertainty related to the task is the main contingency factor that defines the appropriate coordination mechanisms. Moreover, he proposes that the increase in task uncertainty is directly proportional to the amount of information that must be processed by the decision makers during the task execution. Thus, the selection of proper coordination mechanisms dependents on decision makers' capacity to process information. For example, rules and procedures represent proper coordination mechanisms in tasks that are highly predictable and not uncertain. Coordination through lateral relations, such as integrators or coordination groups is needed when the tasks are highly uncertain and there is a need to process lot of information between the actors. A number of later studies support the view that information processing in organizations is positively related to the uncertainty of the tasks (Tushman, 1978, 1979; Van de Ven and Ferry, 1980; Daft and Macintosh, 1981; Randolph, 1978).

Daft and Lengel (1986) have complemented the information processing model presented by Galbraith (1973). They argue that not only the use of different coordination mechanism in organizations is driven by a need to reduce uncertainty, but also the level of equivocality determines the use of different coordination mechanisms. They base their argumentation on the famous study of Weick (1979), who states that the principal reason for organizing is to reduce equivocality between different members of the organization. The concept of uncertainty generally refers to absense of information, and equivocality means the existence of multiple and conflicting interpretations. Daft and Lengel (1986) propose that the two concepts, uncertainty and equivocality, place different requirements for coordination mechanisms in organizations to process information. The coordination mechanisms that enable an organization to process a high amount of information, such as rules and regulations, and formal information systems, are appropriate for reducing uncertainty. Mechanisms that enable processing rich information, such as group meetings, and integrators, are suitable for equivocal tasks.

The recent development in information technology has created new possibilities for organizations to coordinate work that is constrained by location, permanence, time, distribution, and distance. For example Rice (1992) has studied through multi-site exploration the effects of task analyzability on the use of new media. The study focuses on comparing the performance effects of information rich new media, such as videoconferencing and voice mail, and information lean new media, such as online

database and electronic mail in unanalyzable and analyzable task environments. Rice (ibid.) found mixed support for the hypothesis that the use of an information rich coordination medium would be more strongly associated with positive performance effectiveness in analyzable task environments than in unanalyzable task environments, and the use of information lean coordination medium would be associated more strongly with positive performance effectiveness in analyzable task environments than in unanalyzable task environments. The mixed results of the study seem to suggest that task analyzability might not be the only explanation for the use of different coordination mechanisms and related performance effects.

The contingency theory approach shares the general underlying premise that contextual factors (e.g. task analyzability) and structural factors (e.g. coordination mechanisms) should fit together in order for a organization to perform well (Drazin and Van de Ven, 1985, Donaldson, 2001). Thus, in contingency studies performance is explained through the concept of fit. High performance is a result of fitting together coordination requirements that emanate from the task and organizational environments, and the capacity of coordination mechanisms to fulfil these requirements. Venkatraman (1989) gives an extensive review of different forms of fit in strategy research. Even if a variety of forms of fit exist, it is often preferred to use the ones that are criterion-specific and thus appropriate for the specific context of the study (Nidumolu, 1996). Moreover, it has been argued that all fits are equally good (Van de Ven and Drazin, 1985). This implies that if the coordination strategy fits with the requirements of the (task) environment in case A and in case B, the performance would be equal in both cases. This quality is also called iso-performance.

Within this study the fit-concept represents a theoretical term that links logically the coordination requirements caused by structural complexities and the perceived uncertainty related to the program, with the coordination capacity of the portfolio of the adopted mechanisms. The existence of fit between coordination requirements and coordination capacity is expected to lead to high performance. In a similar vein, misfit between the coordination mechanisms and coordination requirements is related to low performance. The concept of performance itself is widely used in organization research. In the next sub-chapter I will discuss the concept of performance and its applications in multiple-project programs.

2.3.2 The concept of performance

The performance of the organization is generally measured through its effectiveness (Donaldson, 2001). Effectiveness has a wide meaning in contingency studies, including e.g. efficiency, profitability (Child, 1975), employee satisfaction (Dewar and Werbel, 1979), and innovation rate

(Hage and Dewar, 1973). From the ecological and system theoretical perspective, effectiveness is related to survival (Kast & Rosenzweig, 1972). Generally organizational effectiveness is, however, defined as the extent to which an organization achieves its goals (Parsons, 1961; Price, 1997), by its ability to function well as a system (Yuchtman and Seashore, 1967), or by its ability to satisfy its stakeholders (Pfeffer and Salancik, 1978). Thompson (1967) uses the term 'technical rationality' instead of effectiveness. He proposes that there are two different ways of evaluating technical rationality in organizations: instrumental rationality and economic rationality. Instrumental rationality refers to achievement of desired outcomes through taking specified actions. Economic rationality refers to achievements of results with the least necessary expenditure of resources.

There is no single criterion for organizational effectiveness, but organizational effectiveness is rather an open-ended multidimensional set of criteria (Yuchtman and Seashore, 1967), and effectiveness should be judged in a wider environmental perspective (Kast and Rosenzweig, 1972). Contrary to this view, in the project context, the success of projects is often evaluated through criteria that emphasize effectiveness in the management of single projects, i.e. achievement of goals within budget and time limits (see e.g. Shenhar et al., 2002, Ribbers and Schoo, 2002; Keller, 1994; Tatikonda, 1999; Tatikonda and Rosenthal, 2000; Kessler and Bierly III, 2002; Chen et al., 2005; Tushman, 1978; Larson and Gobeli, 1988). It has been argued that the most appropriate criteria to evaluate the successfulness of projects are its objectives (de Wit, 1988). The goal achievement of projects is in project management literature traditionally evaluated through efficiency measures, such as adherence to schedule, adherence to budget, and scope of the work. For example Shenhar et al. (2002) evaluate the meeting of design goals through four indicators; meeting operational performance, meeting technical performance, adherence to budget, and adherence to schedule. In a similar vein Ribbers and Schoo (2002) evaluate the successfulness of the process of ERP-implementation programs through measuring their adherence to plan and budget. Moreover, Keller (1994) has studied the performance of R&D projects through technical quality, meeting of assigned budget and cost performance, meeting the schedule, value to the company, and overall project group performance. The measurement of performance through narrow goal oriented measures, however, neglects the fact that projects often have connections to the organization's strategy and other projects (Dietrich and Lehtonen, 2005). Thus, most studies neglect the fact that project success should be understood as a multifaceted strategic concept that goes far beyond meeting the time and budget constrains (Shenhar et al., 2001).

Measuring effectiveness through organizational goals is not unambiguous, however. According to Price (1997), organizations often have multiple goals, which may diverge between different members

of the organization. In addition, the organization's public and operative goals may differ (ibid.). In addition, most of the existing empirical studies that explicitly measure or evaluate successfulness in the project context are focused on measuring the goal achievement of individual projects. The multi-project context has been less a focus of interest of researchers. It has been argued that the goals related to single project management are not sufficient enough to justify the existence of program entities, but rather their existence should provide additional benefits through improved coordination, improved dependency management, more effective resource utilization, greater senior management visibility, more effective knowledge transfer, as well as more coherent communication, improved project definition, and better alignment of project goals with business drivers and strategy (Lycett et al., 2004). By definition, the objective of the program entity is to improve the coordination between individual projects and thereby ensure the achievement of business benefits (Pellegrinelli, 1997; Turner, 1999). The effects of coordination are evaluated in some studies through the outcome measures related to indirect outcomes of coordination, such as effective goal achievement, team performance (Hoegl et al., 2004), or improved service level (Argote, 1982) that results from coordination. These effects represent the justification of the existence of a coordination system. However, coordination may also have direct effects on systems or participants, such as enhanced access to relevant information, improved picture of the overall situation of the entity in which the participants are operating in, and enhanced view of the status of participants' own work compared to others (Kraut and Streeter, 1995). The direct effects of coordination described above may have indirect long term effects related to task accomplishment itself. Many authors, especially in product development literature, have emphasized long term and indirect benefits, such as opportunity window (Cooper and Kleinschmidt, 1987), impact on company (Cooper and Kleinschmidt, 1995), strategic success, creation of new market, creation of new product line and development of new technology (Shenhar et al., 2001). In addition, it has been argued that learning from projects represents a key capability for project-based companies to maintain competitive advantage (Berggren et al., 2001).

Based on the discussion above and previous studies on coordination, I have adopted a multiple constituent's perspective on organizational performance and distinguish between two different areas of organizational performance that are important from the point of this study: meeting goals, and learning and innovations. These areas reflect the short team performance and long term performance of programs, respectively.

2.3.3 Conflicting contingencies

Previous research suggests that organizations face multiple contingencies (e.g. task uncertainty, task interdependence, size) concurrently, and multiple coordination requirements respectively (Drazin and

Van de Ven, 1985; Gresov, 1989; Andres and Zmud, 2001; Sambamurthy and Zmud, 1999). Variations in the contingency configurations (in a set of multiple contingencies) may result in conflicted demands on coordination requirements and are likely to create internal inconsistencies in structural patterns of organizations (Andres and Zmud, 2001; Drazin and Van de Ven, 1985). The multiple contingency theory states that in a given situation the contingency factors are expected to differ in their salience. Respectively, some of the contingency factors within the given situation represent more dominant ones while others are secondary, having either conflicting or unconflicting coordination requirements with the dominant contingency factors (Sambamurthy and Zmud, 1999; Gresov, 1989). Studies on multiple contingencies suggest that addressing conflicting contingencies simultaneously results in suboptimal behaviour (Sambamurthy and Zmud, 1999; Gresov, 1989). For example, Child's (1975) study on manufacturing firms shows that organizations with internally consistent structures perform better than those of inconsistent structures. Thus, lower performance is inevitable in the case of conflicting contingencies (Gresov, 1989). Conflicting contingencies increase the likehood of erroneous management choices and thereby may drive organizations to misfit, rather than to finding a variety of equally effective structural alternatives (Donaldson, 2001).

The primary attention of previous research utilizing the contingency theory is focused on identifying and measuring the effects of single contingency factors (Donaldson, 2001; Gresov, 1989). Therefore, some studies on conflicting contingencies are rather rare. However, previous research has revealed some pairs of contingency factors that may lead to conflicting demands. For example, Andres and Zmud (2001) have studied the effects of goal conflict and task interdependence on coordination. The results of their study shows that in the case of conflicted contingencies (that is combination of either high task interdependence and high goal conflict or low task interdependence and low goal conflict) result in lower productivity in projects. Gresov (1989) has studied the effects of task uncertainty and horizontal dependence on unit design and efficiency. The results of his study reveal that conflicting contingencies (high horizontal dependence and low task uncertainty and low horizontal dependence and high task uncertainty) are related to design misfit and lower performance. Moreover, Gupta et al. (1994) have studied the effects of task characteristics and institutional expectations on work-unit design in a government agency, and found that the more consistent the alignment between institutionalized expectations, task characteristics, and work unit design, the higher the work unit efficiency.

The studies above show that organizations face multiple contingencies that affect how organizations are structured and coordinated. In addition, some of the contingencies are expected to represent conflicting requirements with others and differ in their salience. This results in multiple fits or misfits

between the structural qualities of the organization and their contingencies (Donaldson, 2001). The fits and misfits all have an effect on organizational performance. Some researchers have argued that the fits are additive (Randolph and Dess, 1984), meaning that if the first fit (or misfit) is added to the second fit (or misfit) and so on, and the sum of all fits (or misfits) implies the overall effect on performance. It has also been argued that the combination of multiple fits is not additive, but a combination of fits that represents the system's fit (Drazin and Van de Ven, 1985). According to this view the effects of multiple fits on performance can not be evaluated through adding all fits together, but instead the effects on multiple fits represent a holistic property that can not be evaluated through atomistic analysis of each fit separately. This argument has, however, proved to have only limited empirical support (Drazin and Van de Ven, 1985).

Within this study, multiple contingency is approached through analyzing the concepts of structural complexity and uncertainty suggested by previous studies to explain how coordination takes place in an organization (Van de Ven et al., 1976; Adler, 1995; Gittell, 2002; Keller, 1994; Kraut and Streeter, 1995; Lawrence and Lorsch, 1967a; Nidomolu, 1996).

2.4 Complexity in programs

Several studies exist on coordination, and more broadly, organizing acknowledge complexity as the principal factor affecting the requisite coordination (Donaldson, 2001). But what does the complexity actually mean, and what are its effects on coordination? Through the elaboration of these questions in this chapter, I will derive a model that summarizes the elements of complexity in organizational development programs.

2.4.1 The concept of complexity in organization theories

In organization theory the concept of complexity is explained and studies from at least three different interlinked perspectives; from systemic perspective (Daft, 1992; Levinthal and Warligen, 1999; Dooley and Van de Ven, 1999), from decision-making perspective (March and Simon, 1958; Terborg and Miller, 1978; Payne, 1976; Campbell, 1988), and from socio-psychological perspective (Hackman and Lawler, 1971; Hackman and Oldham, 1976; Pierce and Dunham, 1976).

Systemic perspective on complexity

The researchers representing the systemic perspective often present complexity as an inherent, objective quality of a system of interrelated elements (Anderson, 1999). According to this perspective, the concept of complexity refers to the number of activities or subsystems within the organization (Daft, 1992). Moreover, organizational complexity can be measured along three

dimensions: vertical complexity, horizontal complexity and spatial complexity (Andersen, 1999; Hatch, 1997). Horizontal complexity refers to the number of different units or work specialities within the organization, vertical complexity refers to the number of levels from the highest to the lowest position in the organization, and spatial complexity refers to the number of geographic locations (ibid.). The systems theory argues that these structural complexities of the organization should be matched with the complexity of its environment and technology (Galbraith, 1973).

Levinthal and Warglien (1999) have explained organizational complexity through different landscapes that can be used to map the action of a group of individuals and their collective performance. If the elements of the system [e.g. individuals or projects] act independently, the landscape is called single-peaked. Improvement in any of the system's components leads to enhancement of the whole system. Adding interdependence between the elements of the system leads to a rugged landscape. Complexity in the rugged landscape comes from the local peaks that represent optimal behavior of the parts of the system, but not the optimal behavior of the whole system. Thus, rugged landscapes are characterized by unpredictability of behavior and need of coordination. Moreover, due to the linkages between the actors and processes of mutual adaptation between different parts of the system, landscapes may be coupled. In coupled landscapes the movement of one actor may change the landscape for other actors, posing added complexity. Thus, complexity in organizations and the unpredictability in their behavior is due to interdependencies between different elements of the system. Decreasing interdependencies and increasing autonomy leads to local search and predictability, whereas increasing interdependencies (e.g. introducing cross-functional teams) fosters the emergence of innovations and leads to added complexity (ibid.).

In addition to interdependency between the elements, the complexity of the causal system is also affected by its dimensionality (Dooley and Van de Ven, 1999). Dimensionality refers to the number of dimensions of a geographic space that are required to plot all the points in a return map of a time series (ibid.). For example in a human system, high dimensionality may imply a large number of individuals involved. Dooley and Van de Ven (1999) make a distinction between four different types of time series that reflect the behavior of the causal system: periodic, chaotic, white noise, and pink noise. First, white noise systems are high on dimensionality and there is no or just linear interaction between the causal factors of the system. For example, a human system of numerous individuals in which each individual acts independently of each other, represents a white noise system. Second, a pink noise system is characterized by many variables acting interdependently. A human system in which a large number of individuals are contributing to a collective action represents a pink noise system. Dooley and Van de Ven (1999) note that the interaction between individuals may emanate

from feedback loops or organizational constraints. These loops or constraints are, however, local, not global (or macro level feedback loops). Dooley and Van de Ven argue that the presence of global constraints or feedback loops would reduce the dimensionality of a system. If the dimensionality of the pink noise system is reduced, for example through global control mechanisms such as behavioral rules or cooperation between individuals, the system is called chaotic. Chaotic systems are characterized by low dimensionality and high interdependence between the acting variables (e.g. individuals or projects). Finally, a periodic system is characterized by low dimensionality, and the causal factors do not interact with each other or interact linearly. The simple interaction between the different causal factors of the system makes the system not sensitive to small changes. Unlike in the chaotic system, small changes in the system do not lead to the "butterfly" effect.

Moldoveanu and Bauer (2004) make a distinction between structural complexity and cognitive complexity. Structural complexity represents a property of a system, and cognitive complexity is a property of a model of the system that is used by an actor to predict or explain the behavior of the system. Moldoveanu and Bauer approach organizational complexity from the cognitive point of view and explain it through the computational complexity of the productions tasks. They propose that task complexity can be defined through a finite number of critically linked steps that together make up a task. An increase in critically linked steps corresponds to an increase in task complexity. The authors make a distinction between critically linked tasks (that denote complexity) and tasks that are critical in terms of the outcome. For example, neurosurgical operations include a high number of different and critically interlinked steps (that denote complexity) that are also critical in terms of the outcome. The tasks of graduate education may also involve many different and critically interlinked steps, but it is error tolerant since shortcomings in teaching methods may easily be remedied by another lecturer.

Decision-making perspective on complexity

The decision-making perspective relates complexity into a specific task with different alternatives to choose from. For example, March and Simon (1958) argue that complex tasks are characterized by unknown or uncertain alternatives of action or consequences of action. In addition, in complex tasks the mean-end connections are unknown and may include a variety of subtasks, which may or may not easily break down into independent parts. According to Terborg and Miller (1978), task complexity can be defined through path-goal dependencies. They propose two different scenarios for task complexity. First, tasks are considered complex if there seems to be multiple possible paths to choose from, but only one path leads to the desired results. Second, complexity may also emerge in the situation in which there really are several possible paths to achieve the goal, but the individual is required to find the optimal one.

Latham and Yukl (1975) propose that task complexity can be determined through the complexity of the outcomes of the task. Complex tasks contain several performance dimensions, some of which may also be qualitative ones. Complexity emerges from the necessity to determine optimal performance for the tasks by using uncertain and ambiguous performance criteria that may be interrelated in conflicting ways. Campbell (1984) has studied difficult employee scheduling tasks and defines complex tasks as having several and interrelated and conflicting elements to satisfy. The same idea has been used by Earley (1985), who defines complexity through the number of rules that need to be satisfied.

Many authors have also defined complexity through information. Steinmann (1976) relates complexity to the absolute amount of information involved in the task, the internal consistency of the information, and the variability and diversity of the information. Payne (1976) has studied task complexity from the decision making perspective and propose that complexity stems from the number of alternatives available for the decision maker and the amount of criteria used to evaluate each alternative. Schroder et al. (1967) define the properties of the complex task environment. They argue that the complexity increases as a function of the number of dimensions in information that require attention, the number of alternatives related to each dimension, and the level of information change.

Finally, Campbell (1988) proposes that task complexity can be defined through the following four task-related characteristics derived from theoretical analysis: the presence of multiple possible ways to achieve the desired end-state, the presence of multiple desired outcomes, the presence of conflicting interdependence among the paths to multiple outcomes, and the presence of uncertain or probabilistic links among paths and outcomes. With these four dimensions, Campbell (1988) creates a typology that distinguishes between four clusters of cases that differ in their complexity. Simple tasks represent cases in which none of the above-mentioned sources of complexity are present. Decision tasks are those in which the focus is on selecting the outcome that optimally achieves multiple desired end-states. Judgment tasks are characterized by conflicting and probabilistic nature of information. Finally, problem tasks are those that involve complexity related to finding the best way to achieve the outcome.

Socio-psychological perspective on complexity

Some researchers argue that complexity is primarily a subjective psychological experience (Campbell, 1988) that can be determined for example through task significance, task identity, or task scope (Hackman and Lawler, 1971; Hackman and Oldham, 1976; Pierce and Dunham, 1976). The researchers point out that complexity should be evaluated through person-task interaction, and the

complexity of the specific task dependents on the individual's ability and motivation to process the task in question. For example, Frost and Mahoney (1976) have studied goal setting and make a distinction between tasks with prescribed processes and tasks with nonprescribed processes. Nonprescribed processes are those of incompletely defined alternatives and several ways of reaching task completion. The tasks with nonprescribed processes are perceived as more complex. In addition, Frost and Mahoney (1976) propose that complexity is also dependent on the task doers' skills and insight. The socio-psychological perspective on complexity is to a great extend overlapping with the concept of uncertainty, which is elaborated further in the next chapter 2.5.

2.4.2 The concept of complexity in project research

In project and multi-project contexts the concept of complexity is often explained through the system perspective (e.g. OGC, 2003; Williams, 1999; Thiry, 2004: Ribbers and Schoo, 2002: Shenhar, 2001a,b). Some examples of definitions of complexity in multi-project and single project contexts are presented in Table 4.

According to Waldrop (1992), the complexity of a system follows from many independent agents in the system interacting in many ways. Following the idea of Waldrop (1992), Thiry (2004) has proposed that the environment of a program is often complex and the complexity itself emanates from multiple stakeholders with divergent and often conflicting needs, from emergent inputs for the management process, and from a high level of ambiguity. Payne (1995) argues that complexity in programs follows from multiple interfaces between the projects, between the projects and the parent organization, and between the related parties.

Williams (1999) proposes that structural complexity in projects emanates from the number of elements that are included in the project and the interdependence between the elements of the project. Both the increase in the number of elements (such as the number of stakeholders) and complexity in the relationships between the elements increase the complexity of a project (Williams, 1999).

Shenhar (2001) has modelled complexity in programs (or projects) by a hierarchical framework of systems and subsystems. In Shenhar's model, system scope constitutes, along with uncertainty, another dimension through which projects are categorized. System scope is divided to assembly projects, system projects and array projects. An assembly project is constructed of a single component or consists of a collection of components and modules combined into a single unit. An assembly project is either focused on a well-defined function within a larger system (being itself a subsystem) or is an independent function with a limited scale. A system project consists of interactive elements that function together within a single product or goal. In addition, a system project includes many

subsystems, each of which is capable of performing its own function. Finally, an array project is defined as a dispersed collection of systems that function together to achieve a common goal or purpose. In other words, an array project is a "supersystem", a collection of various systems. Array projects are often large in scale and are "built in an evolutionary form in which more and more systems are gradually added" (Shenhar, 2001). [5] Shenhar and Dvir (2004) explain that project complexity depends on the product scope, the number and variety of elements, and the interconnections among them. In addition, they mention that project complexity also depends on the complexity of the organization and the connections among its parties.

Table 4 Definitions of complexity in program and project contexts

Author(s)	Construct	Definitions
Danilovic and Sandkull (2005)	Program complexity	The main elements of complexity are: • Functional complexity (e.g. customer demands, functional requirements) • Technological complexity • People-related complexity
Thiry (2004)	Complexity of program environment	Not defined
Jaafari (2004)	Environmental complexity and project complexity	Environmental complexity refers to changes in market and regulatory regimes that affect the implementation of the project. Project complexity refers to interdependency between the subsystems.
Shenhar and Dvir (2004)	Project complexity	Project complexity refers to product scope, number and variety of elements, and the interconnections among them.
Ribbers and Schoo (2002)	Program complexity	Complexity refers to variety, variability, and integration.
Tatikonda and Rosenthal (2000)	Project complexity	The nature, quantity, and magnitude of organizational subtasks and subtask interactions posed by the project. The determinants of complexity are: • Technology interdependency • Novelty • Project difficulty
Clift and Vandenbosch (1999)	Project complexity	Project complexity refers to the extent of change provided. Reengineering projects are categorized as simple, whereas major modifications and highly innovative projects represent complex ones.
Williams (1999)	Project complexity	Number of elements included in projects and the interdependencies between them
Payne (1995)	Program complexity	Interfaces between the projects, parent organization, and related parties
Larson and Gobeli (1989)	Project complexity	The number of different disciplines involved in the project and the intricacy of the design

[5] Examples of array projects are New York City's Trancit Authority Capital Program issued to modernize the city transit infrastructure, and the English Channel Tunnel program.

Ribbers and Schoo (2002) have studied complex software implementation programs, and define complexity through the following three concepts: variety, variability, and integration. Variety refers to the number of elements and their interrelations in a given situation or system. Variability refers to the dynamics of the elements of a system over time and the interrelations between them. Integration is explained as the degree of innovation or change to existing business processes introduced through the program.

According to Jaafari (2004), the complexity of the project emanates from two different sources: from external environment complexity and from complex make-up of the project itself. Environmental complexity that affects the implementation and operations of the project is a consequence of changing market and regulatory regimes. Project complexity stems from the interdependence between the subsystems of hardware, software, project specific human and social systems, technical and technological systems, financial and managerial systems, specialized expertise, and information sets, which are all related to the management of the project towards its goals.

Danilovic and Sandkull (2005) propose that complexity in multi-project situations arises from functionality, people, and technology. Functionality-related complexity stems from the various customer demands, functional requirements, and specifications of the product. Technology-related complexity is based on product design, and emanates from the use of various technologies and their interaction. People-related complexity is related to how to organize people in the project structure and match the required skills with the respective needs. Danilovic and Sandkull (2005) argue that complexity, even if based on individuals' perception of the situation, can be treated as an analytic issue, while uncertainty, defined as variation of items through which work is performed and the unpredictability of individuals' behavior, should be seen as a management issue. They propose three sources of uncertainty in multi-project situations: organizational settings, product architecture, and project management.

2.4.3 A model of complexity in programs

In this study I adopt the systemic perspective on complexity. Thus, complexity is defined as an inherent quality of the system to be studied. The concept of complexity is in this study defined as:

"*the number of interrelated elements or sub-systems within the systems and the interdependency between them"(Rivkin, 2001)*

Some researchers call this kind of conceptualization structural complexity (Williams, 1999; Lebcir, 2002), to make a distinction between the objective qualities of the system and individuals' cognition of the complexity of the system. An increase in one or both of the building blocks of structural

complexity, the number of elements or interdependency between them, leads to increased complexity of the system (Dooley and Van de Ven, 1999; Levinthal and Warligen, 1999).

According to Hatch (1997), one of the most commonly used indicators of organizational complexity is horizontal differentiation, which is typically measured in organization theory through the number of different units in the organization. In large scale project settings, such as programs, the work is often organized into multiple (project) teams or units (Kazanjian et al., 2000), and these teams represent the building blocks of a program organization (Gray, 1997). Since the present study focuses on coordination between project teams in organizational development programs, it can be argued that the number of concurrent projects reflects the complexity of the program structure. Thus, it can be assumed that an increase in the number of concurrent project teams increases the structural complexity of the program. The complexity of the program organization emanates partly from the inter-project interfaces, whose quantity in a system of n concurrent project teams follows the formula n*(n-1)/2. The interfaces between organizational units represent the boundaries that are in the organization theory often suggested to form communicational barriers between the members in different units (Lawrence and Lorsch, 1967a; Griffin and Hauser, 1996; Dougherty, 1992). The barriers are created by the teams' concentration on their own tasks (Kazanjian et al., 2000), which enforces the emergence of team-specific culture and strong inertia, and impedes increased need of coordination.

In addition to the number of concurrent project teams and respective number of inter-project interfaces, the complexity of the program organizations has also been suggested to be dependent on the interdependency between the tasks of different project teams (Hoegl et al., 2004). Gerwin and Moffat (1997b) explain that in new product development, the interdependencies between the tasks of different project teams are a consequence of product architecture, and refer to the intensity and direction of workflow relationships between the different teams. As mentioned above the dependencies in workflows can be categorized to represent pooled, sequential, reciprocal and team dependencies (Thompson, 1967; Van de Ven, 1976). In project-type organizations the interdependencies between teams or sub-systems may evolve over time (Adler, 1995), and a project organization can be seen as either a coupled or separated system, not only became of the sub-systems' interdependency but also the intricacy between the temporal phases (Söderlund, 2002). Moreover, Kazanjian et al. (2000) argue that within large complex multi-team projects (or programs), the project teams do not pursue their tasks in isolation or in dyadic relations with other teams, but the entity forms a network of interdependencies between the teams acting in the project (program). Furthermore, it has been argued that due to an increase in the level of interdependency between

teams, the difficulty and costs of coordination will also increase (Thompson, 1967; Adler, 1995). Thus, in programs the interdependencies between the project teams are assumed to be another key factor that indicates the complexity of the program.

Geographical dispersion or distance between the actors has been claimed to increase the complexity of a project (Kim and Wilemon, 2003). Geographic dispersion and especially physical distance have been shown to have negative effects on communication behavior (Van Fenema, 2002). The distance reduces the frequency of communication, decreases the quality of communication, and increases the cost of communication (Kraut and Galegher, 1990). In addition, it has been shown that distance reduces the informal ad hoc communication that is often important in uncertain and complex projects (Allen, 1984). Geographically dispersed projects also include a number of challenges due to delays (Herbsleb and Mockus, 2003), inherent misunderstandings between the members of the team (Cramton, 2001; Hinds and Bailey, 2003), inconsistent working procedures, priorities in different sites, and problems in information sharing (Hinds and Mortensen, 2005). Due to the challenges in communication and lack of intimate knowledge of the context of remote sites, the geographical dispersion has been argued to increase the costs of coordination (Van Fenema, 2002). Therefore, the level of geographic dispersion, defined as the number of geographic locations, of the program is in this study assumed to increase the complexity of the program.

In development work accomplished by projects it is common that individuals from different organizations are involved (Berggren et al., 2001). Several studies, especially in product development, have focused on the impacts of including different organizations in projects. For example, studies by Hoegl and Wagner (2005), Birou and Fawcett (1994), Clark (1989), Droege et al. (2000), O'Neal (1993); Ragatz et al. (1997), and Wynsta et al. (2001) address the issue of supplier involvement in product development. Some empirical studies have shown that the involvement of suppliers in product development may induce managerial challenges and have negative affects on the outcomes of projects (Eisenhardt and Tabrizi, 1995; Von Corswant and Tunälv, 2002). Littler et al. (1998) argue, based on their empirical study of 106 organizations, that involving suppliers in product development increases the complexity related to the management of these projects. Cohen and Regan (1996) explain the complexities in technology intensive design projects through different gaps between customer expectations and the development team's perceptions on customer expectations. Moreover, Kim and Wilemon (2003) argue that in development projects complexity is encountered whenever more than two functional groups or organizations must work together in order to solve the development problems. I assume that also within the context of programs, the differences in organizational cultures may be one of the reasons that increase the complexity of the program.

Therefore, I suggest that the number of participating organizations, indicating the amount of potential cultural clashes, increases the complexity of the program.

Based on the discussion above I suggest a conceptual model of complexity that distinguishes between four characteristics that all reflect the complexity of the design of a program organization: the number of concurrent project teams, interdependency between the teams, geographic dispersion, and the number of participating organizations (Figure 4).

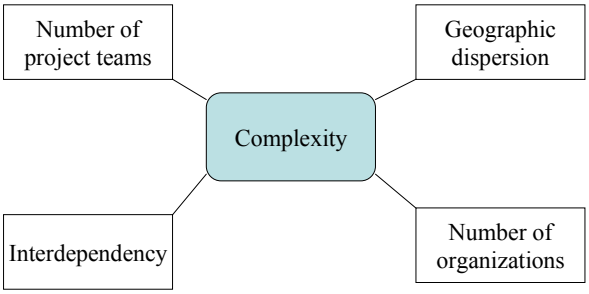


Figure 4 Elements of complexity in a program

An increase in any of the elements in the model, number of project teams, interdependency, geographic dispersion, and the number of participating organizations, is expected to add complexity of the program. The salience of each element is examined through an empirical study.

2.5 Uncertainty in programs

Management under uncertainty requires organic structures, opposite to mechanistic ones (Burns and Stalker, 1961). While mechanistic structures are based on centralized decision-making, well-defined roles and responsibilities, careful planning and top-down-orientation, the organic means to manage is grounded on the decentralization of decision-making authority, and lateral ways of communication (ibid.). Furthermore, it has been suggested that in uncertain situations the need for information increases, making hierarchical, centralized channels of information delivery insufficient and leading to adoption of complementary structures for coordinating activities (Galbraith, 1973).

Previous studies show that uncertainty seems to have significant effects on how groups of people are organized and managed (Burns and Stalker, 1961; Galbraith, 1973; Lawrence and Lorch, 1967a; Moenart et al., 1995; Shenhar, 2001a; Chen et al., 2005). The studies, however, seem to have divergent perspectives on the definition of the concept of uncertainty itself and its characteristics (Chen et al., 2005; Buchko, 1994; Kreiser and Marino, 2002; Milliken, 1987). In this chapter I will review the existing studies and definitions on uncertainty, and on the basis of the review, derive a model that distinguishes the relevant dimensions of uncertainty in programs.

2.5.1 Definition and characteristics of uncertainty

Early modernistic organization theorists considered uncertainty to be a property of the environment. Uncertainty was seen as a result of two different causes: complexity and rate of change. According to this conception, complexity refers to the number of different elements in the environment and the rate of change indicates how rapidly these elements change (Hatch, 1997). In new product development literature the two generally accepted sources of uncertainty are market and technology (Souder et al., 1998; Chen et al., 2005; Tatikonda and Montoya-Weiss, 2001).

Organization theorists Lawrence and Lorch (1967) provide a different explanation by arguing that uncertainty is related to different organizational sub-environments (such as sales, production, and R&D) through three components: lack of clarity of information, uncertainty related to causal relationships, and the time span of feedback on the results. According to Scott (1992), uncertainty in organizations can be measured through the variability of inputs, the number of exceptions encountered in the work process, and the number of major product changes experienced. Thompson (1967) argues that uncertainty emanates from the organizational environment. Uncertainty is due to a lack of understanding the cause-effect relationships of the culture at large, and a lack of understanding which organizational outcomes are partly shaped by environmental elements.

It has also been proposed that uncertainty is not a characteristic of the environment, but it lies rather in the head(s) of the organizational decision maker(s) (Duncan, 1972). Accordingly, uncertainty is rather a characteristic of the decision maker's perception than environmental quality. Duncan has measured perceived uncertainty through individual verbal statements of the perceived uncertainty. He defines uncertainty to consist of: lack of information about the environmental factors related to the decision making situation, lack of knowledge about the outcome (or effects) of a specific decision, and the ability or inability to appoint probabilities related to the effect of a given factor on the success or failure of a decision unit. Duncan emphasizes that environmental factors used in measuring uncertainty are dependent on the perceptions of organizational members and thus may vary among individuals. Galbraith (1973) explains uncertainty through the concept of task environment. He proposes that the perception of uncertainty of individuals responsible for decisions on organizational design is affected by environmental factors in the task environment that is created by the organization itself.

It has also been argued that the individual's perception on situational uncertainty can be explained by situational favourability (Nebeker, 1975). Situational favourability refers to the favourability of the situation for the leader of the work group. The favourability of the situation can be explained by leader-member relations, the amount of training the leader possesses, and the leader's perceived

control or influence over the workgroup. Nebeker (1975) has studied the linkage between the situational favourability of the supervisors and environmental uncertainty in naval maintenance shops and in a county public work department. The results of both studies revealed that environmental uncertainty is positively related with situational favourability.

Weick (1979) explains uncertainty through his theory of enactment. According to the enactment view, environmental conditions can not be separated from the perceptions on those conditions. Both the uncertainty and environment are located in the decision maker's head. Environmental uncertainty is constructed through demands of the increasing amount of information. Based on this view, people understand their uncertainty as a lack of information and explain it through the complexity and change in the environment. From this point of view, both buffering and boundary spanning serve as mechanisms to create a complex environment rather than means to absorb it.

Downey and Slocum (1975) conceptualise uncertainty as a psychological state of the individual. They define uncertainty as "*a state that exist when an individual defines himself as engaging in directed behaviour based upon less than complete knowledge of (a) his existing relationships with his environment, (b) the existence of and knowledge of conditional, functional relationships between his behaviour and environmental variable to the occurrence of a future (t1) self-environmental relation, and (c) the place of future (t1) self-environment relations with the longer time frame (t2…tn) of a self-environment relations hierarchy*". Downey and Slocum (1975) propose that man does not interact directly with the environment, rather he maps it, and the map of reality he forms is always less than complete. They state that four sources of variability exist in the process of mapping the environment, which cause variation in an individual's perception of uncertainty. First, environmental characteristics, such as complexity and dynamism are associated with the perception of uncertainty[6]. It is expected that an increase in either complexity or dynamism increases the perception of uncertainty. Second, an individual's cognitive processes, such as tolerance of ambiguity, affect his perception of uncertainty. Third, the perception of uncertainty is also dependent on an individual's behavioural response repertoire. Downey and Slocum (1975) propose that the experience of a variety of situations will increase the range of behaviour patterns to cope with the situation. This variety of

[6] Downey and Slocum (1975) base their environmental characteristics on the work of Emery and Trist (1965), Thompson (1967), and Terreberry (1968). In their terminology, a complex environment refers to one in which "the number of interactive relations relevant for the decision making require a high degree of abstraction in order to produce manageable mappings". The dynamic environment is characterized by a constant change of factors that are relevant for the decision making.

behaviour patterns is increased through various learning experiences. Finally, Downey and Slocum (1975) argue that also social expectations affect the perception of uncertainty. For example the level of discretion defined for the organizational position reflects the organizational expectations of uncertainty related to that position.

Daft and Lengel (1986) make a distinction between the concepts of uncertainty and equivocality. Based on the definition of Galbraith, they argue that uncertainty refers to *"the difference between the amount of information required to perform the task and the amount of information already possessed by the organization"* (Daft and Lengel, 1986). Equivocality refers to ambiguity, *"the existence of multiple and conflicting interpretations about organizational situation"* (Daft and Lengel, 1986). In other words, high equivocality refers to confusion and lack of understanding, while high uncertainty means lack of information.

The information perspective in the organization theory states that managers experience uncertainty when they perceive that the environment is unpredictable. The sense of unpredictability is due to a lack of information (Aldrich and Mindlin, 1978). Hatch (1997) has explained the linkage between the perceived environment, uncertainty and information as follows: when the perceived rate of change in the environment is low and the environment is not complex, managers sense that they have all the needed information and they perceive a low level of uncertainty. An increase in the complexity or rate of change makes managers to face either too much information or a need to constantly find new information. In either of the cases managers perceive a moderate level of uncertainty. If both the rate of change is high and the environment is highly complex, managers confront a huge amount of constantly changing information. In this situation managers do not know what information they really need and feel highly uncertain.

The concept of uncertainty is often also related to the concept of probability in management sciences. Williams (2002) suggests that there is a distinction between two types of probability statements, aleatoric and epistemic. Aleatoric statements are related to intrinsically uncertain situations. For example, a machine that makes castings will cast a different amount of material each time, and the difference will lie in a recognizable distribution, and thus represents an aleatoric uncertainty statement. However, by asking how much material a new machine will cast, represents an epistemic uncertainty statement. Epistemic statements are related to a measure of belief or more generally, lack of complete knowledge. In this example the fact that one has not tried out such a machine before, forces one to express a certain uncertainty. The epistemic uncertainty statements are also, according to the definition, characterized by the fact that individuals may not know what they do not know (Williams, 2002). In addition, these two different types of uncertainties, aleatoric and epistemic, seem

to merge with each other in complex real life situations (ibid.). The aleatoric perspective on uncertainty has induced a wide range of research in management science executed under the label of risk management (see e.g. Ward and Chapman, 2001; Miller and Lessard, 2001; Jaafari, 2001).

The review above shows that the uncertainty itself can be explained by different factors, depending on the focus of the study. Many of these different perspectives, however, agree that uncertainty is a perceptual concept and is affected by both individual and environmental characteristics (Chen et al., 2005). However, due to the fact that the personal characteristics of different individuals are out of the scope of this study, I have adopted the definition suggested by Galbraith (1973) and Daft and Lengel (1986), according to which uncertainty refers to *the difference between the amount of information required to perform the task and the amount of information already possessed by the organization.*

The definition above forms a basis for the information organization perspective, according to which organizational performance depends to some extent on the fit between the characteristics of the coordination mechanisms used and the characteristics of the task (Daft and Lengel, 1986; Rice, 1992). The next sub-chapter presents the general characteristics of the task that reflect its overall uncertainty.

2.5.2 Task uncertainty

Perrow (1967) explains that the uncertainty related to specific tasks can be explained through the concept of technology. Technology refers to the knowledge, tools and techniques used to transform inputs into organizational outputs (Daft and Lengel, 1986). Two distinct characteristics define the technology: the analyzability and variety of the task (Perrow, 1967). Analyzable tasks are characterized by predetermined responses to potential problems, and well-known procedures are available. The outcomes of the analyzable tasks are known, and the people involved are able to respond to challenges that arise during the process of task completion. In addition, in analyzable tasks the procedures to cope with the situation are established and the individuals performing the tasks do not have to rely only on previous and shared experiences about the task establishment (Rice, 1992). According to Daft and Weick (1984), environments, events and processes related to analyzable tasks are hard, measurable, and determinant. Thus, the accomplishment of analyzable tasks is based more on the processing of formalized and written information (Rice, 1992).

In unanalyzable cases, the completion of the tasks is based more on personal, ad hoc and improvisational forms of processing information (Daft and Weick, 1984). Unanalyzable tasks require individuals to participate in a creative process that exists outside the area of facts, rules or procedures (Rice, 1992). According to Kim (1988), unanalyzable tasks require personal means of coordination through instantaneous sharing of information between the individuals.

Task variety refers to the frequency of unexpected and novel events that happen during the process of task completion (Daft and Macintosh, 1981). A low variety related to the task has been said to be related to the participants' experience of certainty related to future events (Daft and Lengel, 1986). High variability of the task, instead, refers to a low ability of the participants to predict problems and activities in advance (Daft and Macintosh, 1981).

In project-like organizations the analyzability and variety, unlike in permanent organizational settings, do not remain constant. For example, Souder and Moenart (1992) propose that variability is decreased and analyzability increased during the project's life-cycle. Also the arguments by Adler (1995) support the same view that the characteristics of technology, analyzability and variability, do not remain constant during the program, and the coordination requirements also change as the organization of the program evolves in time. Adler (1995) conceptualises the concept of uncertainty in product development context through two dimensions: novelty and analysability. He defines the novelty of the project as the number of exceptions with respect to the organization's experience of previous situations. Thus, the concept of novelty in Adler's terminology is not related to the novelty of the product in the market, but rather indicates how well the organization's existing procedures cope with the new situation at hand. Analyzability, on the other hand refers to "*difficulty of the search for an acceptable solution for the given problem*" (Adler, 1995). According to Adler (1995), the increase in novelty leads to increased uncertainty. Respectively, a low degree of analysability creates uncertainty and calls for creation of new information.

2.5.3 Elements of uncertainty in programs

According to the information processing perspective, the more uncertain the tasks are, the more information is required to be processed during the task in order to achieve the necessary knowledge to complete the task (Daft and Lengel, 1986; Galbraith, 1973; Daft and Macintosh, 1981). The uncertainty that affects the task completion emanates from various sources and represents thus a multidimensional construct (Chen et al., 2005). Respectively, various models has been presented that describe the related uncertainty (Moenart et al., 1995; Kessler and Bierly III, 2002; Chen et al., 2005; Loch and Terwiech, 1998; Tushman and Romanelli, 1983). In this study I adopt the generally acknowledged model based on Perrow's (1967) model of technology introduced above, and distinguish between two concepts that are used in this study to reflect the uncertainty of the program task, the analyzability and novelty related to the program. Of these two concepts, that are explained above, the former one is expected to be negatively related to uncertainty and the latter one positively related to uncertainty.

Task analyzability

Task analyzability is related to the way that individuals are able to respond to problems that arise in the completion of tasks. Analyzable tasks are those in which well-known procedures to cope with arising problems are available, and the outcomes of the tasks are understood (Rice, 1992, Perrow, 1967). Daft and Macintosh (1981) evaluate task analyzability through the following characteristics: work activities guided by standard procedures, directives, and rules, known procedures and standard practices to do the work well, understandable sequence of steps that can be followed in carrying out the work, and established materials (manuals, standards, directives, statuses, technical and professional books, and the like) covering the work. Nidumolu (1996) relates task analyzability (requirements analyzability) to the use of a clearly known way to accomplish the task, use of available knowledge, use of existing procedures and practices to cope with the situation, and the use of an understandable sequence of steps in task completion. Kraut and Streeter (1995) use the term project certainty in a similar meaning to task analyzability. They define projects with high certainty to include a clearly defined body of knowledge or subject matter that guides the work on projects.

Based on the definition of task analyzability by Perrow (1967), Rice (1992), and Tushman and Romanelli (1983), the concept of task analyzability is used in this study to refer to the *degree of understanding or clarity related to a program and its execution.* The evaluation of the task analyzability has been modified from the indicators used by Daft and Macintosh (1981) and Nidumolu (1996), and include the following items: required working methods well-known, resource and competence needs understood and defined, clarity about inter-project interdependencies, and understanding about the relevant stakeholders.

Task novelty

The novelty related to different elements of the task and the lack of knowledge of how to accomplish the task increases the uncertainty of the task (Daft and Lengel, 1986; Perrow, 1967; Tushman and Nadler, 1978). The novelty or newness is in the new product development literature often related to technology produced as a result of development efforts,and in innovation literature often categorized as radical or incremental (Dewar and Dutton, 1986; Ettlie et al., 1984; Tatikonda, 1999). These models relate technological novelty to the product of the development activity, also called product technology novelty (Tatikonda and Rosenthal, 2000). In addition to product technological novelty, technological novelty can also be related to the development process. For example, Tatikonda and Rosenthal (2000), Tatikonda (1999), and Chen et al. (2005) relate technological novelty, in addition to project outcome, also to the processes needed to accomplish the project task, and define it as

process technology novelty. In a similar vein, Shenhar (2001a, 1998) defines technological novelty through the organization's familiarity with the technology used in the development of the product. In this study the novelty of the programs is evaluated on the basis of the concept of technological novelty and measured through three distinct indicators modified from Tatikonda (1999): the technological novelty of the program's outcome from the organization's perspective, novelty related to the working methods used in the program, and novelty of the resource and competence needs in the program.

2.6 Synthesis and a refinement of the research model

The need for coordination is often explained through organizational boundaries that emerge as a consequence of task division and are enforced by differences in interpersonal and goal orientation (see chapter 2.1.2). This view is to a great extent based on the studies on coordination in permanent organizational context, and is related to the adoption of different coordination mechanisms based on the structural properties of the organization, such as differentiation between the organizational parts (Lawrence and Lorsch, 1967) and type of technologies (Thomson, 1967) linking the organizational parts together. Accordingly, increase in differentiation between the organizational parts and technological interdependence between the tasks performed by the organizational parts increases the need for coordination and requires more participative mechanisms to accomplish the coordinative tasks. Complementary to this perspective, some contingency studies have suggested that the utilization of specific coordination mechanisms can be explained through information requirements (Galbraith, 1973; Daft and Lengel, 1986). Uncertainty related to the task to be accomplished or its environment increases the information need of decision makers. In addition, recent research has acknowledged the effects of location and time, which play a critical role especially in globally dispersed tasks organized through projects (Van Fenema, 2002).

The existing research on coordination has revealed a number of barriers for coordinated work and the mechanisms through which the coordinative actions take place in organizations (Table 2). Most of the current studies on coordination, however, fail to provide a realistic picture on actual coordinative behavior. This is due to the fact that most studies focus on identifying the relations between individual coordination mechanisms, factors that explain the adoption of certain mechanisms. In reality, however, organizations do not utilize single coordinative mechanisms, but a portfolio of different mechanisms and practices in order to guarantee sufficient coordination between the actors. According to Adler (1995):

"… any given development effort will involve more than one product/process fit problem and that these different problems typically evidence different degrees of novelty and analyzability. So the optimal coordination approach for the project will involve a portfolio of mechanisms, the mix being determined by the relative importance of different types of problems." (p. 159)

Thus, the question of what kind of a portfolio of different coordinative actions should be applied in different types of programs has not been answered by existing studies. In addition, most empirical studies on coordination are based on coordination in permanent organizational contexts (Nidumolu, 1996; Bryman et al., 1987). The ongoing emphasis on temporary organizational structures as one of the key forms operating in different industries has created a need to extend our understanding of coordination into temporary organizations. Among the project management literature the new emerging area – management of multiple project entities such as programs and portfolios – has received increasing attention. Management of multi-project entities has been argued to enable the achievement of organizational goals and serve as a communication bridge between organization strategy and operational level activities, such as projects. Programs represent a special case of temporary organizations that include a number of individuals from different areas of expertise, with divergent cultural worlds collected together to accomplish a specific complex task (see pp.12-17). In addition, the task accomplishment is structured around multiple concurrent and interdependent project teams. These characteristics result in unique demands and challenges for coordination, and thus the mechanisms utilized in permanent organizational context may not suffice. Moreover, the studies on coordination in the project context are largely focused on coordination in product development. Significantly less attention has been paid to coordination in organizational development, even though the organizational internal processes and ways of working as means of organizing the activities of knowledge creating and coordination has been argued to be one of the potential factors that might explain why some organizations competing with the same products are superior to others (Teece et al., 1997; Eisenhardt and Martin, 2000).

The present study extends the current knowledge on coordination into programs that represent a specific and increasingly utilized mode of organizing complex and uncertain development efforts. The study focuses on identifying the mechanisms through which coordination takes place in practice, discovering the overall logic of coordination in programs by examining coordination strategies, i.e. portfolios of coordination mechanisms applied and their relative importance within the portfolio. Moreover, the study distinguishes between two different arguments from the literature that explain the adoption and utilization of distinct strategies; systemic structural design-based (Thompson, 1967; Lawrence and Lorsch, 1967) and information processing-based ones (Galbraith, 1973; Tushman and

Nadler, 1978; Daft and Lengel, 1986). First, the systemic structural-based argument is associated within this study to the concept of complexity, and is based on the idea that the structural dimensions of the program organization, such as the number of concurrent project teams, interdependency between the project teams, organizational diversity, and geographical dispersion define the required coordination and respective adoption of a certain coordination strategy. It is reasoned that increase in the number of concurrent project teams and the interdependency between them increases complexity and thereby the overall need of coordinative actions within the program. In addition, geographical dispersion sets specific challenges for coordination through the high distance and temporal differences between the coordination parties. In a similar vein, organizational diversity sets specific demands on coordination through potential conflicts and barriers on understanding, which emerge when individuals with different backgrounds and from different organizational, cultural and institutional environments are brought together to accomplish a common task (Prencipe and Tell, 2001; Sydow et al., 2004). Second, the information processing-based argument states that the existence of coordinative actions can be explained through a necessity to process information to support different decisions required in the task accomplishment. This information processing perspective is within this study associated to the concept of uncertainty, which refers to a lack of information or knowledge required to accomplish a task. Based on the literature analysis, the concept of uncertainty is related to the two different qualities of the task; analyzability and novelty (see chapter 2.5). The analyzability of the task accomplished through the programs refers to the degree of understanding and clarity related to the goals and execution of the task. Unanalyzable tasks require intense, participatory and flexible information processing and coordination between the participating actors in order to be successfully accomplished, unlike analyzable tasks that call for fairly structured means for managerial actions. The concept of novelty refer in this study to the organization's familiarity with the technology used in the development of the product or service. It is reasoned that the higher the novelty of the task, the more information needs to be processed between the participating actors, causing a stronger higher need for coordination.

Moreover, in this study I adopt the concept of fit from the contingency studies and argue that the coordination strategies adopted and utilized by the programs, if fit with the requirements caused by both structural properties of the program organization (yielded by complexity) and information processing requirements (yielded by uncertainty), lead to high performance. I distinguish between two different performance effects: direct and indirect, the former being related to the achievement of the goals, and the latter to the emergence of future long term benefits through learning and innovations. Figure 5 summarizes the key concepts and constructs, and their relations in this study.

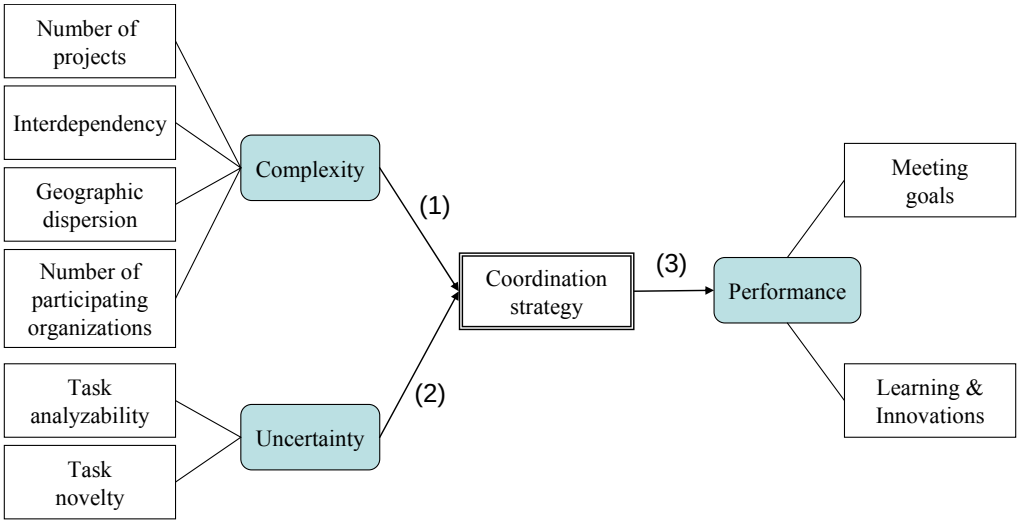


Figure 5 Research concepts and constructs, and their relations

In Figure 5 the white rectangular boxes represent constructs that are subject to empirical observations and analysis. The rounded colored boxes represent theoretical concepts that are not directly measured or empirically analyzed, but are utilized to relate empirically observed constructs with each other through arguments derived from the existing theory. The single lines between the theoretical concepts (rounded, colored boxes) and empirically observed concepts/indicators (rectangular boxes) refer to the relation between these two elements derived from the existing literature. The arrows between the theoretical concepts (rounded, colored boxes) and empirical constructs (rectangular boxes) indicate the idea of a causal path that is followed within this study. This causal path includes antecedent factors (complexity and uncertainty) that lead to the adoption and utilization of certain patterns of behavior (coordination strategy), which depending on its fit with the different antecedent factors is expected to have effects on the performance of the program. The arrows between the complexity and coordination strategy, and uncertainty and coordination strategy reflect the structural argument (1) and information processing argument (2) explained above. The arrow between the construct coordination strategy and performance concept refers to the fit argument (3). This frame is used in this study to guide the empirical research on coordination between project teams within programs.

3 RESEARCH METHODS AND DATA

The objective of this study is to gain new understanding on coordination in the organizational development context. More specifically, the focus of this study is on coordination between different project teams within the organizational development program. I identify individual coordination mechanisms used in organizational development programs, and recognize specific coordination strategies based on the identified coordination mechanisms. I examine how two distinct antecedents of coordination, complexity and uncertainty, are related to the use of different coordination strategies. Moreover, I identify the relations between the use of different coordination strategies and program performance. The research context and the specific research questions were stated in Chapter 1, and this chapter introduces the scientific paradigm which this research belongs to, the research strategy, including the logic through which the research questions are answered, the research design used in this study, the data collection process, and the process of data analysis.

3.1 Scientific paradigm

Philosopher Thomas Kuhn (1970) defines normal science as "*research firmly based upon one or more past scientific achievements, achievements that some particular scientific community acknowledges for a time as supplying the foundation for its future practice*". These achievements, if adequately revolutionary to attract a group of enthusiastic researchers and open-ended enough to provide problems for a group of people to resolve, are called paradigms (ibid.). The scientific paradigm in this study is to a great extent determined by the choices of theoretical frames and reference literature within which the results of the study are reflected. This study builds upon three distinct theoretical areas; the contingency theory, organizational coordination, and studies of projects as special cases of temporary organizations. First, the contingency theory, and more specifically, the structural contingency theory serves as the general meta-theoretical frame guiding the design of the study. It is one of the key issues in this study to investigate how antecedents, such as complexity and uncertainty, are related to the utilization of different kinds of coordination strategies. According to Donaldson (1996), the theoretical frame and empirical evidence utilized within the structural contingency paradigm are positivist. The core idea behind the paradigm is that the structure of an organizations is determined by such factors as technology and size, and the fit between the contingencies and organizational structure affect the performance of the organization. Ideas and values are not considered as causes to organizations' structural configuration (ibid.). Most often, the analysis is rather depersonalized and focused on the organizational level, rather than the individual level (Pennings, 1992). In addition, the employed research methods are often based on comparing a

number of different organizations to find an association between contingency and structural factors (Donaldson, 1996).

Second, studies on organizational coordination in different contexts provide an extant body of knowledge in which the empirical findings of the study are compared. The vast majority of studies on coordination can be categorized as belonging to the structural contingency theory paradigm (e.g. Thompson, 1967; Lawrence and Lorsch, 1967a,b; Van de Ven et al., 1976; Edström and Galbraith, 1977; Pinto et al., 1993; Keller, 1994; Kraut and Streeter, 1995; Nidumolu, 1996; Menon et al., 1997; Nihtilä, 1999; Sicotte and Langley, 2000; Leenders and Wierenga, 2002; Tsai, 2002; Sherman, 2004; Hoegl et al., 2004), and thus represent positivistic research.

Finally, in addition to the theoretical reference field, this study is related to the positivistic paradigm through its overall goal as well. However, unlike in many other studies within the positivistic paradigm, applying deductive logic in theory development, this study bases the reasoning on inductive reasoning. The aim of this research is, through examination of selected case studies, to induce generalizable propositions that are subjected to be tested in a larger set of organizational development programs. Thus, rather than basing the research on falsification of logically constructed hypotheses (Lee, 1991), I focus on a particular set of programs, and through in-depth investigation of these, aim to generate theoretical explanations for the observations that would be valid also in a larger set of programs. Through this objective the study is aligned with the fundamental premises of the positivistic research paradigm. Thus, in line with this research paradigm I adopt a realistic ontology and acknowledge the existence of a real social world independently of an individual's recognition of it (Burrell and Morgan, 1979).

3.2 Research strategy

Research strategy describes the logic of answering the research question. It serves as a basis through which the researcher may convince the validity of his findings (Remenyi et al., 2000). It is defined as a basic approach of creating new knowledge and theories (Reisman, 1988). The discussion on research strategy is largely guided by the relationship between data and theory (Easterby-Smith et al., 1991). The primary objective of this study is to increase understanding on inter-team coordination in programs through explanatory empirical research. The research strategy used in this research is categorized as inductive, because it begins from specific empirical findings that are generalized to create new theory, opposed to deductive strategies, which take theoretical truths as a starting point and aim to deduce it to a distinct problem. (Olkkonen, 1993).

Eisenhardt (1989) argues that the ideal beginning state of inductive theory generating research should be lack of any kind of hypothesis or assumptions related to the phenomenon to be studied. Others have suggested that some amount of theoretical understanding helps to direct and focus the study (Yin, 1994; Miles and Huberman, 1994). In the actual research process the inductive and deductive cycles alternate during the different phases of the research (Miles and Huberman, 1994; Emory, 1985). In this study, the overall analysis of relevant literature on coordination and programs has formed the basis for case selection and further consideration of the research strategy.

In addition to the general categories of inductive vs. deductive, and empirical vs. conceptual, the research strategy utilized in this study is explained more specifically. Yin (1994) describes three conditions that affect the choice of research strategy; the type of research question posed, the extent of control the researcher has over the actual behavior of the events, and whether the research focuses on contemporary or historical events. These conditions define which of the empirical approaches, experiment, survey, archival analysis, history and case study, are appropriate for different situations. This study was guided by the research question, *what kinds of coordination strategies enable effective coordination in complex and uncertain organizational development programs?* The research question is explanatory by nature and requires the researcher to acquire in-depth contextual understanding in order to provide an answer for the question. In addition, this study focuses on a contemporary phenomenon, and the researcher has had no control over the behavioral events of the study. These restrictions, according to Yin (1994), leave three possible research strategies to be chosen: case study research, survey research, and archival analysis. From these options, the case study strategy was selected as the primary approach for the purposes of this study. Several reasons explain this choice. First, because the aim of this study was to base the findings of coordination mechanisms on actual patterns of behavior, the case study strategy was seen superior to archival analysis, which could limit the study on formal behavioral events. Second, the phenomenon was, even though well focused, not understood sufficiently enough to employ a survey study. The case study strategy enabled the understanding on the phenomenon to increase during the study, and supported the selection of the inductive theory building logic. In addition, the case study strategy was seen as an appropriate strategy to study a technologically distinctive and complex phenomenon in which there are more variables of interest than data points. Finally, the case study strategy has been used successfully to study coordination in globally distributed projects (Van Fenema, 2002), in complex systems development (Taxen, 2003), and in design/manufacturing interface (Adler, 1995). Thus, the case study strategy was seen appropriate for the purposes of this study as well.

Case study refers to an empirical inquiry that investigates a contemporary phenomenon within the real life context, when the boundaries between the phenomenon and context are not clearly evident, and in which multiple sources of evidence are used (Yin, 1994). The principal characteristic of a case study is profound focusing on the research object, being it either a group, an organization, a culture, and incident or a situation (Ghauri, 2004). Finally, Eisenhardt (1989) states that case studies are an especially appropriate approach to examine a phenomenon that is either relatively unknown or the current perspectives are inadequate or conflicting. The focus of examination in this study, coordination in organizational development programs, fulfills the above mentioned criteria and characteristics of the case study research.

3.3 Case study design

After the determination of the case study research strategy, the design of the case study includes the following key issues: selection of cases, planning of data collection instruments, and selection of informants. These issues are discussed next.

3.3.1 Case selection

In case oriented research every case should serve some specific purpose within the overall study (Yin 1994). Thus, the selection of cases should not be based on a random choice. The selection should not be based on a statistical sampling from a larger population, either. In case study-based research the selection of cases should be directed by theoretical reasons, often called replication logic. (Eisenhardt, 1989; Yin 1994)

Two types of replication logic have been suggested: literal replication or theoretical replication. In the literal replication logic, each of the selected cases predict similar results. In theoretical replication, the cases are selected to represent theoretically polar types producing different results for identifiable reasons (Yin 1994). The selection of the cases in this study follows the theoretical replication logic. Some researchers have proposed that the performance of the cases provides a proper ground for selecting cases (Bourgeois and Eisenhardt, 1988). In addition, also other dependent variables, such as organizational integration have been used as a criterion in selecting cases (Meyer, 2001). However, because this study focuses on identifying different coordination strategies and explaining how situational factors (uncertainty and complexity) would explain the selection of distinct strategies, the performance of the case programs was not used as a criterion in the case selection. Rather, the aim of the theoretical replication was to achieve variance in situational factors. However, because some of the situational factors (e.g. task analyzability, task novelty, and interdependencies) could be analyzed only based on the in-depth understanding and analysis of the data several additional criteria were

established in order to guarantee the requited variance in situational factors. The theoretical replication of the cases on the several dimensions was based on the analysis of the data acquired from the thematic interviews and on the first semi-structured interviews. The following criteria were used in the case selection process: number of concurrent projects, number of organizations involved, geographic dispersion, type of the program structure (as a proxy of interdependence), experience on programs alike (as a inverse proxy of task novelty), and the perception of the "fuzziness" of the program (as a inverse proxy of task analyzability). The case selection criteria related to theoretical replication and selected cases are described in Table 5.

Table 5 Case selection criteria related to the theoretical replication

Case	Number of projects	Organizations involved	Geographic dispersion	Program structure	Previous experience	Fuzziness
Alpha	Low	Many	Dispersed	Product	Moderate	High
Beta	Low	Many	Dispersed	Product	High	Low
Gamma	Low	Many	Dispersed	Product	Low	Low
Delta	Low	Many	Localized	Product	High	Low
Epsilon	Low	One	Localized	Organization /product	Low	High
Myy	High	One	Dispersed	Organization	Low	Low
Sigma	High	One	Localized	Organization	Moderate	High

The number of projects in a program distinguishes between low and high values, low being less than 10 projects and high being 10 projects or more. Organizations involved criteria differentiates cases based on the involvement of one or several organizations. Geographic dispersion makes a distinction between programs that were executed in one country vs. several countries. Program structure describes the logic through which the program is divided into several tasks. Product structure means that the structure of the program reflects the architecture of the end result (e.g. process or system). Organization structure means that the structure of the program reflects the organizational structure of the parent organization. Previous experience is related to how experienced the organization/ the informants were in execution programs alike. From the Table 5 can be seen that only two organizations considered having high level of experience of the similar types of programs. Fuzziness of the program describes the level of clarity of the program goals. Based on the very first semi-interviews/ initial discussion with the representatives of the programs three case programs could be

categorized as “fuzzy”, because the goals seemed to be clear/exist only at the high level of abstraction or the first interviews revealed that the goals “had been rather unclear and just evolved during the program execution”. Other cases were categorized having low fuzziness. When comparing cases from the theoretical replication perspective the researcher used two principles: if the two cases would have similar “values” in each criteria dimension another of them should be omitted, and when comparing the cases along specific criteria the two extremes (low-high, one-many, dispersed-localize, etc.) should be found.

In addition, the case programs were selected to present organizations from different industries and of different size. The industrial environment was expected to affect the parent organization’s structures, which forms the operating context for the program. Of the seven selected case programs one was executed in information services industry, one in telecommunications industry, one in medical services industry, two in logistic services industry, one in pulp and paper industry, and one in communal services industry.

In addition, in the case selection process it was made sure that the portfolio of cases would include both large and small scale programs, because the size of the organization[7] has been acknowledged as one of the factors explaining how organizations are formed (Donaldson, 2001). Of the case programs three represented rather small in size, having 15-30 persons actively involved in development, two represented medium sized programs with 30-40 individuals actively involved in development, and two case programs were rather large in size, one with over 300 individuals allocated into a total of 44 projects, and the other with no formally established program organization, but including more than a hundred individuals in conjoined development and implementation work. An overview of the selected case programs is given in Table 6.

The above mentioned criteria were complemented with other criteria that affected the selection of cases and were more related to ensuring the focus of the studied phenomenon and the quality of the data. First, access to data was considered as one of the key requisites defining the suitable cases. The potential case programs in which, due to personnel changes, some important informants were not reachable were not approved as sources of data. Second, it was decided that the case programs should be either already executed or in the phase where much of the development of was already done. This criterion was used in order to ensure that the results of the analysis would be comparable. Finally, the case programs were selected among those that focused on organizational development distinguished

[7] In this study, a program is considered as a special form of a temporary organization

from product development, research and delivery programs that were not included in the study. After a few in-depth contacts and preliminary discussions with the selected organizations, seven case programs from six different organizations were selected as a source of empirical data for this study.

Table 6 Overview of the selected case programs

Case program	Industry	Target of the development	Size/ persons	Phase[8]
Alpha	Information services	Order-delivery process	35-40	On-going
Beta	Telecommunication	Integrated project management system	15-20	On-going
Gamma	Medical services	Management information system	20-30	Executed
Delta	Logistic services (*)	Operations management system	30-40	On-going
Epsilon	Logistic services (*)	Service product development concept	20-30	Executed
Myy	Pulp and paper	Strategy implementation process	n/a (**)	Executed
Sigma	Communal services	Organizational service production processes	300	On-going

(*) represent different parts of the same organization

(**) program executed with the help of resources from the parent organization. Only program manager officially allocated to the program

3.3.2 Key concepts and data collection instruments

Several reasons support the selection of using relatively well defined data collection instruments and concepts in the study, if the research questions are relatively well focused. For example, it has been argued that careful planning of how to collect data increases the efficiency and power of the analysis, improves comparability across studies (cases), and guarantees dependable and meaningful findings (Miles and Huberman, 1994). In a similar vein, Eisenhardt (1989) argues that without specifying a priori constructs, the researcher may find himself in front of an overwhelming amount of data. Moreover, a priori specification enables more accurate measurement of the concepts to be studied (ibid.). Moreover, McClintock et al. (1979) suggest that studying social situations without any preconceived definitions prevent the researcher from identifying non-existent events, and provide generalizable basis for inter-case comparisons. Thus, the utilization of the existing theory as the basis

[8] The phase of the program during the data collection

for defining the central concepts within the study decreases the particuliarity of the findings even if the empirical analysis is based on the fairly limited amount of cases.

This study focuses on the examination of coordination strategies in intra-organizational development programs. The coordination strategies represent logics through which coordination is exercised, including the repertory of applied coordination modes and their relative importance. Two factors, organizational complexity, i.e. task interdependence and size, (Andres and Zmud, 2001; Tushman and Nadler, 1978; Lawrence and Lorsch, 1967; Van de Ven et al., 1976) and task uncertainty (Adler, 1995; Galbraith, 1973; Daft and Lengel, 1986; Daft and Macintosh, 1981; Rice, 1992; Argote, 1982; Gittell, 2002; Goldsmith, 2001; Nidumolu, 1996) are the principal factors that explain which of the coordination mechanisms provide sufficient and cost effective coordination in different situation leading to satisfactory performance. Based on above mentioned studies on coordination, the following four central concepts were selected to serve as building blocks for this study: coordination strategy, complexity, uncertainty, and performance, elaborated in depth in previous chapters. The key concepts of the study and their relations were summarized in Figure 5 in chapter 2.6.

These four key concepts also guided the data collection of this study. Like other studies aiming at producing new theories, also this study employed multiple data collection instruments. The data collection in this study was conducted through semi-structured interviews, through questionnaire forms, by reading through documentary data, and through drawings. It has been argued that collecting data through multiple methods serves as a tool for triangulation, and combining qualitative data can be synergistic (Eisenhardt, 1989). In a similar vein, the aim of this study was to gain evidence from multiple sources by using multiple instruments. Because the twofold objectives of this study, identifying the distinct coordination strategies, and analyzing the relations between the identified coordination strategies and antecedents and between the coordination strategies and program performance, different types of data collection instruments were needed. The data collection instruments and their relations to the key concepts of this study are summarized in Table 7.

Table 7 Key concepts in the study and related data collection instruments

Concept	Interviews	Questionnaire	Drawings	Documents and templates
Coordination strategy	X			X
Uncertainty	X	X		
Complexity	X		X	X
Performance	X	X		

The identification of the coordination strategies required in-depth understanding on the behavioral patterns related to inter-project interaction. Since the objective of this study was to identify a broad range of different coordination practices, the interviews served as a principal and the most suitable mechanism for data collection. The data gained from the interviews was complemented by existing documents and templates. In a similar vein, in order to understand the structural complexity of the program, deep contextual understanding of the organization and the actors related to each program was required. Thus, the interview data complemented with informants' drawings and existing documents and templates were used as data sources for the complexity construct, which reflects the structural design of the program. The data collection for the concepts uncertainty and performance was mainly conducted through questionnaire forms. The data from the questionnaire forms was supplemented by rich qualitative data from the interviews. The use of both qualitative and quantitative data collection instruments in this study enhanced in-depth understanding of the context related to individual cases and improved the comparability between the case programs.

3.3.3 Informants

Informants in each case were selected with the help of a contact person and program manager in preliminary discussions or with the help of the program manager after the first interview session. In each case either discussions or an interview session were held with the program manager first, before starting to interview other informants within the case. In order to get broad enough understanding on the dynamics of coordination, the organizational complexities and perceptions on program performance and prevailing uncertainties, I decided to interview individuals that worked or had been working in different roles in the program. I limited the selection of the informants to those individuals that worked or had been working actively within the program in distinct roles, however.

In most of the cases the interviews were done by the team of two researchers. In each case we interviewed the program manager, individuals responsible for managing distinct project teams (project managers), and a representative of the steering group members. In addition, in some of the cases we also interviewed persons who had otherwise actively participated in the information exchange between the project teams, such as external consultants, or representatives of the supplier. In each case I decided to conduct several interviews in order to avoid a perceptual bias characteristic for many single informant studies. The number of interviews in each case was between 7 and 12, depending on the size of the program and on how fast saturation in understanding was achieved. The roles of the informants and the number of interviews in each case program are summarized in Tables 8 and 9.

3.4 Data collection process

The principal data collection process in the selected case programs was multifaceted and included in-depth interviews, questionnaire forms, and analysis of documents and archives. The data collection with the different methods is described below.

3.4.1 Contacting and preliminary discussions

Contacts and preliminary discussions with the representatives of several organizations were conducted in order to help selecting the suitable cases for the study. A total of 8 organizations were approached for this purpose. Of the 8 approached organizations 5 participated in the research project that the author of this thesis was running at the time. The selected organizations were approached by phone and e-mail (for the cover letter see Appendix 1), followed by face-to-face discussions with representatives of the organizations. Of the approached 8 organizations 6 turned out to be suitable for the purposes of this study by interested in allowing the researcher to get access to data and having programs that fit the scope and requirements of the study.

In order to get further information about the potential case programs, additional discussions in the selected organizations were arranged. A total of 3 thematic interviews and various discussions with the representatives of potential case programs were conducted during August and September 2005. In addition, the researcher was able to use transcriptions of two previous thematic interviews conducted between September 2004 and January 2005 as part of the STRAP-PPO-research project. The thematic interviews, as well as the discussions were conducted by a team of 1 to 2 persons. Notes were taken during all the interviews. Preliminary interviews and further discussions with the representatives of 6 organizations led to the selection of 7 case programs that represented theoretically interesting cases. In addition to the preliminary interviews and discussions with the informants, data about the cases was also achieved from documents. The documents included formal descriptions of the goals, organization, and schedule of the programs, as well as and memos of the steering group meetings.

3.4.2 Interviews

The data collection through semi-structured interviews and questionnaire forms was conducted during September 2005 – December 2005. In each case, 5 to 11 informants were interviewed. A total of 48 semi-structured interviews were conducted. Of the 48 semi-structured interviews, two of the informants had served in both cases Delta and Epsilon, and therefore two different interview sessions were integrated temporally, but, keeping the questions specific for different cases.

The interviews were conducted by a team of 1 to 2 researchers and the process of the interview session followed a predefined frame (see Appendix 2). A high quality of the interview frame and the questionnaire form was ensured by having discussions with experienced research colleagues and the thesis supervisor before the interview sessions in the case programs were started. The discussions led to minor refinement of the initial questionnaire form and interview frame by removing a few questions as irrelevant and adding some new insights.

On the beginning of the interviews the focus and purpose of the researcher was explained to the informants. In addition, the concept of program and project was defined in order to avoid misunderstandings. The interview form was divided into 8 distinct subject matter areas. First, the questions on the background information of the informant covered the informant's position in the organization, work history, and experience on working with projects and programs. Second, the informant was asked to focus on the specific program that was examined and answer the questions keeping in mind experiences of that specific program. The second subject matter area covered background information of the program, including a description of goals, the reason for the initiation of the program, the current situation of the program, the informant's role in the program, and a description of the different phases of the program. The third subject matter area covered the program organization. In this area the informants were asked to describe the program organization through different stakeholders and project teams. The fourth interview area included three general questions on communication and cooperation between different stakeholders within the program. The fifth interview area focused on interfaces and information exchange between the different project teams within the program. This interview area represented the core of the study and thus included nine distinct questions that covered, among other questions, interdependencies between the project teams, mechanisms for information exchange between the project teams, and factors that prevented or enabled collaboration between the project teams. In one of the questions within this subject matter area the informants were asked to draw a picture of the program organization with its projects. The informant was also supposed to draw lines or arrows within this picture to indicate interdependencies between the different projects. In addition, the informant was asked to explain the interdependencies he/she had drawn. The sixth interview area included questions on the interface between the decision makers and the projects within the program. The seventh interview area included questions on the (external) stakeholders of the program and how information was exchanged between them and the program. Finally, the eighth interview area included two questions related to the informant's perceptions on how successful the program had been (so far).

Notes were taken during all the interviews. In addition, of the 48 interviews, 45 were tape-recorded and transcribed. Of the 48 interviews 47 were carried out in person on site, and 1 through telephone. The informants had various roles in the case programs, such as program managers, project managers, project employees, and members of the program steering group.

3.4.3 Questionnaire form

In order to measure the perceived uncertainty and effectiveness of integration in case programs, the interviews were complemented with a structured questionnaire form. The questionnaire form provided the researcher an opportunity to utilize structured survey data in the research. The objective for the use of the questionnaire form was, however, not to infer results with a larger population, but to measure conceptually mature constructs in a way that would enable a reliable comparison between the case programs with respect to these concepts.

The filling out of the questionnaire was integrated into the interviews and was placed at the end of each interview session. The researchers monitored and tape-recorded the filling out of the questionnaire in order to ensure that the respondents understood the questions. This process of monitoring also gave the respondents an opportunity to comment on the questions and to explain their choices, when necessary. In the questionnaire form, a seven-point Likert-scale was used. The complete questionnaire form is presented in Appendix 3. The first part of the questionnaire form included background information, such as the respondent's name and organization, name of the program (and project), and the informant's role in the program. The second part of the questionnaire form included statements and questions related to uncertainty. The third part of the questionnaire covered statements on coordination effectiveness. The fourth part of the questionnaire form focused on the outcomes of the program. Finally in the last part of the questionnaire form respondents were asked to specify the most important factors that had enabled and prevented the execution of the program.

3.4.4 Secondary material

In addition to the pre-interview discussions, the interviews, and the questionnaire form, also documentary material, templates and transcribed interview documents from 11 additional interviews conducted in two of the case programs during August 2006 – September 2006 were used as complementary data sources. The documentary material included program process models, organizational charts, schedules, objectives documents, initiation descriptions, meeting memos, and reports. The data sources in each case study are summarized in Table 8.

Table 8 Data sources in the case studies

Case	Pre-interview discussions	Thematic interviews	Semi-structured interviews	Questionnaire responses	Additional interviews	Documents, templates, and reports	Σ(interviews)
Alpha	Several discussions with the program manager	-	6	6	6	No	**12**
Beta	-	1	9	8		Yes	**10**
Gamma	Discussions with the program manager	1	6	6		Yes	**7**
Delta	Discussions with the program manager		5	6	5	No	**10**
Epsilon	Discussions with the program manager	2	5	5		No	**7**
Myy	Discussion with the organization representative,	1	6	6		No	**7**
Sigma	Discussions with the development director of the organization	-	11	11		Yes	**11**
TOTAL		**5**	**48**	**48**	**11**		**64**

Table 9 The roles of the informants in the case studies

Alpha	Beta	Gamma	Delta	Epsilon	Myy	Sigma
• Program manager • Project managers • Steering group members • Consultant	• Program manager • Project managers • Steering group members • Consultants	• Program manager • Project managers • Project employee • Steering group members • Consultant	• Program manager • Project managers • Steering group members	• Program manager • Project managers • Project employee • Steering group member	• Program manager • Vice presidents • Senior vice president • Development team member	• Program manager • Project managers • Steering group members • Managers of the project support office

3.5 Qualitative data analysis

Yin (1994) proposes that there are two alternative approaches to analyze qualitative data: theory driven and case descriptions. The theory driven approach utilizes the knowledge on existing theories as a basis for creating initial propositions that guide the design and analysis of the study. The case description strategy, instead, relies on the development of a rich case description that serves as a mechanism to frame and organize the study. Due to the relatively large amount of data and the nature of the data (both qualitative and quantitative), this study relies mainly on the first mentioned strategy. As a researcher I, however, have tried to keep an open mind during the analysis, and letting new ideas to emerge from the data. The review of existing literature has helped to focus the interest on the key data and organize the study report, empirical analysis and results around the key concepts of this study: coordination strategy, complexity, uncertainty and performance.

According to Miles and Huberman (1994), the analysis of data includes three distinct phases: data reduction, data display, and conclusion drawing and verification. All of these three types of data analysis activities, complemented with the data collection itself, constitute a cyclical and interactive process (Miles and Huberman, 1994). Accordingly, the analysis process within this study included continuous transitions between the three above mentioned phases already during the data collection, and afterwards continually until the finalization of the conclusions of the study. Each of the three phases of the analysis are, however, reported here as separate entities[9].

3.5.1 Data reduction

Data reduction refers to a process of selecting, focusing, simplifying, abstracting, and transforming the data from written-field notes or transcriptions (Miles and Huberman, 1994). The collected data in this study consists of transcribed interviews, interview notes, questionnaire form responses, and documents and slides sets that describe the background and organization of the case programs. Of the collected data, the part that was obtained through questionnaire form responses was arranged on separate excel sheets, each representing one of the seven case programs and including the answers of the respondents belonging to that program. From the excel sheets the data was then collected and transferred further to a SPSS file.

The transcribed interview data was arranged into seven sets, each including the informants representing the case in question. The interview transcriptions were first read through and initial remarks and comments were made manually in the transcribed documents in the form of marginal remarks, as

[9] An in-depth description of the analysis of quantitative data is presented in chapter 3.6

suggested by Miles and Huberman (1994). The marginal remarks complemented with the interview notes were utilized when writing interim case summaries. An interim case summary represents a synthesis of what the researcher knows about the case and are usually made in order to derive a coherent, overall account of the case (Miles and Huberman, 1994). The interim case summaries in this study served as mechanisms to condensate the relevant data in each case into a single document and to get overall understanding on the different aspects of the case in question. The case summaries included background of the case programs, an organization chart showing the key actors, such as project teams, program manager, decision makers, and other relevant stakeholders, and their observed relationships, a description of different coordination mechanisms used, the informants' perceptions on uncertainty and the performance of the program. In addition, key challenges and critical success factors in each case were included within the interim case summaries.

After completing the data collection in all the case programs, an in-depth analysis of the data was started. The in-depth analysis of the data began with re-reading the transcribed interviews, field notes from the interviews, interim case summaries, and getting familiar with the documentary data and the drawings made by the informants. While reading through the interview transcriptions, all important quotations and data were coded using a unified coding structure in all interview transcriptions. The preliminary remarks and comments made in the first reading round were used as a guiding tool when creating the final codes for this second encountering with the data. The key concepts and framework of the study served as starting points when coding and categorizing the data. The final code structure reflected the posed research questions and defined the key concepts of this study.

In addition, the empirical data from the drawings of the informants and from the existing documents was translated into an organizational diagram describing the organizational structures of each case program. The organizational diagrams were constructed by taking the formal organizational chart of the program or the respective drawing of the program manager as a starting point for describing the structure of the program in question. This preliminary organizational map was complemented by the respective drawing of a second informant. While complementing the original drawing, similarities and differences between the drawings were analyzed and details were added to the initial organizational map if necessary. The interview notes and transcribed interview data were concurrently reviewed in order to understand the meaning and logic of the drawings. The process then continued by completing the existing organizational map by adding another drawing and comparing the drawing with the current map and with the two other original maps. Similarities and differences were again analyzed and the collective organizational map was complemented. The process continued until the drawing of the last informant in the case was analyzed and compared with the collective map. Two issues were specifically relevant when constructing and analyzing

the organizational maps: different actors/stakeholders and interdependencies between them. In some of the drawings made by different informants within the same case program, the actors/stakeholders were named differently, leading to interpretative challenges. These challenges were, however, overcome by comparing the pictorial data with the explanations found in the transcribed interview data. A more challenging part of the analysis was describing the network of interdependencies between the project teams. The analysis of the interdependencies was conducted after the final map of the organizational structure in each case program was completed. In analyzing the interdependencies between the project teams, I started with the drawing of one of the informants with the case. I read through his/her explanation of the interdependencies between the project teams, and compared that with the arrows indicating interdependencies she/he had drawn in his/her organizational map, and added them to the collective organizational map. Then I took the drawing and transcribed interview of the second informant and compared the explanations and the arrows in his/her drawing with the already existing collective map. If new interdependencies were found, I added them to the collective map. This process continued until the information from the last informant in the case was analyzed and the collective map was complete. A similar procedure was applied in all of the case programs, providing seven organizational charts with relevant actors/stakeholders and their relations.

3.5.2 Data display

Data display represents an organized assembly of information that enables drawing conclusions from the data (Miles and Huberman, 1994). In this study the use of relatively well defined research concepts and frame enabled data display through scatter plots and matrices when making within- and cross-case comparisons.

In the case of coordination, the use of different coordination mechanisms and their relative importance were analyzed. The analysis of coordination was based on coding direct observations from the transcribed interview data and from the field notes. The observed coordination mechanisms were coded using descriptive coding logic (Miles and Huberman, 1994). The observed coordination mechanisms and their explanations were inserted into an excel sheet when reading through the coded interview transcriptions. Thus, rather than relying solely on coded data that is often separated from the original context of the case, the analysis of coordination in this study was based on interview transcriptions, in which the codes in the document served as a map to understand the interview as a whole entity and enhanced comparison between the data from the different informants within the case. In addition to identification of different kinds of coordination mechanisms, their perceived importance in each case program was evaluated. The evaluation of the importance of different coordination mechanisms was based on the interviewees' perceptual judgments. All informants within each case were asked to specify, of all mechanisms that she/he had mentioned during the interview, the three most important mechanisms she/he had used. The

concept of importance was explained to the informants to refer the significance or value from the information exchange perspective. In other words, the important mechanisms refer to those that are mostly used by the actors and that are suitable for the information exchange needs of the actors.The importance of the mechanisms is related to the value of the use of the mechanism. A similar kind of idea has been previously used by Van de Ven et al. (1976) in measuring the existence of the mechanism and its significance from the practical point of view.

When analyzing the coordination within each case, matrix representation was utilized to summarize the findings, as suggested by Miles and Huberman (1994). In the matrix the columns referred to informants and the rows referred to different coordination mechanisms observed in the case in question. The matrix was filled up row by row while reading through the coded interview transcriptions again. The presence or absence of the coordination mechanism in each interview was marked in the matrix, as well as which of the coordination mechanisms each informant had perceived the most important ones. This resulted in tables of frequencies indicating how many of the informants in each case mentioned the different coordination mechanisms among the three most important ones. The resulting seven tables, representing findings of the seven case programs, were not, however, directly comparable to each other, because some of the coordination mechanisms used in the case programs were discussed under different labels. In order to overcome this challenge, the coordination mechanisms were further categorized into four different classes called coordination modes. The logic of categorizing the coordination mechanisms into distinct coordination modes was modified from those proposed in the previous studies of Van de Ven et al. (1976) and Kraut and Streeter (1995). Now summing up the mentions of important coordination mechanisms in each coordination mode group in each case resulted in a number indicating the importance of each coordination mode in each case program. Thus, the importance of different coordination modes were calculated as a sum of the importance of individual coordination mechanisms belonging into the respective coordination mode category. These sums were further divided by the total amount of mentions (related to important coordination mechanisms) in each case and multiplied by 100. This gave a percentage number indicating the relative importance of each coordination mode in each case program. An example of how the importance of different coordination modes was calculated is given in the cross-case analysis-chapter (p.132). In addition, several other types of case-ordered displays, tables and matrices were utilized during the data analysis process, as suggested by Miles and Huberman (1994). These different data displays helped in getting the essential out of the data and drawing the final conclusions.

3.5.3 Drawing conclusions and verification

Drawing and verifying conclusions refers to giving meaning to the findings, and it happens through noting regularities, patterns, explanations, possible configurations and causal flows (Miles and Huberman, 1994).

In this study, the principal mechanism for drawing conclusions and verification is based on cross-case comparisons. The objective of the cross-case analysis is to go beyond initial impressions adopted from the individual cases (Meyer, 2004). Miles and Huberman (1994) suggest several tactics for generating meaning from a particular configuration of data in a display. In this study I have utilized clustering as the tactic to induce general coordination strategies from the empirical case data. Clustering refers to a process of forming categories inductively, and the iterative sorting of things into those categories. It enables moving from particular to general and increasing the level of abstraction (Miles and Huberman, 1994).

In this study the case clusters have been formed on the basis of similarities and differences in utilization and the importance of different coordination modes and mechanisms. The careful comparison of case programs resulted in three case clusters that represent overlapping entities. The process of clustering is described in the cross-case analysis chapter. The observed clusters are considered as logical entities and refer to different coordination strategies adopted and utilized by the case programs.

In addition to inductive generation of coordination strategies, conclusions have also been drawn on the basis of observed relations between the key concepts in the study. The median values of complexity, uncertainty, and performance indicators in each case are compared within and between the induced coordination strategy clusters. Observed similarities and differences in the median values of the mentioned attributes serve as empirical evidence, which is used to derive propositions on linkage between the key concepts within the study. Large scale statistical testing of the derived propositions has ben left for further studies. However, two distinct methods have been used to verify the conclusions drawn. First, the results and logic of drawing conclusions has been discussed with research colleagues and professors from different universities e.g. from Helsinki University of Technology, Berlin University of Technology, Stanford University, and Åbo Akademi. In addition, the results of the case studies have been presented to the broader academic audience in conferences and seminar meetings and to the representatives of the case programs in separate organization-specific presentations and in an open academy-industry seminar. The industry seminar served as an opportunity to disseminate information in a larger context, and provided a chance to test the external validity of the results. The findings have also been compared with previous empirical research on coordination in different organizational contexts and conceptual studies on coordination (see pp.152-163). Comparison of the findings with existing literature increases the internal validity, generalizability, and theoretical level of findings that are based on a limited number of cases (Eisenhardt, 1989).

3.6 Quantitative data analysis

The role of quantitative data in this study, as mentioned above, is not to provide a justification for valid and generalizable results in a larger population, but rather to enhance the comparability between the case programs and to provide rough rules for cross-case comparison by helping to judge which of the observed differences between the case programs would be interpreted as significant. The quantitative data was collected in each case program in order to analyze two concepts, uncertainty and performance.

3.6.1 Statistical methods

In this study the analysis of quantitative data is limited into the use of two distinct statistical methods. First, confirmatory factor analysis is used to evaluate the validity of the constructs related to performance and uncertainty, which were derived from the literature. In addition, Cronbach's alpha value has been measured for each construct in order to evaluate the reliability of the measured construct. Second, Mann-Whitney U-test is used to identify the differences in construct values between the case programs. The statistical methods are not used in this study to test pre-set hypotheses, they are rather utilized as mechanisms to support the inductive reasoning process. The underlying assumptions and limitations of the statistical methods used in this study are introduced briefly below.

Confirmatory factor analysis

Confirmatory factor analysis is used in this study to analyze the interrelationships between the measurement items, and thus to conform the validity of the used constructs, known as factors. This study utilizes the generalized least squares (GLS) analysis as the factor extraction method. The selection of GLS analysis is supported by the fact that this method is not very sensitive to the assumptions of the normality of the data, and the fact that it is a recommended method when the size of the sample is relatively small as is the case in this study (Nummenmaa, 2004). The factor analysis is complemented by the standard rotation procedure. The study applies orthogonal varimax rotation, which is preferred when the resulting factors are assumed to be independent of each other.

The factor analysis results in a factor loading, which refers to the correlation between the original variables and the factor. It is said that the factor loading of individual variables should be greater than +/- 0.30 to be practically significant (Hair et al., 1998). In this study, the level of acceptance was, however, set to +/- 0.40 because the role of the factor analysis is in this study confirmative, and because the original variables were drawn from the existing literature.

The results of the confirmatory factor analysis, as well as the reliability measures should be interpreted cautiously because of the limitations of the data set in hand. For example, the factor analysis does not take

into account the fact that the respondents are not independent of each other but adopted from the seven case programs. In addition, the number of respondents is relatively low, when compared to what is generally used in statistical analysis. Furthermore, factor analysis is based on the assumption that the data is normally distributed, which may not be the case in this study. Thus, due to these limitations in the quantitative data, the results of the confirmatory factor analysis and values of Cronbach's alpha should be considered only as directive support for the fact that the measured constructs are valid and reliable within this data set.

Mann-Whitney U-test

A Mann-Whitney U-test is a non-parametric statistical method to compare the distributions of two unrelated populations (Sheskin, 2002). The test is based on the comparison of the medians of the studied variable between the two populations. The null hypothesis is that the two samples are drawn from a single population, and that the medians are therefore equal. The test requires the two samples to be independent, and the observations to be ordinal or continuous measurements. In this study the Mann-Whitney U-test is used to evaluate whether the median values of uncertainty constructs and performance constructs differ between the seven case programs. The Mann-Whitney U-test represents a non-parametric counterpart for the more well-known T-test. The U-test, unlike the T-test, does not assume that the distributions of the populations are normal (Sheskin, 2002; Nummenmaa, 2004), and is thus seen suitable for the purposes of this study.

3.6.2 Uncertainty constructs

The concept uncertainty is defined through two distinct constructs in this study; task analyzability and task novelty, derived from the information processing theory (see e.g. Galbraith, 1973; Tushman and Nadler, 1978). In this study the concept of task refers to the organization development program. Based on the definition of task analyzability by Perrow (1967), Rice (1992), and Tushman and Romanelli (1983) the concept of task analyzability is used in this study to refer to the *degree of understanding or clarity related to the program and its execution.* More specifically, analyzable tasks can be clearly defined through the technology needed to accomplish the task (working methods and resource and competence needs), and through the structural characteristics (interdependencies between the projects that represent sub-tasks, and interdependencies to relevant stakeholders) that define the architecture of the task and its position in the wider organizational environment. It is expected that with analyzable tasks, less uncertainty is related to the execution of the task than with less analyzable ones. The evaluation of the task analyzability has been modified from the indicators used by Daft and Macintosh (1981), and Nidumolu (1996), and includes the following items: (1) the working methods used in the program are well-known, (2) the resource and

competence needs are understood and defined, (3) there is clarity about inter-project interdependencies, and (4) understanding about the relevant stakeholders. The values for the different items have been measured using questionnaire form with a 7-point Likert-scale, where number 1 means strongly disagree and number 7 strongly agree. The construct task analyzability has been calculated as the arithmetic mean of the 7 abovementioned items.

Table 10 Factor loadings for the task analyzability and task novelty constructs[10]

Measured items	**Factor 1**	**Factor 2**
At the beginning of the program…		
Task analyzability		
… inter-project interdependencies affecting the execution of the projects were clear	-0.274	**0.428**
…the interdependencies on relevant stakeholders were clear	0.048	**0.998**
…the working methods needed to achieve the goals were clear	-0.024	**0.616**
… there were defined resource and competence requirements related to the projects	-0.132	**0.448**
Task novelty		
The planned outcomes of the program/projects differ technologically significantly from the previous programs/projects in the organization	**0.835**	0.069
The technology / methods used in the execution of the projects /program differ significantly from the ones used in the previous programs /projects executed in the organization	**0.885**	-0.167
The resource and competence needs related to the program/projects differ significantly from the ones related to previous programs /projects executed in the organization	**0.574**	-0.065

The construct task novelty is in this study used to refer to the *degree of familiarity with technologies needed in order to accomplish the program*. It is expected that task novelty is related to the way the task is completed. For example, McDonough (1993) has found that technology newness is negatively associated with the achievement of goals. In addition, Meyer and Utterback (1995) have shown that the novelty of the product technologies has a positive association with the development time. Moreover, Griffin (1997) has found that product newness is positively associated with the development time needed. In the present study, the composite measure of task novelty is based on the technological novelty of the program and includes two distinct dimensions: technological novelty of the program outcome and technological novelty related to the execution process of the program, as suggested by Tatikonda et al. (2000). Three individual indicators have been used to measure the novelty of the program task: (1) the technological novelty of the outcome of the program from the organization's perspective, (2) novelty related to the working methods used in the program, and (3) novelty of the resource and competence needs in the program. The values for the different items have been measured using the questionnaire form with a 7-point Likert-scale, where number 1 means strongly disagree and number 7 strongly agree. The construct task novelty has been calculated as the arithmetic mean of the 3 abovementioned items.

[10] Generalized least squares analysis with Varimax rotation

Table 10 summarizes the results of the confirmatory factor analysis of task analyzability and task novelty. The results provide two clearly distinct factor solutions, as expected, the first factor explaining 27.22% of the variance and the second explaining 25.67% of the variance. The model seems to fit well with the collected data (Chi-Square (8) = 8.37, $p>0.05$). The Cronbach's inter-item alpha for the task analyzability construct is 0.723 and for the task novelty construct 0.788.

3.6.3 Performance constructs

The analysis of performance within and between the case programs and the strategy clusters they form includes two perspectives: meeting goals and learning and innovations. These two perspectives reflect the nature of the immediate outcomes of the programs and future benefits generated through the process of program execution.

One of the most commonly used perspectives to evaluate the successfulness of a project is to analyze its performance with respect to pre-set time and cost objects and the extent to which the project has been able to produce the planned outcomes (Atkinson, 1999). The review of project success criteria used in academic writings over the last decade (Chan et al., 2002) reveals that these process and outcome-related measures are commonly utilized to analyze the performance of projects. The evaluation of meeting goals-performance construct in this study is based on the mean value of four indicators measured through the questionnaire form. In the questionnaire, a 7-point Liker scale has been used, where number 1 means strongly disagree and number 7 strongly agree. The measures utilized in this study are based on the ones utilized in previous studies by Dvir et al. (2003), Shenhar et al. (2002), Shenhar et al. (2001), Sicotte and Langley (2000), Dvir et al. (1998), Keller (1994), Pinto and Slevin (1988), de Wit (1988), and include the following items: (1) meeting planned goals, (2) adherence to budget, (3) adherence to schedule, and (4) extend to which the program was successful as an entity.

In addition to immediate outcomes, the program may result in outcomes that can be utilized in the future. These outcomes may be related to emergence of new business possibilities or development of organizational capabilities through learning. For example, Shenhar et al. (2001) have identified four dimensions for project success criteria, of which one is "preparing for the future". This dimension includes the long term benefits that are realized in the future when the project is completed, and often indirectly. In addition, creation of new opportunities has been acknowledged as one of the key dimensions of success in the innovation project context (e.g. Cooper and Kleinsmidt, 1987). Furthermore, people development is mentioned as one of the key criterion of organizational success (Maltz et al., 2003). The evaluation of learning and innovations produced in the case programs is based on calculating the mean value of three indicators, measured through the questionnaire form. In the questionnaire, a 7-point Liker scale has been

used, where number 1 means strongly disagree and number 7 strongly agree. The construct learning and innovation is based on the idea that in addition to immediate outcomes, the program may also create the potential for future benefits through learning and emergence of new business opportunities. The term learning is related to the experience accumulation, knowledge articulation and knowledge codification processes that takes place at the project/program level, and differentiated from the perspective that focus on learning of the individuals (Prencipe and Tell, 2001). The measures included the following items: (1) emergence of novel business potential, (2) emergence of technological innovations, (3) emergence of knew technological know-how.

Table 11 includes the results of the confirmatory factor analysis of meeting goals and learning and innovations-constructs. The results provide two clearly distinct factor solutions, as expected, the first factor explaining 28.91% of the variance and the second explaining 25.26% of the variance. The model seems to fit well with the collected data (Chi-Square (8) = 4.656, $p>0.05$). Cronbach's inter-item alpha for the meeting goals construct is 0.719 and for the learning and innovations construct 0.834.

Table 11 Factor loadings for meeting goals and learning and innovations constructs[11]

Measured items	**Factor 1**	**Factor 2**
Meeting goals		
The program succeeded well as an entity	0.148	**0.542**
The projects produced/has produced planned outcomes	0.259	**0.736**
The projects managed to stay / has managed so far to stay within the planned budget	-0.279	**0.624**
The projects managed to stay / has managed so far to stay within the planned schedule	-0.151	**0.731**
Learning and innovations		
New business opportunities were recognized as a consequence of the program	**0.617**	0.051
The program produced technological innovations for the organization	**0.738**	-0.072
The program produced new technological know-how for the organization	**0.954**	0.039

[11] Generalized least squares analysis with Varimax rotation

4 INTRODUCTION OF THE CASE PROGRAMS

The empirical study consists of the analysis of 7 individual case programs. This chapter describes the background of the case studies in detail in order to get necessary understanding for the cross case analysis that will follow in the next chapter. This chapter illustrates the main characteristics of the case programs through their context, objectives and organization. In addition, the distinct coordination mechanisms applied in each case program are discussed.

4.1 Case Alpha: Development of the order-delivery process

In early 2004 the top management of a large logistic sector organization noticed that the management practices and product concepts in its nine business divisions were largely heterogeneous. The divisions were characterized by a lack of clear product definitions and product hierarchies. The management of the organization decided to establish a development program in order to utilize synergies between business divisions and to increase the level of integration between different divisions. Program Alpha was initiated in autumn 2004. The objective of the program was to produce and launch uniform product definitions for the business divisions, and a description of the practices to support the management in the process from a service bid to its delivery.

The program started with a preliminary study phase, which was completed in January 2005. This was followed with the development phase, which included actual development of the product definitions, management processes, and a supporting information system. The development phase was completed in September 2005, and the launch and implementation of the model was started in one of the nine business divisions.

The organization of program Alpha consisted of a program manager, a program steering group and six distinct project teams, each having dedicated project managers. Case Alpha included 35 to 40 persons assigned permanently or on the need basis to different positions in the program. Two of the project managers represented a single main supplier and the four others represented the parent company. In addition, external consultants from two different companies were used during the program. The backgrounds of the individuals related to the program varied from purely technically-oriented experts to business-focused managers. Moreover, the individuals participating in the program represented different nationalities. The principal development activities were allocated in Germany and Finland. In addition, experts from several other countries were used during the program.

The execution of program Alpha was organized into six concurrent project teams. Of these six projects four were formally recognized as projects and two represented rather more informal but separate entities with dedicated resources and defined goals. In addition, the program organization was also closely

influenced by various decision making bodies (such as the working committee and different management boards of the parent organization), sales directors of the parent organization, and numerous other stakeholders.

The program structure consisted of the following six individual project teams, each having their own areas of responsibility:

- *A1 (Bid-to-contract project)*: development of a unified model and requirements for a supporting IT-system for nine business divisions on how the process from the customer's service bid to the signed contract should be managed
- *A2 (Order-to-invoice project)*: development of a unified model and requirements for a supporting IT-system to manage the process from the product/service order to invoice handling
- *A3 (Product definition project)*: development of product hierarchies used as a basis for product prizing
- *A4 (System implementation project):* implementing the developments of the above three projects in nine business divisions
- *A5 (Customer data master project)* defining the customer data needs in different phases of the sales-delivery process
- *A6 (Performance management project):* development of performance measurement and management requirements to guide the sales-delivery process

The project teams were highly interdependent on each other through several operational linkages. The observed interdependencies between the project teams in case Alpha are depicted in Figure 6.

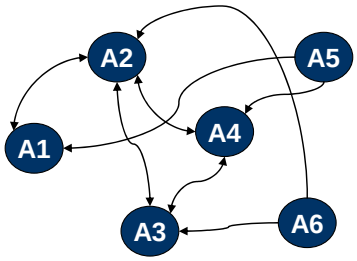


Figure 6 Interdependencies between project teams in case Alpha[12]

The project manager of the customer data master project describes the nature of the interdependencies between the projects as follows:

[12] In this and the following Figures on program team structures the circles with the letter and number code combination represent a project team, two-headed arrows represent reciprocal interdependencies between the project teams, one-headed arrow represent sequential interdependence between the project teams, the head of the arrow indicating the target or direction of the principal information delivery, and the lack of an arrow indicates pooled interdependency between the project teams.

Interviewer: "What kinds of interdependencies exist between the projects, which would affect the execution of other projects, if any?"

Interviewee a1:"Well, quite totalitarian, because in the case of developing the product definition, you need also customer data as input information in order to make sense of the products…and then the development of the bid-to-contract proces, again needs customer data and product definitions as input data…therefore, we can say that almost everything is dependent on each other in this development program…"

In addition to complexity due to interdependent project teams and geographic dispersion, the program was characterized by a high level of uncertainty due to unclear goals. For example, several informants mentioned that at the beginning of the program there was lack of common understanding on all the organizational interfaces that must be taken into account when executing the program. The inability to understand the uncertain goals of the programs eventually led to a large amount of changes to the initial plans of the program. These changes again directed to expansions of the original scope of the program. The chair of the steering group describes the situation at the beginning of the development stage of the program:

Interviewee a2: "*It is essential to note, as you see, that [at the beginning of the program] we did not really know what kinds of influences this program will have… In my opinion it [the program] has expanded from its original scope. In the beginning we spoke about product hierarchy, its definition and the system support related to it. And later on we started to realize what this program had influence on… I think that we had some schedules but the budget was really unclear at the beginning.* "

The prevailing organizational complexity and inherent uncertainty led to several organizational challenges. The participation of employees from different organizations increased the lack of trust between the project teams. The lack of trust was, according to the interview data, one of the reasons for "project team-centricity" and lack of cooperation between the project teams at the beginning of the program. In addition, the geographically dispersed organizational environment, and the cultural differences between different organizational actors within the program were seen by the informants to challenge the communication between the project teams.

The analysis of interview data showed that various mechanisms were used to guarantee sufficient coordination between the interdependent project teams under the high uncertainty. The two most acknowledged mechanisms for inter-project coordination were weekly program core team meetings, and direct contacts between the project managers via e-mail. Both mechanisms were mentioned in five of the total six semi-structured interviews conducted in this case program. The interviews revealed that the

orientation of the weekly core team meetings was rather formal and well focused. One of the project managers of the program describes the meetings as follows:

Interviewee a3: "We have this weekly meeting, it is called team lead meeting, where the team leaders [project managers] meet and report on the status of the projects…it is quite extensive, we [project managers] report the status of each project at a very detailed level, in that sense we know what the situation in each project is."

The required coordination between different project teams was also guaranteed by a co-location of core persons from the different teams and by using specific liaison persons. Of the six informants[13] three mentioned both these mechanisms in the interviews. The co-location of core persons means the use of a common project space within which all the project managers from different project teams worked in predefined days of the week. One of the project managers explained the meaning of co-location in coordination as follows:

Interviewee a3: "…actually, at this moment [end of development phase] the most important mechanism for communication is the one that we work in the same space, in other words, we are located every week from Tuesday to Thursday in Germany where we have a common project space. In the project space we [project mangers] are all located together and the communication happens face-to-face over the table, which facilitates the advancement of the program."

The use of liaison persons in this case meant the utilization of individuals who delivered information and knowledge between different project teams. For example, the employees who worked in various project teams are an example of such liaison persons. Other coordination mechanisms applied in case Alpha were integration meetings between projects, use of separate integrative persons, and direct contacts among project managers via e-mail, phone or face-to-face. The integration meetings were informal meetings between different project teams arranged on the need basis in order to handle interdependencies and emerging conflicts between the projects. The use of integrative persons included two types of coordination, the use of a consultant who served as an integrator from the perspective of the IT system, and a program manager who participated actively in the project management and shared information with the projects. Moreover, schedules and plans, definition of roles and responsibilities, and an information database were mentioned in the interviews as integrative mechanisms.

[13] These informants were interviewed using a semi-structured interview frame

4.2 Case Beta: Development of an integrated project management system

Case Beta represents an ongoing development program in a large international private sector telecom organization. The program was set up in 2003 with the objective to improve and develop organizational capabilities related to the management of the customer interface in delivery projects. One of the main reasons to launch the program structure was that there was a need to increase transparency among individual development projects already at the very early phase of the project life-cycle and to manage the portfolio of development work in a coordinated manner. The planned duration of the program was initially two years, but after successful outcomes, the role of the program has shifted from a short term temporally limited development activity to a more stable form of organizing the development of capabilities by projects. The system developed during the two-year period is implemented in 70 countries where the parent organization operates. The program follows the quarterly planning cycle of the parent organization, serving as an organizational frame for constantly changing short-term projects. During the two year period the program served as a core for approximately 40 projects.

At the time of examination the program organization in case Beta consisted of a program manager, a program management team, a program steering group and five projects with dedicated project managers. The projects within the program have been named after specific inter-related products that enhance the utilization of the capabilities within the organizational networks of the company, and are here for confidentiality reasons named as B1, B2, B3, B4, and B5. The program organization does not have an official program office. The five concurrent projects are divided into sequentially interdependent tasks, and the project managers are responsible for operational decision-making related to the project. The five projects in the program are operated simultaneously and are highly interdependent on each other through several operational linkages. Four of the five projects share the same resources, two of the projects having the same responsible project manager. Most of the project managers are allocated full-time into the program. All the five projects and the names of their responsible project managers are carefully defined in the documents specifying the structure of the program. The program manager is allocated half-time into the program.

A more in-depth analysis of the structure of the program revealed that the five projects in case Beta are interdependent on each other. Two of the projects, project B1 and B2 share the same program manager, and most of the human resources allocated to project B1 work also in project B2. The interdependencies between projects B1, B2 and B5 are reciprocal by nature, because the advancement of each project is temporally dependent on the others. Projects B1, B2 and B5 all develop their own parts to the system. In addition to temporal interdependencies among the projects, they are also interdependent from the

technological point of view. Projects B1, B2 and B5 share the same testing environment.[14] The observed interdependencies between the project teams in case Beta are depicted in Figure 7.

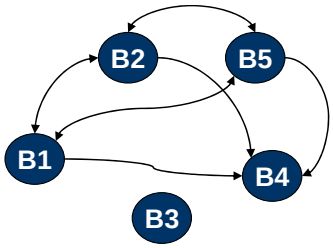


Figure 7 Interdependencies between project teams in case Beta

The project manager of projects B1 and B2 describes the interdependence between the projects as follows:

Interviewee b1:"Well, same persons, first of all, work in both projects [B1 and B2]. Second, because they are [information] system projects, they share the same [technical] environment and are physically interdependent."

He continues and describes the interdependencies between projects B1, B2 and B5:

Interviewee b1: " And this project [B1] is parallel with these projects [B1 and B2] in a way that they make changes to the same system…and from the technical point of view, again we [projects B1 and B2] use the same testing environments with project B5…and then, we [project B1, B2 and B5] are temporally interdependent on each other, in a way that they [B5] need to finish some things so that we can continue our own work [in projects B1 and B2]"

In addition to highly interdependent projects, program Beta also includes more operationally disconnected elements. For example, project B3 is only loosely connected with the other projects in the program. The main objective of project B3 is to ensure that a specific formerly acquired solution is compatible with the other solutions developed in the program. The development work in project B3 is outsourced to a supplier, with the project manager of project B3 representing the parent organization, however. The interdependencies between project B3 and the other projects in the program can be categorized as pooled. The project manager of project B3 describes his project as an "external member of the program" indicating the independent role of his project. Finally, the objective of project B4 is to deploy the developed applications in the program. Thus the interdependencies with projects B1, B2, and B5 are sequential by nature.

[14] Testing the outcomes in different phases of a project is an essential and obligatory phase before the final outcomes of the projects can be implemented in the organization

On average 15 to 20 persons work in program Beta. Two of the project managers represent different competing consultancy companies, one responsible for the management of projects B1 and B2 and other responsible for the management of project B5. The project manager of project B3 describes the structural challenges as follows:

Interviewee b2: "…when there are personnel changes in the projects, people coming from different organizations, the organizations have different corporate cultures, and that is complemented with the individuals' own cultural background, that will have some [challenging] impacts [on interaction between the individuals]…for example, we have individuals from different consulting companies managing projects [B1, B2 and 53] ,and then it is at least expected that there will be some difficulties in communication [among the projects]."

Another factor that increases the complexity of the program is that parts of the main development work related to project B5 are located in the Czech Republic, while the other projects are located in Finland. Furthermore, recent unexpected personnel changes (of key individuals) have increased the complexity of the program, because in-depth understanding of the interdependencies between the projects is to a great extent focused on few key individuals. Thus, the program is highly sensitive to changes of key persons.

The analysis of the interview data exposed a total of 11 different mechanisms through which coordination takes place in case Beta. The most acknowledged and important mechanisms are program management board meetings. All the project managers of the program participate in the management board meetings, which focus on reporting the status of each project and rising up the most current issues. This coordination mechanism represents the most formal mechanism for information exchange and delivery between the projects. It was mentioned by 5 of the 8 informants to belong to the three most important mechanisms of coordination. The steering group chair described inter-project coordination through program management board meetings as follows:

Interviewee b3: "…then in our weekly [program management board] meeting, we have one thing, one item where we implicitly follow the inter-project interdependencies. During that item every [project manager] presents the status of his/her project, and it is agreed that if there is something important related to the progress of a project, the project manager must open his/her mouth and bring that issue to discussion…however, there[in the agenda] is no specific item for the interdependencies, it is just the meaning of the meeting to synchronize what we are doing "

Another important coordination mechanism applied in case Beta are face-to-face discussions between the project managers and direct contacts via e-mail. These mechanisms are rather informal, activated on the need basis, and place authority of coordination to the project managers. A project manager from the program explains the role of e-mail in this kind of informal information exchange:

Interviewee b1: "*…in 'corridor discussions' we often utilize e-mail for very detailed things. Many things, even if discussed face-to-face, are later on put forward through e-mail. This helps in remembering things, and then later, it can be helpful in 'cover my back-type' things. So that if we have agreed on something, it [the agreement] does not exist only as a discussion, but is documented…*"

The interview also revealed a number of other mechanisms used in inter-team interaction. For example, co-location of core persons, integration meetings among project managers, direct contacts among projects by phone, reporting, and the use of schedules and plans were mentioned as mechanisms through which the information exchange between the project teams takes place. The co-location of core persons refers to a open space office in which the employees of four of the five projects are located. The co-location of core persons seems to enhance the informal information exchange among the individuals and helps in creating a community spirit and open culture among the participants of the program. Project manager describes the information exchange through co-location as follows:

Interviewee b2: "*Well, we all sit there so close [to each other] and you can clearly notice that when you sit physically close to others it is unavoidable that you know more about the things [that you hear]. But, it [information exchange] is kind of passive, it is not ordinary information exchange, but you hear what the others are talking about*"

The comments of the project manager stress that the information exchange through co-location usually is not systematic and controlled in its deepest sense. However, the interviews of the program manager and steering group chair revealed that the co-location was purposefully planned in order to enhance informal information exchange.

The integration meeting of the project managers in case Beta refers to a weekly informal gathering of at least three project managers. The meetings are specifically focused on coordination among highly interdependent projects and they are seen particularly important at the beginning of the quarterly cycle of the program. The use of schedules and plans was also mentioned in three interviews to represent an important way to exchange information between the project teams. The plans and schedules seem to specify two separate and important things from the coordination perspective in case Beta. First, the plans and schedules include the estimation of resource needs in different projects for a 13-month period ahead. This characteristic is seen especially important, because the projects within the program share the scarce human resources. Thus, the use of resources is mainly based on schedules and plans. In the case of minor exceptions, the project managers are able to negotiate about reallocation of resources. The major exceptions in resource allocation that could also lead to conflict situations among the projects teams are managed through the project managers and the steering group. Second, the plans and schedules also include recognized technical and technological dependencies among the projects. These recognized

interdependencies serve as a tool or map that enhances the understanding of potential needs for collaboration between projects.

The interviews also revealed three other coordination mechanisms that are utilized in case Beta: use of liaisons persons, definition of roles and responsibilities, and kick-off-meetings. The use of liaison persons in this case refers to the use of employees or project managers who participate in the work and are members of several different project teams. Altough this use of "shared" employees enables easy transfer of rich data and understanding among the project teams, it also creates a secondary need to coordinate the use of the same scarce shared resource. This partly explains the high importance of plans and schedules in coordination within this case.

4.3 Case Gamma: Development of a new management information system

Case Gamma is a strategic inraorganizational development program executed in a medium-sized private healthcare sector organization in Finland. The program was initiated in March 2000 by the CEO of the organization in order to respond to the changes in the society's monetary politics and to rationalize the internal information delivery processes of the organization. Before the implementation of the program, the organization operated locally with customers, utilizing decentralized information storages and billing systems. One objective of the program was to centralize the organization's operations and to offer enhanced services to its big business customers. From the organizational perspective, the launched program represented the largest and fastest pace change efforts ever in the organization's history. The produced change affected most of the employees in the organization from the CEO to shop floor workers. In addition, the program was also seen as strategically important to guarantee the organization's competitive position in the market. The results were implemented in January 2002, and as an outcome the program produced a novel information system that supports the organization's renewed internal business processes.

Program Gamma employed on average of 20 to 30 persons, most of whom were allocated into the program only on a half-time basis. The organization of the program consisted of a steering group, a coordination group and 7 concurrent project teams that were all responsible for different sub-tasks related to the program. Each of the projects required different expertise from the participating individuals, and each project had a dedicated project manager. The projects covered the following task areas:

- *G1 (Experts)*: this project used experts representing various disciplines in the organization in order to ensure that the developed system would operate properly in daily work and different operations
- *G2 (Support functions)*: this project was established to guarantee that the developed operating model and information system would fit with the different support functions currently used by the parent organization

- *G3 (Technical environment)*: the objective of this project was to create and maintain a technical environment that would enable the testing and production use of the system
- *G4 (Application production)*: the objective of the project was to develop and supply an information system to the receiver organization
- *G5 (Implementation and testing)*: this project was responsible for the creating of required information content and testing of the system
- *G6 (Organizational competencies)*: the objective of this project was to ensure that the receiver organization possesses sufficient competencies to test and use the developed system
- *G7 (New services)*: this project aimed at developing the customer services and business of the receiver organization

Because of tight schedule objectives, all the projects operated concurrently from the beginning. Moreover, the six first mentioned projects were highly interdependent on each other from the operational perspective, due to technological interdependencies. Only the new services -project was relatively independent of the other projects, and because of pressures in the schedule its content was eventually reduced significantly. The observed interdependencies between the project teams are depicted in Figure 8.

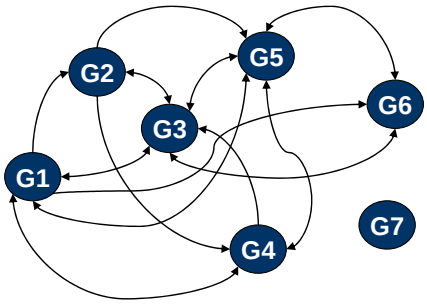


Figure 8 Interdependencies between project teams in case Gamma

The analysis revealed that of the total of 21 interfaces between the project teams, in 11 the interdependency was either reciprocal or sequential, and in 10 interfaces the interdependency between the teams were of the pooled type. A project manager (serving also in a steering group member role) describes the inter-project interdependency in the program as follows:

Interviewee c1: "…In this situation all [projects] were dependent on each other. If you had taken one off, the program would not have worked…"

The program organization included individuals from several different organizations. One of the projects, Application production, was led by the main supplier company. In addition, representatives of a sub-supplier and consultant were active participants of the development program. Moreover, the organizational network around the program included the following actors: capital investors, several customer organizations, regulative institutional actor, suppliers from four different organizations, and a supplier that was excluded from the program in the beginning due to emerging conflicts with the main

supplier company. Of these different organizations being part of the program network, only individuals from the receiver organization, the main supplier, the consulting company and the sub-supplier served as active members of the program organization. These companies represented the key players in the program, while the other organizations formed a contextual milieu in which the program operated. From the geographical perspective, the operational environment of the program included sites in two different countries. The key development and definition activities happened in Finland, mainly in two cities. The coding of the information system, instead, took place in France.

Program Gamma adopted a low hierarchy management ideology, keeping the decision making structure relatively flexible. A weekly program core team meeting served as the most important channel for information delivery among the projects. The consultant describes, as one of the participants, the core team meeting as follows:

Interviewee c2: "*It [the meeting] was like a place for information delivery. It was, however, also a place where we worked. We tended to define there what the critical issues were, and what we should do next. We collected acute problems and utilized the knowledge of the participants and started to solve problems there…*"

Thus, rather than being a meeting for monitoring purposes and information delivery only, the meeting served as a vehicle to create new knowledge and shared understanding. The meeting cycle varied according to the need from once a week to daily meetings. A project manager describes the meetings as follows:

Interviewee c1: "…we had these coordination team meetings, were every project manager participated. The coordination team got together at least weekly and in the most hectic phase of the program, we had short meetings almost on a daily basis. At the final phase of the program when the deadline started to come closer, the program manager took control. Because of the tight deadline she had to make a lot of decisions on her own. Thus, the shape of the coordination team meetings changed and the team meeting practice finally dissolved. That was because we had to advance as fast as possible and we did not have any more time to meet each other…"

These rather formal coordination group meetings were complemented with additional integration meetings between different projects. These projects did not focus anymore on the program entity but concentrated on relevant individual problems that occurred. These informal integration meetings were mentioned by three of the informants as being within the three most important mechanisms for information delivery between the projects. A project manager describes the integration meetings as follows:

Interviewee c1: "These integration meetings were actually real work meetings that focused specifically on the identification and discussion of inter-project dependencies. In other words, individuals from different projects discussed about what kind of information was needed in other projects and when. Very often only project managers participated in these meetings, so that the whole project group was not present. Thus, project managers were responsible for the information exchange between the projects."

In addition to integration meetings and coordination team meetings, the program manager and consultant played an important role in inter-project coordination. The consultant was used as a messenger who supplied information requests and responses between the projects. This mechanism was used especially in the occasions where one of the projects formed a bottleneck that hindered the advancement of the whole program. It was important that the messenger represented an external neutral party that solved the information delivery problem objectively. Also the program manager served as an integrative person who delivered information between the different projects. The program manager participated in the project meetings of different projects and served also as an employee in the program. She describes her role as follows:

Interviewee c3: "Well I participated in quite many projects. Actually it (the participation) was daily. When we think about my role as the program manager, it should be noted that I also participated in the actual development work. So, I filled information queries, wrote manuals, actually I participated in everything that the other participants were doing. Thus, I was not only leading the project, I also participated in actual work. It was a kind of a double [role]…"

The informants also mentioned electronic mail as an important vehicle in the information exchange between the project teams. From the coordination perspective, information delivery via e-mail was especially appropriate for two reasons. First, it did not require the actual physical presence of participants, and thus geographical distances did not form a problem when coordination happened via e-mail. In this case it was essentially important, because a significant part of the development work was dispersed between France and two cities in Finland. Second, the use of e-mail formalized, the language, when converting the message into a written document. Thus, it could be used as a log, which made it possible to go back to the message. This system was perceived as dexterous, especially in the situations where there was a reason to assume that not all key individuals in the program were completely committed to the overall goal of the program. The informants mentioned that e-mail also provided a possibility to cover their back in situations when something went wrong.

4.4 Case Delta: Development of a new operations management system

Case Delta is ongoing program carried out in large private sector organization in Finland. The objective of the program is to develop and launch a new information system to manage operations related to customer information handling and delivery processes in one of the logistic business units of the organization. The program was initiated due to two different but overlapping drivers. First, one of the main business customers of the organization decided to renew their customer information system, and this created a need in the organization to renew their system also to ensure that the two systems, the organization's own system and its customer's system, would be compatible with each other. Second, several business customers of the organization had requested the organization to provide new services that the organization was unable to provide because of deficiencies within the existing system. Thus, the organization was partly forced by its business customers to renew the existing, already old and rather rigid system. ON the basis of these initial requirements, a two-year program Delta was initiated in spring 2005.

Program Delta employs approximately 20-30 persons who are either full-time or part-time allocated into the program. In addition, it utilizes a large number of expert resources occasionally on a need basis. The structure of program Delta resembles a network in which the boundaries are hard to define. However, the core of the program organization consists of a program manager, a program steering group, a quality group, a coordination group, a one-person program office, and several individuals working in three concurrent project teams. Each of the project teams has a dedicated project manager who is also a member of the coordination group and quality group. The steering group represents the highest decision making body, and is responsible for the advancement of the program. The quality group is an informal group of representatives of the business units, who have been attached to the program to ensure that the program fulfills the expectations of the business. The coordination group is organized as biweekly meetings in which the project managers report to the program manager the status of the projects and potential problems. The program manager describes the structure of the program as follows:

Interviewee d1: "*We have tried to create the kind of decision-making hierarchy in which each project group is authorized to make decisions that are project-specific and do not have effects on other projects or the schedule. The decisions that might have an impact on other projects, but not the schedule of the whole program are made in the coordination group. Finally, those issues that might have an impact on the overall schedule of the program are decided in the program steering group*"

The actual development work in the program is organized into three projects representing the following key areas of the development process:

- *D1 (Customer information):* this project develops a system that verifies the customer information and creates an unambiguous identification number for each customer

- *D2 (Delivery planning):* this project utilizes the identification number in order to optimize the delivery network and enable reporting practices for customers
- D3 (C*hange management)*: this project implements the developed processes and models in practice, and is responsible for the training of the employees to use the developed system

The projects described above represent logically sequential steps from customer information to change management and are organized to operate concurrently. The analysis of interdependencies between the project teams revealed that from in all the 3 inter-project interfaces, the interdependency between the project teams was either sequential or reciprocal by nature. The observed interdependencies between the project teams in case Delta are depicted in Figure 9.

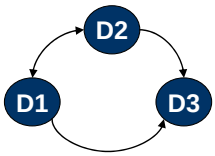


Figure 9 Interdependencies between project teams in case Delta

Even though the program organization is relatively simple from the structural perspective, the coordination is challenging because of strong organizational boundaries that have emerged between the different project teams. The project managers of the delivery planning and change management projects come from different business units, and the project manager of the customer information project represents a supplier company. The interviews revealed that the selected structure with the supplier's representative as one of the responsible project managers in the program did not seems to work well and finally led to overwhelming challenges. As a consequence of this structure, the project manager of the customer information project has been changed twice. The first two project managers represented the main supplier, and the third one was selected to represent the business unit in which the changes are supposed to be implemented.

In addition to the internal network, the program is embedded into a network of different actors that do not directly participate in the actual development work, but whose work would affect the program itself, actors who would be influenced by the programs, or both. The organizational net around the program includes the following actors: different business units of the parent organization, IT management of the parent organization, end-customers, national cooperative actors and research centers, internal and external suppliers, other projects within the parent organization, and process owners within the parent organization.

In case Delta the principal mechanisms used for coordination between the project teams are the coordination group meetings. The coordination group meets every two weeks and in this group the project managers report the progress of the projects. In addition, the group evaluates the potential risks related to the projects. The coordination group serves also as a formal steering group for individual projects, and is

used as a filter between the individual projects and the program steering group. The coordination group was mentioned by the three informants to represent one of the three most important mechanisms for information delivery between the project teams.

The formal coordination group meetings are complemented with more informal weekly meetings. The IT director of the parent organization describes these meetings as follows:

Interviewee d1: "*In addition to the coordination group, they (project managers) meet weekly. In those weekly meetings they discuss acute things that are related to various projects. The meeting is called "one-hour meeting", which describes the fact that the meeting is supposed to last only one hour. They even don't have any agenda for the meetings. It is just a place for information delivery and knowledge dissemination. Also the program manager participates in these meetings and occasionally I (sponsor) if necessary…*"

These informal meetings were rated by five of the six informants[15] to be among the three most important mechanisms for information exchange between the project teams, and on this base it seems to be the most important coordination mechanism in case Delta. These two mechanisms, coordination group meetings and informal weekly meetings, complemented with other meetings serve as the primary mechanisms for information delivery between the project teams. The project manager of the customer information project describes the inter-project coordination practices as follows:

Interviewee d2: "*We have a lot of meetings within this program. Every two weeks we have a coordination group meeting, once a month we have a steering group meeting, and every month we have also quality group meeting. In addition we have common stakeholder meetings with other project managers. I spend approximately 60%-70% of my working time in different kinds of meetings. Thus, we meet a lot with other project managers…Here we have this kind of culture that we need to sit down and meet in order to make things happen…*"

In addition to meetings, the informants mentioned that also documents and plans serve as an important mechanism to coordinate the interdependencies between the projects. For example, there is a need to coordinate the use of two key individuals who serve as resources for both the customer information project and the delivery planning project. The use of these resources between the projects is coordinated through project-specific plans and schedules. In case of unexpected changes to plans and other urgent issues, e-mail is used to contact other projects. Both of these coordination mechanisms, plans and

[15] These 6 informants were interviewed using a semi-structured interview frame

schedules and e-mail communication were mentioned by two informants to belong to the three most important mechanisms of inter-project information exchange.

Moreover, the informants mentioned a few other mechanisms as very important from the information exchange perspective. First, the weekly meetings of project managers and the IT director were mentioned as an important channel of information delivery. The meetings include individual half-hour informal face-to-face discussions of the project manager and IT director. The objective of these discussions is to screen possible challenges in the future from the IT perspective and ensure that each project keeps going. Second, the centralized information database is also used for information storage and delivery system. Even though mentioned in many interviews, only one informant evaluated this to belong to one of the three most important information exchange mechanisms. Finally, project managers serve as liaison persons between the project teams and thereby deliver information between the projects. The liaison position has been arranged by having project managers to participate in other projects' weekly meetings. This practice was emphasized by the project manager of the change management project, but it seemed to be valid for other project managers as well through common stakeholder-meetings.

4.5 Case Epsilon: Renewal of service products

Program Epsilon was carried out in a business unit of a large multinational private sector organization in Finland. The program was initiated by the head of the business unit to respond to the changed market conditions. Prior to the program the business unit was operating with a logic that was based on service product definitions developed in the early 1980's. The introduction of new information technology (www-technology), however, had changed the market dynamics by intensifying the competition in the market. The introduction of new technologies was seen to eventually replace the existing ones, and formed a strategic threat for the profitability of the business unit. Thus, there was an urgent need to renew the logic of existing service products, and program Epsilon was officially initiated in 2002. The program was started with a one-year definition phase in which the primary objective was to identify changed customer needs, as well as potential for modifications and major revisions in the existing service product portfolio. The actual development work started in late 2003 and produced a structure for service products that enables the business unit to use internal synergies among different service products to compete in three different markets. The developed process models and service product structures were launched in the business unit in spring 2005.

The program employed 20 full-time individuals at the most, complemented with 50 to 60 part-time employed persons from the parent organization. The full-time employees of the program were recruited internally from the parent organization. The persons were selected to represent different functions of the

parent organization. In addition, most of them were young and new employees in the organization. This selection criterion was purposefully added in order to allow innovative ideas and atmosphere to emerge.

The organizational structure of the program changed several times during the program. At the beginning of the development, the structure of the program reflected the logic of the functional structure of the parent organization. In the first phase the program structure was divided into three concurrent projects: production (E1.1), products (E2.1), and finance (E3). The structure of the program was relatively rigid, with a strict definition of roles and responsibilities. This led to the creation of strong mental organizational boundaries between the project teams. These boundaries hindered information exchange and cooperation between the teams. A project manager of the products-project describes the structural characteristics and challenges in case Epsilon as follows:

Interviewee e1: "It (program's structure) was like a functional organization with a clear definition of roles…Then we tried to work with projects in this kind of environment. In my opinion there was a lack of rational project work… The structure was so functional that we encountered problems with that. For example, when we started to find our focus (in products-project), we offered our free resources to the financing project that seemed to be a bottleneck in the critical chain of the program. Thus, it would have been beneficial for the whole program to allocate resources into that project, but they (employees from the financing project) told us to focus on the product and not to interfere with the financing matters."

In the second phase of the program the structure was changed to the support organizational change. The finance-project team (E3) continued the development work, but the focus of the products and production projects shifted from development towards finalizing the results and starting the change enforcement activities. The new program structure included, in addition to the finance project team, also an internal change project team (E1.2) and external change project team (E2.2). The former production project was integrated into the internal change project and the former product project was integrated into the external change project. This new structuring was challenging, however, because of the specific knowledge that the employees possessed as a consequence of the previous structure. The interview data revealed that the employees in the internal change management team did not know enough of the new products in order to communicate the forthcoming changes internally within the "parent" organization. This problem was solved through including employees from the external change project team as experts in the workshops and situations in which internal change project team needed in-depth information about the characteristics of the new products.

In the third phase, the responsibility related to the implementation of the developed product structures and production processes was assigned to the business unit of the parent organization. The external change project team (E2.2) continued to work with issues related to changes in the customer interface. A separate

coordination and implementation project team (E1.3) was established to support the internal change management activities managed by the business units (E4). In addition, the finance project team (E3) continued its development activities as a separate entity. The observed interdependencies between the project teams in the different phases of case Epsilon are summarized in Figure 10.

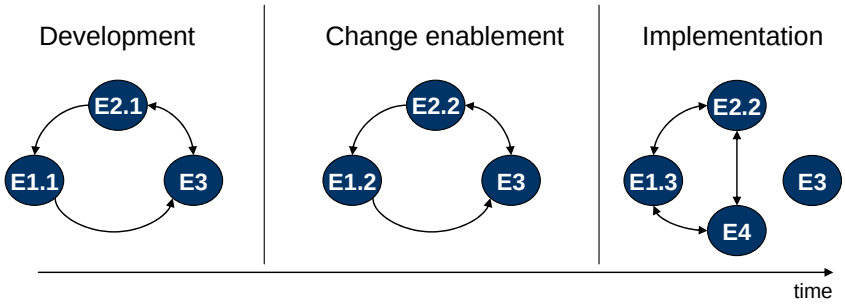


Figure 10 Interdependencies between project teams in case Epsilon

The management structure of the program consisted of a program manager, responsible project managers, a coordination group, and a steering group. This managerial scheme remained unchanged the same throughout the development and implementation phase, although changes were made in the team structure of the program. Several informants criticized the structure of the program for being ineffectively organized. The changes in the team structure of the program may also reflect the fact that the structure used at the beginning in phase 1 did not work well, and the program manager was obliged to change the structure of the program. The structural changes might have had, among other things, some effects on the communication between the project teams. A program manager described his observations about the communication behavior in different phases of the program as follows:

Interviewer: "Have you noticed any factors that have prevented information exchange between the project teams within the program?"

Interviewee e2: "Well, yes, in a way. At the beginning (of the program) we tried both to set up a program and simultaneously gather people to establish (a more permanent) organization to execute the program. And the fact that the people had remarkably different backgrounds, they came from different business units. In addition, during the program we changed the persons as well. These facts, your cultural background, your way of communicating, and the way how you understand the world, will definitely affect the inter-project interaction. Thus, it is not that easy just to take 20 persons and put them into a single room and tell them to communicate, it is more demanding. It took some time for the people to get used to the situation. In the second phase, communication between the project teams seemed to be very active and well-functioning, whereas in the third phase the facts that the we integrated new people with new ideas and preferences from the business units into our working, and we did not all work in the same

physical space anymore, brought some challenges to communication between the project teams. " (Program manager)

The analysis of coordination in case Epsilon revealed that the program's core team/coordination group meetings were perceived to be the most important mechanism for information exchange between the project teams. A total of four interviewed individuals valued the core team as the most important mechanism for coordination. The coordination group served as a steering group for individual projects and meetings were scheduled to occur every two weeks. The meetings focused on reporting of the project's status, on preparing material for the program steering group, and on discussing relevant risks and problems.

The co-location of employees from different project teams was also perceived by the informants as a very important method for information exchange between the projects. Three of the informants mentioned the co-location of program employees to be one of the three most important mechanisms for information exchange between the projects. The aim of co-locating the employees was to increase the possibility for informal "over the table" information exchange. The organizational structure at the beginning of the program differentiated the projects organizationally from each other through unequal work-loads in different projects. This kind of unequal workload structure created communication boundaries between the project teams, having people within each project to focus on intra-project activities. The change in program structure solved the situation and the role of informal "over the table" information exchange increased.

In addition to the above mentioned mechanisms, the informants also mentioned mid-term kick-off meetings, project managers' active participation in other projects' meetings, informal program core team meetings, informal employee group meetings, direct e-mail contacts, and plans and documents as important information exchange vehicles between the projects.

The additional attempts to exchange information between the projects were relatively project-specific with not many commonly agreed practices. The important notion, however, is that these kind of integration practices were needed and occurred. For example, the project manager of the finance project team reported about his role as a liaison between his project team and other projects. By participating in other projects' meetings he was able to deliver information between different projects and thus serve as an important integrative element.

A project employee of the external change project team, responsible for managing the customer interface, mentioned informal employee group meetings as an important information delivery channel between the projects. The informal employee group was formed by the employees of the program during the first phase, 3 to 4 months from the beginning of the actual development work in the program. The group got

together once a week with the objective of exchanging information about what the "other" people were doing in "other" projects within the program. In addition to actual information delivery, the employee group meetings served at the beginning also as a place to disgorge the employees' frustration. After a while the group meetings, however, focused more and more on information exchange activity solely. In the second phase, when the role of informal "over-the-table" discussion increased as the form of information exchange, the informal employee group dispersed as unnecessary.

Another example of the importance of informal information exchange practices are informal program core team meetings. The meetings differ from program coordination group meetings in a way that they were informal in nature. The meetings were also called "brown bag lunch meetings" named after the idea of getting all employees of core team together to enjoy lunch one a week. These informal meetings did not have any written agenda, but they rather served as a place for program manager to report to other core team members the overall situation of the program and for program core team members to exchange information among the project teams.

In addition to fore-mentioned coordination mechanisms the informants reported also about well-organized information database and unscheduled meetings that were utilized to complement the fore-mentioned mechanisms. According to interviewed persons the database, however, was not perceived important from the practical perspective because the culture within the program preferred to face-to-face contacts rather than information search from the documents and database.

4.6 Case Myy: Development and implementation of a new strategy process model

This case program was carried out in a large multinational pulp and paper industry company, with the objective to develop a new, more effective process for implementing corporate strategy. The former process of strategy implementation was based on systematic operation plans made by the production plants. Thus, the strategy of the organization was to a great extent capacity-driven, and the organization was unable to successfully integrate the corporate level vision with the detailed operational level plans. The new model of strategy implementation incorporates the sales and R&D functions as an integral part of the strategy formation and implementation process, and ensures that the strategy process proceeds fluently from the corporate level to the business unit level, and finally to the production plant level.

The execution of the program was divided into three distinct chronological phases; development, piloting, and implementation. The development phase was carried out during a half year period in 2002. The development team consisted of 7 to 15 persons and a program manager. Only the program manager was full-time allocated into the development work. The development phase produced a process model for strategy implementation with a common terminology, supporting templates, defined key success factors,

and a supportive information system. The second phase – piloting – was carried out between August 2002 and February 2003. The piloting phase included implementing the developed model in one business area. The piloting phase produced further developments and modifications into the initial model. After the piloting, the model, with experiences from the piloting phase, was presented to the management board of the organization, which decided that the model would be implemented into the whole organization. The implementation was executed sequentially, starting with the divisions of the organization.

During the interviews from October 2005 to December 2005 the model had been implemented in 80% of the organization. In this case study I will focus temporally on the piloting and implementation phase activities. These can not, however, be clearly distinguished from the development activities, because both piloting and implementation seemed to be rather development-oriented by nature.

Program Myy did not have a formally established organization, but it was carried out with the help of resources taken from the parent organization. The role of the program manager changed in the beginning of the implementation phase due to the fact that the responsibility of the implementation was shifted to the business developers and business controllers in the divisions, and the program manager did not have power over the implementation entities of the program. In addition, the program manager was only part-time allocated into the program during the implementation phase. The program utilized the parent organization's structure and chain of command in the implementing and development activities, and a formal project-based organization was not established. The parent organization was divided into 5 divisions and 5 functions, which represented the working entities (projects M1-M5 and M6-M10) in the program. In all divisions and functions, responsible persons were nominated to take care of the implementation of the developed practices.

The implementation of the developed strategy process was arranged through scheduled one- to two day meetings, for which each division and function collected a team of 15 to 25 persons, which utilized the developed templates and instructions in their strategy formation. The implementation continued by having business area level meetings, and finally production facility level meetings. At each level the upper level strategic goals were used as guidelines when forming more accurate goals and plans for respective actions to be taken. These one- to two day meetings in the different divisions and functions seemed to be relatively independent from the meetings in other functions and divisions.

I felt it somewhat challenging to make a distinction between implementation activities in the program and the actual practices, i.e. the process model that was supposed to be implemented. These two issues seemed to be easily intermiscible in practice. The in-depth analysis of interview data revealed, however, that even though the different parts of the organization were closely interdependent on each other from the perspective of the implemented strategy process, the actual implementation of the new developed process

itself included work entities (responsibility areas, i.e. divisions and functions) whose execution was relatively independent. However, there was a strong need among different functions and divisions to integrate the outcomes of the implementation process, i.e. the strategic outlines and actions, in order to ensure that the different parts of the organization (divisions and functions) are strategically aligned. These kinds of interdependencies between the different parts of the program can be categorized as pooled, because the projects were interlinked through a common overall goal, but operationally relatively unconnected. The requisite coordination was related to sharing implementation experiences and the overall goal of unifying the strategy implementation practices. Thus, having all "parts" of the program implemented in total isolation from each other might not have produced unified practices. The observed interdependencies between the project teams in case Myy are summarized in Figure 11.

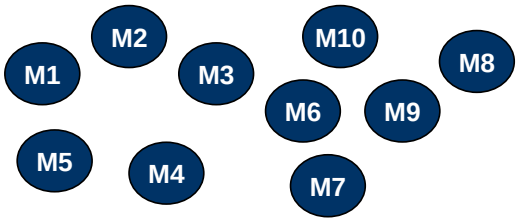


Figure 11 Interdependencies between project teams in case Myy

The required coordination between the different parts of the program was relatively low, and thus the interaction between them was not very frequent. The interviews revealed that the organizational parts were relatively highly differentiated from each other. Each part had its own practices and ideas on the implementation. The extent to which the different parts of the program followed the common principles of implementation that were described in various plans, was highly dependent on the executing entity in question. Some of the divisions and functions followed the model strictly, while others used it mostly as general level guideline.

The most important mechanisms for information exchange between the divisions and functions were network meetings, direct face-to-face contact of directors, and use of liaison persons. Half of the informants mentioned each of these mechanisms during the interviews. Network meetings refer to twice a year arranged meetings of business developers and persons responsible for implementation in the functions. The meetings were facilitated by the program manager and provided a place to share information and experiences. The liaison in this context refers to directors and managers within the division or function who participated in other divisions' or functions' one-day implementation meetings either as experts who brought information from their own functions / divisions that could be used as input information, or as a facilitator, who was responsible for making the implementation day proceed according to the planned model. These liaisons enabled direct information exchange between two or more

divisions / functions. The use of liaisons, even though effective, was somewhat limited because it was impossible to have a liaison from each function and division as a participant in the implementation meeting. The informants evaluated that the optimal size of the implementation meetings would be 15 persons. In that case the meeting would be effective. The actual size of most meetings was evaluated to be around 25 persons with not many liaisons from other functions or divisions involved. Thus, the possibility of exchange information between divisions and functions through liaisons participating in implementation meetings seemed to be somewhat limited.

The other coordination mechanisms mentioned by more than one informant in the interviews were information exchange through management board meetings, use of plans and documents in information delivery, information exchange through the IT tool developed to support the process, information exchange through the intranet, planned meetings among different functions and divisions, and information exchange through the program manager. Moreover, the interviews revealed also the following coordination mechanisms that were mentioned only by one informant: informal network meetings among business developers, definition of roles and responsibilities, and e-mail communication.

4.7 Case Sigma: Development of organizational processes and the quality of service products

Case Sigma represents an ongoing strategic organizational development program in a large public sector organization in Finland. The program is based on strategic guidelines defined by the head of the organization in September 2004. The strategic guidelines have been further developed into distinct individual projects with tentative action plans. The collection of projects forms a program that is followed by the board of directors of the organization. The objective of the program is to ensure the development of the organization from the financial and operational perspective. The individual projects focus on increasing the effectiveness and productivity of the organization, as well as the quality of the services it provides. Thus, the aim of the program is to both increase the quality of the services and the intra-organizational processes and to decrease the unit costs related to producing service products for the customers.

Program Sigma was officially initiated in December 2004 when the management council of the organization decided to fund the program. The decision was made on the basis of the initial plans of 40 individual projects that formed a frame for the program. The 40 projects (S1-S33) that were funded by the management council were categorized into four strategically important task domains that reflect the functional structure of the organization. Each of the four task domains has dedicated sub-program manager(s). Part of the projects represent a rather large frame or overall goal that is implemented by

various individual (sub-) projects. In addition, all the projects are not executed concurrently. The monitoring of the individual projects is organized through project-specific steering groups or management boards of the parent organization. The individual projects vary in size and duration from one to two persons' definition projects to several years' development and implementation projects. The projects typically include several different actors, external and internal to the organization.

The individual project teams in case Sigma operate as relatively independent entities. Some of the projects, however, constitute more coherent groups in which the execution of the projects is dependent on others. Moreover, the structure of the four different task domains varies, so that in some task domains the projects are more interdependent on each other than in other task domains. The observed interdependencies between the project teams in case Sigma are depicted in Figure 12.

An informant describes the inter-project interdependencies in one of the task areas as follows:

Interviewee s1: "…the projects have some (not direct) interdependencies, but we have tried to design the projects in a way that there would not be much overlap in the projects…however, in case there are some interdependencies, we try to ensure through steering groups, using the same persons in different steering groups, that the necessary information delivered to the projects…"

The management of program Sigma is based on a hierarchical mode of operating. The existing decision making boards of the parent organization constitute the principal frame through which the information flows and the program are managed. As in case Myy, also in case Sigma the program does not have a formally established separate organization, but it is carried out mainly with the help of resources taken from the parent organization.

The interview data reveals that the management boards of the parent organization represent one of the most important mechanisms through which the coordination between the project teams takes place in practice. The division's management boards serve as a formal means to share and exchange information between the management board members, most of whim are also included in the individual projects, either in the project manager's role or as steering group members. The manager of one of the task domains describes the role of the management boards in program Sigma as follows:

Interviewee s2: "the division's management board is the place where they (projects) meet in our division. They (projects) are reviewed once a month in the divisional management board…In addition, we have a kind of more in-depth reviews every now and then, for example every six months I require that each project reports their achievements and future plans. We take a thorough look of these reports in our division's management board two, three times per year…we have to a great extent the same individuals in different projects. First of all, all the members of our division's management board are included in some

of the projects, and actually there is no project with not at least one member of the management board participating in the project…I am not sure whether I am involved in three or four projects myself…"

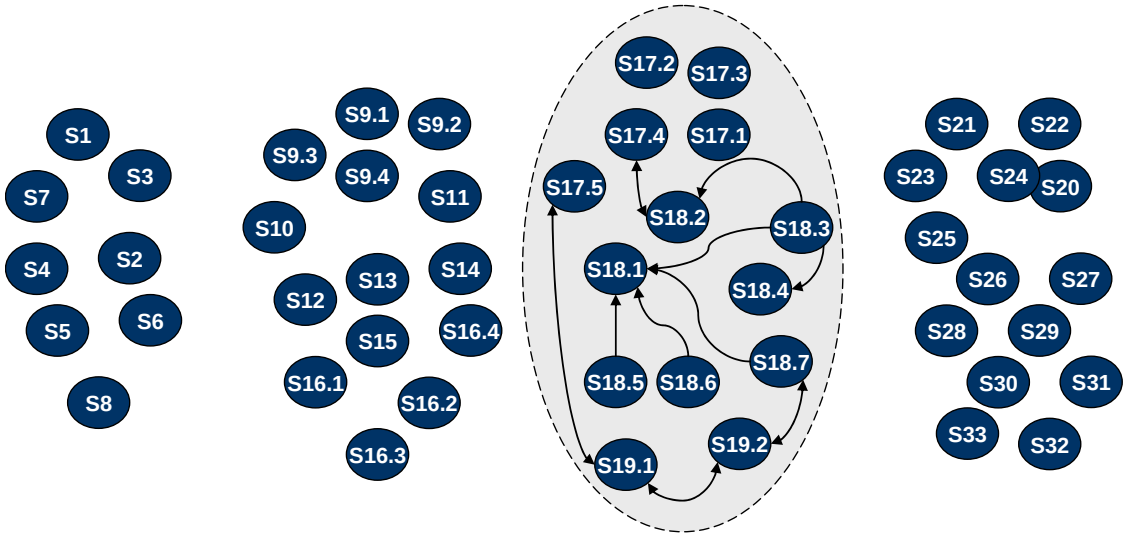


Figure 12 Interdependencies between project teams in case Sigma[16]

In addition to divisional management board meetings, the necessary coordination in case Sigma takes also place through weekly business unit management board meetings, strategic management board meetings, weekly informal meetings between business unit directors and project managers, and steering group meetings. In addition, the information between the project teams is exchanged through more infrequent common group meetings arranged for the project managers within the program, project manager courses utilized for creating contacts between the project managers, and informal ad-hoc meetings between the project teams if necessary. From the above mentioned meetings the ones that were already institutionally legitimized practices of the parent organization and inseparable parts of its structure were perceived by many of the informants as the most important mechanisms for coordination.

Interaction between the four strategic task domains in this case is rather rare, and the project teams in different task domains seem to be highly differentiated from each other as regards their goals and objectives. However, within each task domain, the information exchange through different board meetings is complemented by engaging the same key individuals in different projects. This mechanism provides a more flexible and faster form of increasing understanding and managing necessary interdependencies

[16] The analysis of interdependencies between the project teams is limited into the gray circle (project teams S17-S19), which represents one of the four strategically important task domains with 14 distinct project teams.

between the projects. In most of cases the key individuals that are involved in several projects are directors or managers of the divisions or business units, who serve in either a project manager's role or as members of the steering groups of individual projects. The coordination is also to a great extent supported by the regular reporting system that forces project teams to report on their progress to the management boards. The reports of the progress of each project are shared between the projects via the intranet, which partly serves as a mechanism for information exchange between the project teams. This managerial frame is considered as beneficial for some projects, but overly bureaucratic for others. In some projects the coordination between the management boards or reports in the intranet are not seen sufficient, and complementary direct contacts are needed between the project managers of two or more project teams.

5 CROSS-CASE ANALYSIS

In this chapter the case programs are compared with each other. More specifically, the cross-case analysis focuses as suggested by Eisenhardt (1989) on identifying the differences and similarities among the cases and finding explanations for these. The cross-case analysis includes a comparison of the coordination mechanisms and their significance in the case programs, identification of coordination strategies, examination of the structural complexity and its relation to coordination in the case programs, examination of the uncertainty and its relation to coordination in the case programs, and finally examination of the performance in the case programs.

5.1 Coordination mechanisms and modes in the case programs

The cross-case analysis started with comparing the observed coordination mechanisms and their perceived importance in the case programs. The analysis of the coordination mechanisms was based on the coding of direct observations from transcribed interview data and field notes. The observed coordination mechanisms were coded with descriptive coding logic (Miles & Huberman, 1994). The codes were changed and developed during the analysis process, until the additional analysis no longer refined the observed coordination mechanisms. The process of data analysis proceeded iteratively, including various comparisons among existing theories and empirical data.

The coordination mechanisms, obtained as a result of the analysis, were further categorized into four different classes called coordination modes. The coordination modes were modified from the previous studies of Van de Ven et al. (1976) and Kraut and Streeter (1995). The respective modes for the observed coordination mechanisms in this study are: group mode of personal coordination, individual mode of personal coordination, electronic mode of coordination, and impersonal mode of coordination.

The group mode of personal coordination refers to the use of mechanisms in which mutual adjustments occur in a group of occupants (more than two) through meetings. The analysis of data revealed several different types of group coordination mechanisms, such as coordination group meetings, co-location of core persons, integration meetings, kick-off meetings, informal employee group meetings, use of existing decision making boards, and external network meetings.

The individual mode of personal coordination refers to the use of mechanisms in which individual role occupants make mutual task adjustments through vertical or horizontal communication. Within the context of this study I observed the utilization of such mechanisms such as liaisons, integrative persons, direct contacts via the phone, and direct face-to-face contacts.

The impersonal mode of coordination refers to the use of a codified blueprint of action that is impersonally specified. In-depth analysis of each case in the study revealed several coordination mechanisms that fell into this category. The observed mechanisms were: specified reporting practices, use of formal plans and schedules, definition of roles and responsibilities, and the use of standardized information systems, such as a common database.

Finally, the electronic mode of coordination includes the use of electronic mail as a communication mechanism. The electronic mode of coordination was separated from the other coordination modes as a distinct category because information exchange through electronic mail does not require an actual physical proximity of the coordinated parties, the coordination is not necessarily based on the concurrency of information exchange, and the delivery of information does not require face-to-face interaction, as is often the case in the group mode of coordination and most often in the individual mode of coordination (except for direct contacts via the phone) The observed coordination mechanisms categorized by the coordination modes within each case are summarized in Table 12.

Table 12 Summary of the observed coordination mechanisms in the case programs categorized by coordination modes

Case	Group mode of coordination	Individual mode of coordination	Electronic mode of coordination	Impersonal mode of coordination
Alpha	• Weekly status review meetings • Co-location, informal information exchange • Informal inter-project group meetings • Workshops for result approval	• Direct contacts between project managers via phone or face to face • Use of same resources in different projects • Program manager's participation into the projects	• Direct contacts between project teams via e-mail	• Interdependencies between the projects identified in overall task list • Common place for information storage, serves as a mechanism for information sharing through documents
Beta	• Weekly status review meetings • Open space office • Informal inter-project meetings • Participation in steering group meetings • Kick-off meetings	• Direct contacts between project managers via phone or face to face • Use of same resources in different projects	• Direct contacts between project teams via e-mail • E-mail as a mechanism to formalize informal interaction	• Use of reports/documentation to share data • Project plan as an integrative map • Organizational process for program management • Resource allocation tool
Gamma	• Work meetings between project teams • Coordination group meetings • Co-location	• Direct face-to-face contacts between project managers • Program manager worked in the projects • External consultant worked as a facilitator delivering required information between the project teams • One person served as the project team manager in two different teams • Supplier worked as liaison between the projects	• Direct contacts between project teams via e-mail • E-mail as a mechanism to formalize informal interaction	• Functionality reports and testing documents • Schedules, critical path method • Clear definition of roles and responsibilities, role-responsibility matrix
Delta	• Informal weekly meetings of the core group • Coordination group meetings • Quality group meetings • Informal meetings between project managers • Stakeholder group meetings • Steering group meetings	• Weekly meetings between the information management director and each project manager • Use of same IT and system experts in different projects • Project manager's participation in weekly meetings of the other projects	• Direct contacts between project teams via e-mail	• Use of development model for information systems • Reporting practices • Common database • Resource use plans

Table 12 Summary of the observed coordination mechanisms in the case programs (continued from the previous page)

Case	Group mode of coordination	Individual mode of coordination	Electronic mode of coordination	Impersonal mode of coordination
Epsilon	• Coordination group meeting (biweekly) • Informal meetings between project teams • Brown bag lunch • Co-location • Other people's discussion group (this vanished when the project organization changed) • Kick-off meetings	• Informal face-to-face discussions	• Direct contacts between project teams via e-mail	• Sharing documents • Common database
Myy	• Facilitator network meetings • Information exchange in management boards/implementation • Arranged meetings between different divisions and functions • Informal loose network meetings of business developers (discussions on how to implement developed practices in different divisions)/Implementation • Formal development team meetings/development phase	• Program manager served as a messanger delivering information between the divisions and functions • Use of facilitators to share understanding between the organizational groups • Individuals participated in other areas implementation activities in order to deliver information between different areas • Direct face-to-face contacts	• Direct contacts between project teams via e-mail	• Documentation about the process in the intranet • IT tool that enabling the follow-up of how the project proceeded in different parts of the organization/Implementation • The process itself served as an integration tool • Use of sales plans to direct the logistic and orders • Schedules for implementation, strategy clock
Sigma	• Divisional management board meetings, business unit management board meetings, and strategic management board meetings • Weekly meeting between the director and project managers • Common meetings arranged for the project managers of the program • Informal meetings with other BU directors and divisional managers • Project management course • Informal meetings with other projects that are linked to this project • Steering group meetings	• Use of same (liaison) persons in several projects • Direct contact to other projects if necessary • Integrating organizational unit	• Direct contacts between project teams via e-mail	• Reporting system • The information preserved in the intranet • Common templates

The comparison of the coordination modes and mechanisms (Table 12) reveals that rather than relying on single mechanisms or modes of coordination, each of the seven case programs utilizes several coordination mechanisms and different coordination modes to guarantee information exchange between different project teams within the program. The coordination mechanisms that belong to the impersonal mode of coordination represent rather formal means to exchange information due to the fact that their use, when put in practice, necessitates minimal verbal communicative action between the project teams. In addition, these mechanisms produce information that seems to be clear and easily transferred between different projects without a fear of major misunderstandings and emergence of equivocality between the coordinated actors. For example, the use of common templates (Sigma), functionality reports and testing documents (Gamma), document sharing and reporting practices (Beta, Sigma, Delta, Myy), and common database (Alpha, Delta, Epsilon) represent coordination mechanisms that advocate formalization of the delivered information.

The observed coordination mechanisms utilizing the group mode of interaction seem to differ from each other both within and between the case programs. Some of the mechanisms, such as weekly status review meetings (Alpha, Beta), coordination meetings (Gamma, Delta, Epsilon), formal development team meetings (Myy), steering group meetings (Sigma), and different management board meetings (Sigma, Myy) represent rather formalized and regular practices in which the information exchange may, however, utilize rich face-to-face interaction. Conversely, the other coordination mechanisms that belong within the group mode of coordination seem to be more informal by nature, characterized by more irregular, not pre-defined, and voluntary usage. The use of these mechanisms is triggered by the need for information exchange, and unlike more formal group meetings are not bound by behavioral rules, such as meeting agendas or formalized roles of the individuals in the meetings. Co-location of key individuals from different project teams (Alpha, Gamma, Epsilon), open space offices (Beta), inter-project meetings (Delta, Sigma), and development network meetings (Myy) are examples of a more subtle and informal type of group mode of coordination, which due to their nature leave room for interpretation and formation of shared understanding.

In a similar vein, the coordination mechanisms that the represent individual mode of coordination include a more formal and systematic use of integrating individuals, such as program managers in the integrating role (Alpha, Gamma, Myy), experts working in several project teams (Alpha, Beta, Delta), and consultants and suppliers as integrating actors (Gamma). In addition, coordination through the individual mode was performed via a more informal and unplanned manner in direct face-to-face contacts between project teams (Alpha, Beta, Gamma, Epsilon, Myy, Sigma).

The electronic mode of coordination in all the case programs was based on the utilization of e-mail as a communication medium that enabled both direct contacts between project teams and sharing reports and documents if necessary. In two of the case programs, Beta and Gamma, the use of e-mail was, in addition to a communication medium, also mentioned as a mechanism to formalize otherwise informal "corridor discussions" and to "keep track" of spoken promises and commitments.

5.2 Importance of coordination mechanisms and modes

In order to compare the coordination between the case programs, the perceived importance of each coordination mechanism in each case program was evaluated. The evaluation of the importance of different coordination mechanisms was based on the interviewees' perceptual judgments. All informants within each case were asked to specify from the all mechanisms that she/he had mentioned during the interview the three most important mechanisms she/he had used. The importance of the mechanism in this context was explained to the informants to refer to the significance of the mechanism in exchanging information and increasing mutual understanding between the projects. The importance of the mechanisms is related to the value of the use of the mechanism. A similar kind of idea was used by Van de Ven et al. (1976) in measuring the existence of the mechanism and its significance from the practical point of view.

As an example of the above-mentioned method of evaluating the importance of different coordination mechanisms in the case programs, case Alpha is examined more in-depth below. Only five informants were able to identify the most important coordination mechanisms used, as one of the informants represented the "owner" of the program and was extensively aware of the actual coordinative practices applied. Four informants mentioned weekly status review meetings, three mentioned co-location and related informal information exchange, one mentioned informal inter-project group meetings, and one mentioned result approval workshops to belong to the three most important mechanisms for coordination. All the mentioned coordination mechanisms represent the group mode of coordination. In addition, two of the informants evaluated direct contacts via phone or face to face as one of the three most important mechanisms for inter-project coordination. These mechanisms represent the individual mode of coordination. Moreover, three of the informants perceived that direct contacts via e-mail were one the three most important coordination mechanisms used. Furthermore, none of the informants mentioned that coordination mechanisms that would be categorized belonging to the impersonal mode of coordination were among the three most significant mechanisms for coordination within this case.

A similar procedure was applied in all of the cases, except for case Myy, in which the importance of each coordination mechanism was evaluated as the number of informants that mentioned the coordination mechanism during the interviews. This exceptional method was used in case Myy because the informants

in case Myy were unable to specify the importance of different coordination mechanisms used. The validity of this treatment was, however, ensured by presenting an individual case report and discussing the findings with the program manager of the case program. A summary of the importance of different coordination mechanisms in each case program is given in Appendix 5.

The analysis continued by evaluating the relative importance of each coordination mode in each case program. The importance of different coordination modes was calculated as a sum of the importance of the individual coordination mechanisms (frequencies [NoM] in Appendix 5) belonging to the respective coordination mode category. These sums were further divided by the sum of all frequencies within the case program and multiplied by 100. This resulted in a percentage number indicating the relative importance of each coordination mode in each case program, summarized in Table 13.

Table 13 Relative importance of different coordination modes in the case programs[17]

Coordination modes	**Alpha** (% of 14)	**Beta** (% of 17)	**Gamma** (% of 18)	**Delta** (% of 18)	**Epsilon** (% of 12)	**Myy** (% of 30)	**Sigma** (% of 21)
Group mode of coordination	65	41	50	61	92	37	43
Individual mode of coordination	14	24	22	17	8	33	33
Electronic mode of coordination	21	18	22	11	0	0	0
Impersonal mode of coordination	0	17	6	11	0	30	24

The analysis of the importance of different coordination modes within and between the case programs revealed that in all 7 organizational development programs, the group mode of coordination seems to be the most important form of coordination. In addition, in all case programs the mechanisms that represent the individual mode of coordination were mentioned among the three most important mechanisms. Thus, these two coordination mechanisms seem to be important in all types of organizational development programs. I also utilized Person's chi-square test to evaluate whether the relative importance of different coordination modes would differ significantly between the case programs within this dataset. The test result revealed that the case programs differ from each other ($\chi^2 = 33.82$; $p < 0.05$).

[17] The calculation of the relative importance of different coordination modes is based on a total of 130 mentions received from 45 informants.

5.3 Identification of coordination strategies

The analysis of coordination modes revealed that the case programs differ from each other through their emphasis on different types of coordination modes and the mechanisms utilized. In order to compare the case programs further, I focused on analyzing the coordination from the holistic perspective through the concept of coordination strategy defined and discussed on page 40 above. The coordination strategy describes the adopted practices and logic for information exchange within the program and reflect the programs organization's capacity to process information between the project teams.

The analysis of the relative importance of different coordination modes within each case and between the cases, complemented with the analysis of the use of different coordination mechanisms in the case programs suggests that the case programs can be categorized into three clusters, each representing logically and theoretically distinct and meaningful coordination strategies. In the clustering process, both the relative importance of the different coordination modes and in-depth understanding from the interviews (Appendix 4: Summary of the key observations in the case programs) were used as a basis for defining which cases would form a cluster. Table 13 shows that case programs Myy and Sigma form one cluster due to their largely similar logic of coordination, which is also reflected in the importance related to the different modes of coordination. The basis of the second cluster are cases Epsilon and Alpha, which share common characteristics, such as high emphasis on the group mode of coordination, centralized power structure, high differentiation between the project teams, and low importance of impersonal coordination. Case programs Beta, Gamma, and Delta resemble each other by having on average more emphasis on the group mode of coordination than Myy and Sigma, but less than cases Epsilon and Alpha. In addition, these three cases seem to put less emphasis on the individual mode of coordination than cases Myy and Sigma, but more than cases Epsilon and Alpha. Moreover, the mechanisms of the individual mode of coordination differ in cases Beta, Gamma, and Delta from the ones applied in cases Myy and Sigma. The former emphasize inter-team information exchange through employees who work in several projects and thereby serve as unintended liaisons and integrators. In cases Myy and Sigma the information exchange between the differentiated teams is actualized through shared steering group memberships and other decision committees. In addition, unlike in cases Beta, Gamma, and Delta, direct contacts between project teams are rather rare in case programs Myy and Sigma. Moreover, cases Beta, Gamma, and Delta differ from the other case programs (except case Alpha) through the fact that in these cases e-mail was mentioned as one of the most important mechanisms for coordination. Finally, the impersonal mode of coordination seems to be in all of these case programs less important than in cases Myy and Sigma, and more important than in cases Epsilon and Alpha. Looking at the relative importance of the group mode of coordination, individual mode of coordination, and impersonal mode of coordination more closely in the

three case programs Beta, Gamma, and Delta reveals that these programs represent a mixture of two different strategies, one represented by cases Epsilon and Alpha, and the other by cases Myy and Sigma. In addition, in all of these four case programs, all modes of coordination were mentioned as important ones. The in-depth content and logic of the three distinct coordination strategies is explained next.

5.3.1 Cluster 1: Centralized strategy

The coordination strategy utilized by case programs Alpha and Epsilon is called hereafter a centralized strategy. Within this strategy cluster, the group mode of coordination represents the dominant mode of coordination and the interaction between the project teams is strongly centralized. The centralized coordination strategy is based on the use of different types of formal and informal group meetings as primary means to exchange information between the project teams. Relatively small importance is put on informal specially arranged direct face-to-face contacts and use of liaison persons. Thus, information sharing between the project teams is to a great extent based on physical contact in a group of participants. In case Alpha the relative importance of the group mode of coordination is over 64%, and in case Epsilon the respective figure is over 91%. The observations from the interviews reveal that within both cases, Alpha and Epsilon, the "culture of cooperation" between the project teams is weak. Strong communication and collaboration gaps exist between fairly differentiated project teams. In both cases, power is centralized to program managers and thus weekly status review meetings serve as the most important coordination mechanism complemented with another more informal group mode of coordination (co-location). The second distinct characteristic of this cluster is the insignificance of impersonal means of information exchange between the project teams. The relative importance of the impersonal mode of coordination in the case programs is 0%. This is not to say that case programs Alpha and Epsilon would not use any impersonal means for coordination, but rather that they are not perceived important compared to other modes of coordination. In both of these case programs, the interview data gives an indication of use of only two different types of informal coordination mechanisms in each case, whereas in other case programs the respective analysis gives indication of several mechanisms falling into this category (see Table 12).

The individual mode of coordination is perceived as relatively insignificant, with less that 15% relative importance in both cases in the centralized strategy cluster. The only coordination mechanisms that are mentioned among the most important ones within the individual mode of coordination in cases Alpha and Epsilon are direct contacts between project managers via phone or face-to-face. Finally, the role of electronic mail as a coordination mechanism seems to alter from not important at all (case Epsilon) to somewhat important (case Alpha).

5.3.2 Cluster 2: Balanced strategy

Cases Beta, Gamma and Delta, form the second cluster called balanced strategy. The overall common characteristic of the cases within this cluster is that coordination mechanisms from all four modes of coordination are mentioned in all case programs to belong within the three most important means for inter-project coordination. The relative importance of the group mode of coordination in this cluster varies from Beta's 41% to Delta's 61%. In cases Gamma and Delta, four of the six informants, and in case Beta five of the six informants mentioned weekly status review meetings as one of the three most important coordination mechanisms applied. In addition, in cases Gamma and Delta, the weekly informal inter-project work meetings were mentioned by four informants to belong among the most important coordination mechanisms. The relative importance of coordination in the individual mode through direct contacts, liaisons or integrators varies from 17% (Delta) to 24% (Beta). Moreover, electronic mode of coordination was seen within this strategy cluster on average as more important, compared to the subordinate strategy cluster (see chapter 5.3.3). Its significance, however, remains rather moderate, the range of relative importance in the case programs being 11% (Delta), 18% (Beta), and 22% (Gamma). Finally, within this cluster the important mechanisms of impersonal coordination include e.g. specified activities for document sharing and accurate project plans (Beta), functionality reports and testing documents (Gamma), and a common database (Delta). The average relative importance of impersonal coordination within this cluster varies from 6% to 17%, witch is significantly less than the respective values in the subordinate strategy cluster. In the case programs representing the balanced strategy cluster, the group mode of coordination, even if relatively the most important mode, is less important than in the centralized strategy cluster. In addition, the individual mode of coordination is more important than in the centralized strategy cluster. Moreover, unlike in centralized strategy, in the balanced strategy cluster, impersonal coordination mechanisms such as project plans, reports and common database are perceived important. Thus, when compared to the centralized strategy, the focus of information-exchange activities in the balanced coordination strategy is shifted away from the centralized mode towards more localized project team-initiated activites.

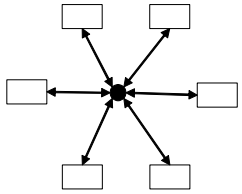
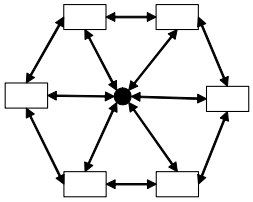
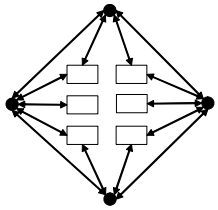
5.3.3 Cluster 3: Subordinate strategy

Case programs Myy and Sigma constitute a cluster called subordination strategy. In this cluster, unlike in the centralized strategy cluster, inter-team interaction is not based on one clearly dominant mode but rather the relative importance of three different coordination modes, the group mode of coordination, individual mode of coordination, and impersonal mode of coordination seem to be of the same magnitude. In case Myy the relative importance of the group mode of coordination is 37%, and in case Sigma the respective figure is 43%. A distinct feature that differentiates cases Myy and Sigma from the other case

programs is that in case programs Myy and Sigma the decision making boards of the "parent" organization constitute an important mechanism for inter-project coordination. In case Myy three of the total of six informants mentioned the management board of the corporation as an important place for information exchange between directors responsible for the implementation and development of project-like entities of the program. Respectively, in case Sigma, seven of the eleven informants mentioned either strategic management board meetings, divisional management board meetings or business unit management board meetings to belong to the most important mechanisms for inter-project coordination. Thus, in both cases the "parent organization's" structure and chain of command was seen as an important means for information exchange between the project teams. Thus, the information flows between the project teams principally follow the vertical channels in which managerial positions form nodes where bottom-up information turns to flow back down to other teams. It is also characteristic for cases Myy and Sigma that the program organization had a few if any full-time allocated resources. Thus, the resources were adopted from the parent organization, and the structure of the program in both cases reflects the structure of the parent organization. The group mode of coordination is in both cases complemented by using individual liaisons to deliver information between the coordinated entities. The relative importance of the individual mode of coordination in both cases was 33%. The analysis of the interview data, however, revealed that the individual mode of coordination is cases Myy and Sigma mostly based on shared steering group membership and participation in different decision making committees. In this sense, the nature of the individual mode of coordination differs from the ones in the cases applying balanced- or centralized coordination strategy. In addition, this cluster is different from the centralized strategy cluster in two additional dimensions. First, neither in case Myy nor in case Sigma did any of the informants mention e-mail as an important mechanism for inter-team coordination. This reflects, when complemented with the notion of forms of direct contacts, low frequency of horizontal information exchange between the project teams. Second, within this strategy cluster the impersonal mode of coordination is the most important when compared to the other strategy clusters. In case Myy the relative importance of coordination through impersonal means, such as process specifications, IT enabled review tools, sales plans and implementation schedules is 30%. In case Sigma the respective figure is 24% and the important coordination mechanisms include specified reporting system and documentary material preserved in the intranet.

The logic of the three different coordination strategies is summarized in Table 14. In the table, the rectangular white boxes represent project teams, arrows represent information flows, and black circles authority/authorities responsible for the management of the project entity.

Table 14 The logic of the three identified coordination strategies

Centralized strategy	Balanced strategy	Subordinate strategy
		

In case of centralized strategy, the interaction between the project teams is actualized primarily through inter-team group meetings. In addition, the decision making power is strongly centralized and the organizational boundaries between the project teams strong. This consolidated form of interaction between the project teams is complemented with the network of direct informal team-to-team contacts in the balanced coordination strategy. Within this strategy, the boundaries between project teams are rather permeable and weak. In the subordinate coordination strategy, the interaction between the project teams happens mainly through hierarchical referral in decision-making committees and through shared memberships in steering groups. The power structure resembles the parent organizations' configuration. This strategy emphasizes the importance of formality through rigid and uniform reporting practices.

5.4 Antecedents of coordination strategies

The adoption of different coordination strategies in the case programs is in this study explained through the concepts of uncertainty and complexity. This chapter includes an analysis of the relation between these concepts and the coordination strategies.

5.4.1 Uncertainty

The concept of uncertainty is defined in this study through two distinct constructs; task analyzability and task novelty, as described above in chapter 3. The mean values for both constructs in each case program are summarized in Table 15.

Table 15 Mean values of task analyzability and task novelty in the case programs

		Alpha	Beta	Gamma	Delta	Epsilon	Myy	Sigma
Task analyzability	Mean	3.6	4.9	4.7	4.5	3.0	5.0	3.7
	N	6	7	6	5	4	6	11
Task novelty	Mean	3.7	2.7	6.0	3.2	4.5	3.5	4.1
	N	6	8	6	5	4	6	11

The comparison of construct task analyzability reveals that of the case programs, Alpha and Epsilon are characterized as less analyzable than the other case programs. In a similar vein, task analyzability in case Sigma is lower than in the other cases, most of which are on average perceived as relatively well defined by means of interdependencies between the projects, linkages to stakeholders, working methods and competency needs. The task analyzability in case Myy is, however, relatively high, and therefore it can not be reasoned that task analyzability would be directly related to the subordinate coordination strategy as an antecedent factor. The mean values of task novelty do not seem to form meaningful patterns within and between the case clusters. The greatest differences in program novelty exist between cases Beta and Gamma, both included within the balanced strategy cluster. Case Gamma represents a rather novel development effort to its "parent organization", whereas case Beta is not perceived novel at all, and is characterized more like regular type of doing the work.

The Mann-Whitney U-test was used to evaluate whether the observed differences in an median values of task analyzability and task novelty between the case programs could be interpreted as statistically significant. The test results are summarized in Table 16.

Table 16 Comparison of task analyzability and task novelty in the case programs

Mann-Whitney U-values and significances, +=p<0.1, * = p<0.05, **=p<0.01, ***=p<0.001

Task analyzability							
	Alpha	Beta	Gamma	Delta	Epsilon	Myy	Sigma
Alpha							
Beta	**7.50+**						
Gamma	**4.50***	16.50					
Delta	7.50	12.00	15.00				
Epsilon	7.50	**2.50***	**0.00****	**2.50+**			
Myy	**6.50+**	20.00	13.00	10.50	**2.50***		
Sigma	30.00	**15.50***	**10.50***	14.00	16.50	**13.50***	
Task novelty							
	Alpha	Beta	Gamma	Delta	Epsilon	Myy	Sigma
Alpha							
Beta	13.50						
Gamma	**2.50***	**0.50****					
Delta	11.00	13.00	**0.00****				
Epsilon	9.00	**3.00***	**4.50+**	**2.00***			
Myy	16.00	13.50	**2.50***	13.00	8.00		
Sigma	29.50	**23.00+**	**11.00***	20.00	22.00	23.50	

The results reveal that the case programs representing the balanced strategy cluster, Beta, Gamma and Delta, are at least at a 95 percent confidence level more analyzable than case programs representing the centralized strategy cluster. In addition, the observed differences in task analyzability between case programs Beta and Sigma and Sigma and Myy are statistically significant. Moreover, differences in task analyzability also exist within the strategy clusters. The results show that the task analyzability in case

program Myy is significantly lower than the task analyzability in case Sigma. These results seem to indicate that low task analyzability is associated with the centralized coordination strategy.

Significant differences were also found in the task novelty between the case programs. The test results show that case program Gamma represents a technologically, and from the competence perspective, significantly novel program when compared to all the other case programs, except case Epsilon. Case Epsilon also seems to be rather novel when compared to cases Beta and Delta. The results of this study, however, do not indicate that the novelty of the program would somehow be related or explain the adoption of different types of coordination strategies. Thus, it can be concluded that task novelty does not seem to explain the adoption of different kinds of coordination strategies as they are explained here. However, it may have some effects on the coordination mechanisms and their use in the programs. For example, in-depth examination of inter-project coordination between case programs Gamma and Beta reveals that at least the role of the program manager is somewhat different in these cases. In case Gamma the program manager participated actively in the execution of different projects in the program, having, in addition to managerial competency, also in-depth understanding on the content of the actual development. In case Beta the program manager was more dedicated to the managerial side of the program, not having in-depth detailed knowledge related to the actual development work in the projects. In case Gamma the management of the program was strongly personalized into the program manager, who served as a strong central coordinative body, whereas in case Beta the coordination was more constructed within the systems through clearly documented processes and rules. The program manager of case Gamma describes her role in the program as follows:

"*I am personally the kind of person that it is important for me, not only to understand the (program) entity, but also to understand all the related individual parts and things that affect the entity…and in this program we had one person – me – who wanted to understand all these complicated interdependencies within the system… thus, when we think of my role as the program manager in this program, I participated in the actual development work daily. I did not only lead the program. I participated in very many things. I mean in the actual development work.* "

In case Beta the program manager emphasized his role, not as a participative expert as in case Gamma, but rather as a person who is responsible for controlling the advancement of individual projects, a person who makes decisions on resource re-allocation between the projects if necessary, and most of all a person who reports on the progress of the whole program to the upper level management.

5.4.2 Complexity

In order to analyze the relation between the pre-analyzed coordination strategies and characteristics of structural complexity in the case programs, I defined four indicators that would all measure distinct dimensions of the concept structural complexity; the number of concurrent project teams, interdependency between the concurrent projects, geographic dispersion, and organizational variety (see pp. 64-67). Each of these dimensions with respect to the case programs and coordination strategies are analyzed here separately and summarized in Table 17.

Number of concurrent project teams

The number of concurrent project teams was selected as an indicator of size, as it is a commonly used indicator for organizational complexity. Moreover, the number of concurrent project teams is directly proportional to the number of inter-project interfaces that are the objects of coordination, and thus provides a necessary indicator of the organizational complexity of the coordinated system. Furthermore, because the number of projects may not remain constant during the execution of the program, it was decided that the number of concurrent project teams refers to the maximum number of concurrent project teams in the program. In the case programs the maximum number of concurrent project teams was between 3 (Epsilon and Delta) and 40 (Sigma). The respective number of inter-project interfaces is 3 and 780. Comparing the case programs by coordination strategy clusters reveals that in the centralized strategy cluster and the balanced strategy cluster the number of concurrent project teams is rather low, varying from 3 (Epsilon and Delta) to 7 (Gamma). In the subordinate strategy cluster the number of concurrent project teams was high. In case Myy the number is 10 and in case Sigma 40. This observation suggests that high number of concurrent project teams would be one of the triggers leading to the adoption of the subordinate strategy and a low number of concurrent project teams would lead to the adoption of either the balanced coordination strategy or centralized coordination strategy.

Interdependency

In order to find additional relations between the characteristics of structural complexity and coordination strategies, I analyzed the interdependency between the concurrent project teams within the program. The process of analyzing interdependencies between the project teams in each case program is described in chapter 3. Based on the observed interdependencies between the project teams, an interdependency index for each case program was calculated according to the following formula:

Interdependency index = (number of sequential interdependencies between project teams within the program + number of reciprocal interdependencies between project teams within the program) / the total number of inter-project interfaces within the program

The interdependency index may have values between 0 and 1, 0 denoting that all interfaces between the projects are pooled, and 1 indicating that all interfaces between the projects are either sequential or reciprocal or both. Thus, the closer the value of the indicator is to 1, the more interdependent the project teams are on each other. The interdependency index represents the measure of average "tightness" or "intensity" of the internal linkage network within the program organization. The interdependency index does not take into account the difference between sequential and reciprocal interdependency. It was, however, seen as an appropriate indicator in the multi-project environment, in which the type of interdependency between project teams may differ depending on the phase of each project. The interdependency between the project teams in the case programs is summarized in Table 17.

The comparison of inter-project interdependencies reveals that in case programs Myy and Sigma the interdependency between the project teams within the program is low. In case Myy the work entities, interpreted here as project teams, are relatively interdependent on each other. The development and implementation work is carried out in each organizational function or division relatively independently. In a similar vein, case Sigma consists of a high number of relatively independent project teams. The network of project teams in these case programs seems to be rather vague, consisting primarily of pooled type inter-project interdependencies. In the balanced strategy cluster the work in the project teams is more independent of other project teams' work. The project teams in each case program within the balanced strategy cluster form an operationally dense network of cooperative actors, rather than loosely linked isolated entities. The centralized strategy cluster resemble case Delta in the balanced strategy cluster with the value of interdependency index 0.8 (Alpha) and 1.0 (Epsilon). This indicates that all or almost all of the inter-project interfaces can be characterized as sequential or reciprocal by nature. The results of the comparison suggest that low interdependency between the project teams is related to the utilization of the subordinate strategy and high interdependency between the project teams to the use of either the balanced strategy or the centralized strategy.

Number of participating organizations

The number of participating organizations was analyzed on the basis of the interview data and defined as the number of organizations having resources actively participating in the execution of the program. The summary of the organizational variety in each case program is depicted in Table 17. Of the four coordination strategy-clusters, the balanced strategy cluster included only programs in which several organizations were actively involved. For example case Beta included the organization responsible for the

development activities, also called in this study as the "parent organization", and two project managers representing different consulting companies. Both project managers were responsible for the management of their own project teams. In the centralized strategy cluster, in case Alpha four different organizations were involved in the development work, and in case Epsilon the development work was executed as intra-organizational activity with no other organizations external to the parent organization being part of the program. In the subordinate strategy cluster, the development and implementation work in case Myy was done as an internal effort of one organization. In case Sigma most of the development and implementation work was done as an internal effort, as in case Myy. Consulting companies were, however, used in some individual projects. From the coordination perspective, the consulting companies did not form interfaces to other projects, but were merely operating within individual projects.

The analytical cross-cluster comparison did not seem to reveal clear patterns of differences or similarities between the coordination strategy clusters that would relate the number of participating organizations into the specific coordination strategies applied. Thus, it can be concluded that the organizational variety does not seem to explain the adoption of different coordination strategies within these case organizations studied.

Geographic dispersion

The concept geographic dispersion is used in this study to refer to the number of different countries in which the development or execution activities occurred during the program. The description of geographic dispersion in each case program is summarized in Table 17.

Comparison of the four different case clusters did not reveal logically valid or interesting patterns that would relate the concept geographic dispersion to coordination strategies. The comparison of geographic dispersion between the strategy clusters shows that each strategy cluster include cases in which the development work was divided across several geographically dispersed locations, and cases in which all the development is accomplished in a single location. Thus, these findings do not justify the suggestion that geographic dispersion would explain the utilization of different kinds of coordination strategies.

Table 17 Elements of complexity in the case programs

	Number of projects	Interdependency	Organizational variety	Geographic dispersion
Alpha	Low (6 projects)	High (Index = 0.80)	Organizations involved: • developer organization • main supplier • 2 external consulting companies	Development work in Finland and Germany
Beta	Low (5 projects)	High (Index = 0.60)	Organizations involved: • developer organization • 2 external consulting companies both responsible for managing separate project teams	Development work in the Czech Republic and Finland
Gamma	Low (7 projects)	High (Index = 0.52)	Organizations involved: • developer organization • main supplier • external consulting company	Development work in France and Finland
Delta	Low (3 projects with several sub-projects)	High (Index = 1.00)	Organizations involved: • developer organization • supplier organization (belongs into the same concern organization)	All development work accomplished in Finland
Epsilon	Low (3 projects with several sub-projects)	High (Index = 1.00)	• Only one organization involved • Members of the project teams, however, represented different parts of the organization	All development work accomplished in Finland
Myy	High (10 project like work entities)	Low (Index < 0.20)	• Only one organization involved • Project type entities represent different parts of the organization	Development work mainly in Finland. Implementation dispersed in several (15) countries
Sigma	High (40 projects with several sub-projects)	Low (Index < 0.20)	Organizations involved: • Project teams constructed based on the employees of the “parent organization” • Consultants involved in some individual projects	All development work accomplished in Finland

5.5 Performance of the case programs

The evaluation of the outcomes in the case programs was based on meeting the goals, and learning and innovation constructs elaborated in-depth in chapter 3. The mean values of the construct meeting goals in the case programs are summarized in Table 18.

Table 18 Mean values of performance constructs in the case programs

		Alpha	Beta	Gamma	Delta	Epsilon	Myy	Sigma
Meeting goals	Mean	4.6	5.7	4.9	6.7	5.5	6.0	5.0
	N	4	7	3	4	4	3	10
Learning and innovations	Mean	4.9	4.1	5.5	4.8	3.8	3.2	4.6
	N	6	8	5	4	6	6	11

The mean values of the meeting goals-construct in each case are above 4 in a 7-point likert scale. The comparison of the mean values of the meeting goals-construct does not reveal systematic patterns related to a specific coordination strategy cluster. The results do not seem to indicate that any of the selected coordination strategies would provide better ability for meeting goals than other strategies. For example, the balanced coordination strategy cluster includes case programs with rather high values of meeting goals (Delta and Beta) and lower values of meeting goals (Gamma). Also the centralized strategy cluster includes a case program (Epsilon) with high performance from the meeting goals-perspective, and one with low performance in the meeting goals-perspective (Alpha). Similar kind of observations can be made within subordinate coordination strategy cluster with cases Myy and Sigma.

From the learning and innovations-perspective, case Gamma seems to be the program with the highest perceived learning and innovation outcomes. The high values in learning and innovations in case Gamma can be explained through its unique nature within the parent organization. The case program was mentioned by several interviewees to represent the first major revelatory change of this kind within the parent organization. The respective values of learning and innovations in case programs Beta and Delta are somewhat lower and do not seem to indicate that the case programs applying balanced coordination strategy would be superior to other cases as means to produce new technological know-how or business potential. Unlike case Gamma, case Beta represents a rather customary way of working within the parent organization. Also in case Delta the interviewed persons were well aware of and used to working through projects. In the structured strategy cluster, the low values of learning and innovations can be explained through the fact that in both of cases Myy and Sigma the work done within the program constitutes a part of the frequent organizational development scheme in which the individuals are involved in addition to their traditional working practices. Thus, the change efforts within the program are either based on the improvement and extending of existing practices (case Myy), or emerge from the challenges observed in

the everyday work by individuals involved within the program (case Sigma). Within the centralized strategy cluster both of the case programs, Alpha and Epsilon, represent rather large and innovative change programs which were initiated in order to respond to the strategic need of the parent organization. The parent organizations in both these cases, however, had experience on previous programs. This also partly explains the relatively low level of learning and innovations in these two case programs.

In order to evaluate the observed differences, Mann-Whitney U-test was done. The test was utilized to compare whether the observed differences in meeting goals and learning and innovations between the case programs could be considered as statistically significant. A summary of the Mann-Whitney U-test values and their statistical significances is depicted in Table 19.

Table 19 Comparison of performance constructs in the case programs

Mann-Whitney U-values and significances, +=p<0.10, * = p<0.05, **=p<0,01, ***=p<0.001

Meeting goals							
	Alpha	Beta	Gamma	Delta	Epsilon	Myy	Sigma
Alpha							
Beta	5.50						
Gamma	5.50	**0.00***					
Delta	**0.00***	**0.00****	**0.00***				
Epsilon	4.50	9.00	**1.00+**	**0.00***			
Myy	**1.00+**	4.50	**0.00***	0.00*	2.50		
Sigma	18.00	**17.50+**	13.00	**0.00****	14.50	**3.50***	
Learning and innovations							
	Alpha	Beta	Gamma	Delta	Epsilon	Myy	Sigma
Alpha							
Beta	20.50						
Gamma	16.50	14.00					
Delta	11.00	13.00	8.50				
Epsilon	**5.50***	18.50	**6.50+**	8.50			
Myy	**1.00****	14.50	**4.00***	**4.00+**	14.50		
Sigma	24.00	42.00	23.00	18.50	**13.50***	**10.50***	

The statistical comparison of the values of the meeting goals-construct between the case programs shows that within the balanced coordination strategy cluster the mean value of the meeting goals-construct in case Delta is significantly higher than in case Gamma. The mean value of the meeting goals-construct in case Beta does not differ significantly from the respective values in cases Gamma or Delta. Thus, it seems that case Delta represents within this coordination strategy cluster a high performing case and case Gamma a low performing case with respect to meeting goals. Within the subordinate strategy cluster, the mean values of meeting goals in case Myy and case Sigma differ significantly. The findings indicate that of these two case programs case Myy represents one in which the performance is high and the case Sigma the one with low performance. The case programs within the centralized strategy cluster do not differ significantly from each other in meeting the goals. The cross-cluster comparison reveals that the high

performing case programs within the balanced strategy cluster and subordinate strategy cluster seem to perform significantly better than either of the case programs within the centralized strategy cluster.

Finally, some differences were found between the case programs in the learning and innovations-construct. The test results fail to identify that any of the coordination strategy clusters would be superior to others from the learning and innovations-perspective. However, the results show that the individual case programs differ from each other in the learning and innovations-perspective within and between the cases. For example case Gamma differs significantly from case programs Epsilon and Myy in the learning and innovations-perspective. In addition, case programs Myy and Alpha seem to differ from each other significantly. Moreover, significant difference were found between cases Alpha and Epsilon that both represent centralized strategy cluster. Furthermore, significant difference was also found between cases Myy and Sigma both representing subordinate strategy cluster.

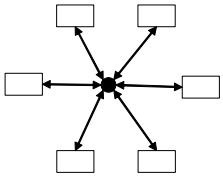
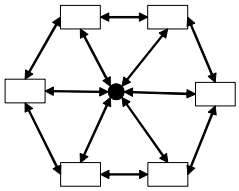
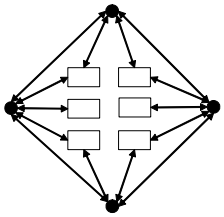
5.6 Synthesis of the cross-case analysis

The cross-case analysis resulted in three different coordination strategies that the case programs apply in managing the information exchange between the different project teams within the project. The three coordination strategies and their key contents are summarized in Table 20. The seven case programs representing the observed coordination strategies were compared to each other with respect to several antecedents of coordination strategies and outcomes of the programs, in order to identify relationships between the antecedents, adopted coordination strategies and outcomes of the programs. The observed differences represent either logically or statistically significant dissimilarities in measured values between the case programs. The identification of relations between the coordination strategies, antecedent factors and performance factors utilizes the logic of inductive reasoning (see e.g. Bourgeois and Eisenhardt, 1988; Ribbers and Schoo, 2002, Adler, 1994).

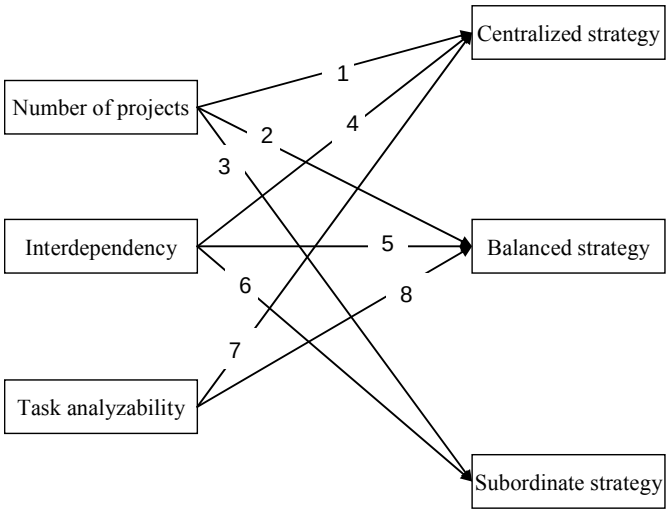
The first part of the analysis findings is related to similarities and differences between the case clusters. More specifically, the analysis was conducted in order to find characteristics that the case programs share within one cluster and that are different from all other cases at least in one cluster. The analysis of complexity and uncertainty within the case programs revealed that of the selected antecedent factors, three seemed to explain the utilization of different kinds of coordination strategies; number of projects, interdependency, and task analyzability. The case programs within the subordinate strategy cluster were characterized by high number of rather independent projects. On the other hand, all the case projects within the balanced coordination strategy cluster and the centralized coordination strategy cluster were characterized by a rather low number of highly interdependent projects (Table 17). The comparison of the case programs within the balanced coordination strategy cluster and the centralized coordination strategy

cluster shows that the task analyzability related to the programs within the balanced coordination strategy cluster (Beta, Gamma, Delta) is higher than that of in the case programs within the centralized coordination strategy cluster (Alpha, Epsilon). In addition, the observed differences were found to be statistically significant (Table 15, Table 16). Based on the cross-case comparisons, the observed relationships between these factors and the coordination strategy cluster are summarized in Figure 13.

Table 20 Summary of the coordination strategies

Centralized coordination strategy 	**Description:** The group mode of coordination the dominant form of information exchange between the project teams. Inter-project interaction strongly centralized to happen through formal and informal group meetings. Physical presence important. Direct personal contacts between project teams rare. Each project team focused on the accomplishment of its own part. Power concentrated to the program manager. Coordination taking mainly place at program level in group meetings through participating project managers Case Examples: Alpha, Epsilon
Balanced coordination strategy 	**Description:** Balanced use of different types of formal and informal coordination mechanisms to support information exchange between the project teams. Utilization of both rich and lean media for information exchange. Direct contacts between project teams frequently used to complement group meetings. Responsibility on inter-project interaction decentralized at project level. Coordination takes place at both program level through group meetings and at project team level through liaison persons. Communication through informal communication channels and through formal reports and plans. Case Examples: Beta, Gamma, Delta
Subordinate coordination strategy 	**Description:** Utilization of parent organization structure as a means for coordination. Formal decision making boards important vehicles for information sharing. Direct contacts between project teams rare, information exchange through liaison persons. Emphasis on formalization, reporting practices, formal documents, and database. Coordination taking place in different decision-making boards at project team level and through the chain of command at program level Case examples: Myy, Sigma

Moreover, the cross-case analysis revealed that the case programs differ in their performance. The results did not, however, indicate that the all case programs representing one of the coordination strategy clusters would perform significantly better than the case programs from another cluster (Table 18, Table 19). In other words, the results failed to identify that any one of the identified coordination strategies would be superior to the others.



Number in figure 13	Explanation	Source
1	Number of projects low in programs utilizing the centralized coordination strategy (cases Alpha and Epsilon)	Table 17
2	Number of projects low in programs utilizing the balanced coordination strategy (cases Beta, Gamma, and Delta)	Table 17
3	Number of projects high in programs utilizing the subordinate coordination strategy (cases Myy and Sigma)	Table 17
4	Interdependency between the project teams high in programs utilizing the centralized coordination strategy (cases Alpha and Epsilon)	Table 17
5	Interdependency between the project teams high in programs utilizing the balanced coordination strategy (cases Beta, Gamma, and Delta)	Table 17
6	Interdependency between the project teams low in programs utilizing the subordinate coordination strategy (cases Myy and Sigma)	Table 17
7	Task analyzability low in programs utilizing the centralized coordination strategy (cases Alpha and Epsilon)	Table 15, Table 16
8	Task analyzability moderate/high in programs utilizing the balanced coordination strategy (cases Beta, Gamma, and Delta)	Table 15, Table 16

Figure 13 Relations between the antecedent factors and coordination strategies

The second part of the analysis focused on the differences and similarities on uncertainty, complexity and performance between the case programs within each coordination strategy cluster. The analysis revealed that case the programs differed from each other on either the meeting goals or learning and innovations-perspectives or both within each coordination strategy cluster. In addition, the case programs within each coordination strategy cluster differed from each other in some of the antecedent factors. The comparison of observed values of antecedent factors with the observed values of performance constructs suggests that some of the performance differences between the case programs within the coordination strategy clusters may be explained through "constraining" antecedent factors. In the case of the centralized coordination strategy cluster, significant performance differences between the case programs were observed in learning and innovations. The learning and innovations performance was significantly higher in case Alpha than in case Epsilon. The comparison of these case programs with respect to different antecedent factors showed

that in case Alpha the execution of the program was divided into two different countries, whereas in case Epsilon the program was executed in a single country. In addition, in case Alpha, 4 different organizations participated in the execution and development work, and in case Epsilon, only one organization participated in the development and execution of the program. These results indicate that in case of the centralized coordination strategy, a higher geographic dispersion and higher number of participating organizations is related to higher learning and innovations performance. The discussion above is summarized in Figure 14.

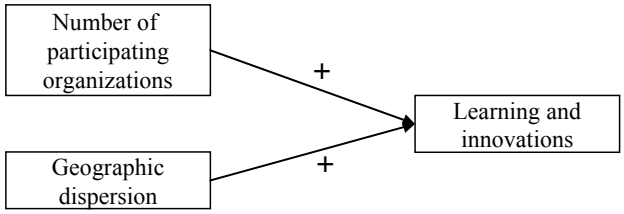


Figure 14 Relations between constraining factors and performance indicators in the centralized coordination strategy

In the case of the balanced coordination strategy cluster, the meeting goals-performance construct in case Gamma was significantly lower than in cases Beta and Delta (Table 19). The comparison of different complexity and uncertainty dimensions between these case programs revealed that the task novelty in case Gamma was significantly higher than in cases Beta and Delta (Table 15). In addition, geographic dispersion differed between the case programs utilizing the balanced coordination strategy. In case Delta the development work was done in Finland only, whereas in cases Beta and Gamma the development work was geographically dispersed between two countries (Table 17). Thus, integrating these two findings indicates that task novelty and geographic dispersion within this research setting explain the meeting goals-performance in the case of the balanced coordination strategy, both higher task novelty and higher geographical dispersion are related to lower meeting goals-performance. The discussion above is summarized in Figure 15.

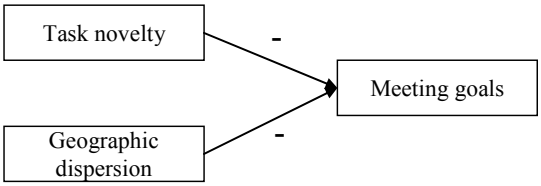


Figure 15 Relations between constraining factors and performance indicators in the balanced coordination strategy

Within the subordinate coordination strategy-cluster, the meeting goals-performance indicator in case Myy was observed to be significantly higher than in case Sigma (Table 18, Table 19). On the other hand,

the value of learning and innovations-construct was significantly higher in case Sigma than in case Myy (Table 18, Table 19). A difference was also observed between these case programs in task analyzability, with case Myy having significantly higher task analyzability than case Sigma (Table 15, Table 16). Comparing the observed differences between case programs Myy and Sigma suggest that in the case of the subordinate strategy, higher task analyzability is related to higher meeting goals-performance and lower learning and innovations-performance than low task analyzability. The discussion above is summarized in Figure 16.

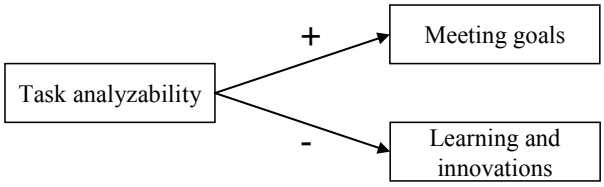


Figure 16 Relations between constraining factors and performance indicators in the subordinate coordination strategy

6 DISCUSSION

This chapter summarizes the findings of the research and positions them in the earlier body of knowledge of program management and coordination. The research findings are presented in the form of propositions, which encapsulate the theoretical contribution of this research. In addition, managerial implications, the limitations of the study, and future research directions are discussed.

The principal objective of this study was to increase understanding on inter-team coordination in organizational development programs. From this background the research question of this study was formulated as follows:

"What kinds of coordination strategies enable effective coordination in complex and uncertain organizational development programs?"

The research strategy in this study was inductive, aiming to extend the existing understanding of coordination into a new context. The research design of this study was based on multiple case studies. Multiple methods were used as a means to collect data from the case programs. The research material included seven case studies analyzed through a total of 64 interviews complemented with 48 questionnaire responses from the interviewed individuals, and with archival data as a secondary source of information.

The answer to the research question was based on the analysis of various theoretical concepts and the empirical case data. The study adopted the contingency perspective on inter-project coordination. The theoretical analysis focused on studies of coordination in organizational settings. The concepts of uncertainty, complexity, and performance were reviewed as key concepts in the study. In addition, current knowledge on program and project management was utilized in order to open up the context of this study. The findings of this study and their relations to the existing body of knowledge are explained below.

6.1 Coordination strategies

Three different types of coordination strategies used in inter-project coordination in organizational development programs were identified, namely Centralized, Balanced and Subordinate (see pp.134-138) These strategies differ from each other through the emphasis and utilization of different coordination mechanisms, and overall logic of coordination within the program. The three strategies do not represent solely a formal planned form of action, but rather patterns of behavior identified on the basis of the actual coordination practices employed in the case programs. In other words, the observed strategies should not be interpreted as intentional per se. Rather, they represent a subset of activities which the project teams are engaged with and perceive important. The logic of this study is aligned with the recent research on strategy that has acknowledged the actual practices and praxis as relevant source to open up the traditional

black box model of strategy (Jarzabkowski, 2004; Whittington, 2003; Orlikowski, 2000; Johnsson et al., 2003).

6.1.1 Centralized strategy

Of the three identified strategies, in the centralized coordination strategy the interaction between the project teams is to a great extent limited to formal and informal group-meetings. This coordination strategy also reflects a relatively high differentiation between the project teams, and fairly limited inter-team interaction outside the centralized group meetings. Coordination through the centralized strategy leans on well-defined roles and responsibilities of the participating actors. Formal group meetings, such as status review meetings and coordination group meetings serve as the primary channel for the exchange of knowledge and information, and are complemented with informal group meetings, such as co-location of project managers, results approval workshops, and integration meetings between project teams. The power on decisions is in the centralized strategy focused on program manager, who also serves as a central connecting node between the project teams.

6.1.2 Balanced strategy

The balanced coordination strategy reflects a rather high amount of interaction between actors from different project teams within the programs. The logic of action within the case programs identified to utilize the balanced coordination strategy reveals that group meetings, even though important form of interaction between the project teams, are complemented with other forms of interaction. The use of individual liaison persons, e-mail and formal coordination mechanisms complement the coordination through group meetings. When compared to the centralized coordination strategy, the responsibility of coordination is more decentralized to happen at individual project teams, and the formal means of coordination are valued as important. An individual mode of personal coordination through such mechanisms as direct contact between project teams, sharing resources between project teams, utilization of facilitating persons, utilization of a supplier as an integrator between the project teams, and utilization of a technological manager who serves as an integrating body between the project teams, have an important role in the inter-team coordination within the balanced coordination strategy. Characteristic for the balanced coordination strategy is also the utilization of electronic mail, not only as a channel for delivering information, but also as a mechanism to legitimize and formalize informal discussions that occur between individual actors representing different teams. Unlike in the centralized coordination strategy, in which the impersonal mode of coordination is a rather insignificant means to transfer information and knowledge, in the balanced coordination strategy the impersonalized mode of coordination through such mechanisms as functionality reports, testing documents, common databases,

resource usage plans and tools, reporting practices, and project plans represent a significant mode for information and knowledge exchange between interdependent project teams.

6.1.3 Subordinate strategy

The third strategy, the subordinate coordination strategy, utilizes the existing parent organization's existing structures heavily as means for coordination between the project teams. The managerial processes within the subordinate strategy are directly integrated and subordinate to the parent organization's existing decision making bodies. The interaction between the projects team within the case programs applying this type of strategy is rather limited and based on meetings in different formal decision making boards and committees. The individual mode of coordination, even though important in the subordinate strategy, emphasizes personal contacts through actors that serve in formal roles in the organizational hierarchy. Examples of the individual mode of personal coordination in the subordinate strategy are sharing steering group members in different projects, contacts through integrating organizational units, and utilization of the same facilitator persons. The interaction between project teams happens mainly through vertical channels, through persons who do not actually participate in the development work and may not have technological understanding on the tasks that are subject to development. In addition, formal reporting practices, and utilization of documents and databases are emphasized in the case programs utilizing this type of coordination strategy. Respectively, informal coordinative patterns of behavior are rather rare and personal interaction between the project teams is limited.

6.1.4 Linkage to existing body of knowledge

The study differs from most of the existing studies on coordination by focusing on coordination strategies rather than concentrating on single coordination mechanisms or modes (e.g. Sicotte and Langley, 2000; Kraut and Streeter, 1995; Nidumolu, 1996; Van de Ven et al., 1976; Jha and Iyer, 2006). This study provides an overall system level picture on the logic of coordination in seven individual case programs going beyond the mere coordination procedures and practices, by introducing also the significance of different types of coordination modes in each case. Moreover, the results of the study complement the coordination modes proposed by Van de Ven et al. (1976) and explicate their meaning in the project context. As already proposed by Van de Ven et al. (1976), the results of this study verify the notion that the significance of different coordination modes is dependent on the task characteristics.

The observed coordination strategies extend the current knowledge on coordination mechanisms and their use in organizations. Most of the existing studies are focused on coordination between "permanent" organizational units (e.g. Kellogg et al., 2006; Moenart and Souder, 1996; Millson and Wilemon, 2002; Gittell and Weiss, 2004; Lawrence and Lorsch, 1967; Van de Ven et al., 1976). In addition, the studies on

coordination in the temporary context most often take a single project or en entire organization as a unit of analysis (e.g. Nidumolu, 1996; Van Fenema, 2002; Nihtilä, 1999; Adler, 1995; Kraut and Streeter, 1995; Andres and Zmud, 2001; Liberatore and Wenghong, 2005). However, the project entity formed by multiple projects has seldom been as a focus of examination (Hoegl et al., 2004). Through this study I partly respond to that emerging need to explain coordination in a multi-project setting, currently used by a growing number of organizations to cope with complexity emanating from the operational environment and product structures.

The earlier research on organizational groups and structures support the findings of this study by acknowledging the existence of different types of organizational configurations and different types of interaction logics between the participants. For example Leavitt (1951) has defined two types of group structures; hierarchical and participatory. The former one utilizes a hierarchical mode of action based on well defined roles and responsibilities, which is also characteristic for the subordinate strategy, whereas the latter one resembles the participatory action logic, which can also been seen in the balanced coordination strategy. In addition, the identified coordination strategies also share similar features with the two distinct organizational structures proposed by Burns and Stalker (1961). They differentiate between a mechanistic organization structure with centralized decision making and formalized roles and working procedures, and organic structure with widely shared understanding, joint responsibility and work flexibility. In a similar vein, the coordination strategies in this study differ from each other in the extent to which the interaction through formal impersonal coordination mechanisms is perceived important and in the extent to which the interaction between the project teams is based on the participatory group mode of coordination. A closer look at the structures suggested by Burns and Stalker (1961) and Leavitt (1961), however, reveals that the strategies identified within this study do not completely correspond to those suggested within the literature. For example, the centralized mode of coordination is characterized by centralization of decision making, but the interaction does not rely on formal methods, but is rather to a great extent characterized by informal and flexible need-based group meetings without a predefined agenda. This coordination configuration thus has both mechanistic and organic characteristics. The results of this study indicate that the theories from the permanent organizational context may not apply as such, but the context of temporary organizations is inherently more complex than the one of their permanent counterparts', and thus implies a need to complement existing theories with additional alternatives.

Similar argument is also presented by Shenhar et al. (2001), who has studied different types of projects along two classical contingency dimensions; complexity and uncertainty, and found that the management schemes of projects differ from the classical spectrum of mechanistic and organic ones. Their study revealed differences in the communication structures of projects, which vary from mostly formal

communication centered around predetermined meetings to a high level of communication with utilization of multiple channels and informal interaction. Even though a study of Shenhar et al. (2001) does not directly focus on inter-team coordination, it shows that both the amount of interaction and utilized mechanisms differ, depending on the project. A similar supporting finding can also be found in the product development context, where Lakemond (2006) has studied supplier involvement in projects. Based on empirical case studies he identifies three distinct approaches for supplier involvement; project integration coordination, disconnected sub-project coordination, and direct ad-hoc contacts. Even though the approaches are not directly applicable to the context of this study, they support the perspective that the interfaces between project teams may be managed in different ways. In addition, disconnected sub-project coordination partly resembles the subordinated strategy suggested in this study.

Ancona and Caldwell (1992) have shown that new-product development groups employ different strategies in interaction with the environment. Their study shows that organizational teams specialize in distinct activities, some more towards external environment, while others remain rather isolated. Even though the unit of the analysis in this study is not the individual project team, but a program entity including multiple project teams, the results are aligned with the ones suggested by Ancona and Caldwell (1992). The results of this study reveal that the role and type of interaction between the project teams differs depending on the coordination strategy in question.

The existing studies on program management also support the view of divergent coordination needs in different types of programs. For example Pellegrinelli (1997) suggests that there are three pure archetypes of program configurations; portfolio, goal oriented and heartbeat. Each of these program configurations differs from the others through the control the program exercises on the projects, the type of program organization, the planning horizon, and the relationship with the parent organization, and consequently have divergent demands for coordination between different actors within the program. In addition, Vereecke et al. (2003) has found that programs differ from each other through the extent to which the interfaces between the projects that are part of the program are tightly managed, and the degree of centralization of the management of the overall program. Furthermore, Gray (1997) suggests three different models for program organization, namely loose, string and open. These three models differ from each other through the role and type of authority exercised to individual projects. The results of these different studies in the program management field support the existence of different types of coordination practices and strategies in programs. The study of Nidumolu (1996) reveals that the coordination in information systems may utilize either horizontal or vertical means. This notion supports the observations of different functioning logics related to the strategies identified in this study. Of the three observed strategies, the subordinate strategy emphasizes vertical means of coordination, whereas the centralized and

balanced strategies embrace also strong emphasis on horizontal, more direct inter-project interaction. Moreover, the findings of the present study are in line with the studies of communication networks, which have shown that the structure of the communication networks is dependent on the nature of the task, and it affects the effectiveness of decision making (Pennington, 2005).

In this study I have identified three distinct strategies utilized for coordination between individual project teams in programs. Moreover, I have analyzed the elements of complexity, uncertainty, as well as performance indicators, and their relations to the observed coordination strategies. The following sub-chapters formulate the observed relations between the empirical constructs in the form of propositions and reflect upon these from the perspective of the existing literature.

6.2 Antecedents of coordination strategies

The analysis of the findings indicates that the utilization of the identified coordination strategies are related to three dominant antecedents; the number of projects within the program, the interdependency between them, and task analyzability. The results of the study suggest that a high number of relatively independent projects is related to the utilization of the subordinate strategy, and a low number of highly independent projects is related to the utilization of either the balanced or centralized coordination strategy. To summarize the findings related to dominant antecedents and different coordination strategies (Figure 13) I propose that:

> *Proposition 1: The utilization of a distinct coordination strategy in programs is determined by the dominant antecedent(s)/situational factors, such as the number of projects, interdependency, and task analyzability*

More specifically, careful comparison of multiple case programs within and between the different identified coordination strategy clusters revealed that there was a relationship between specific combinations of the three identified antecedent factors and the adopted coordination strategy (Figure 13).

> *Proposition 1.1: A high number of projects and low interdependency between the projects is related to the utilization of the subordinate coordination strategy*
>
> *Proposition 1.2: A low number of projects, high interdependency between the projects and high task analyzability is related to the utilization of the balanced coordination strategy*
>
> *Proposition 1.3: A low number of projects, high interdependency between the projects and low task analyzability is related to the utilization of centralized coordination strategy*

The propositions suggest that programs have several antecedent factors (or contingency factors) that all pose distinct requirements for the coordination strategy. The three identified factors; the number of

projects, interdependency, and task analyzability resemble those suggested in earlier studies. The results of this study, however, suggest that the adoption of the coordination strategies can not be reasoned according to a single contingency factor, but rather a combination of at least two factors, one related to the structure of the program (number of concurrent projects), and one characteristic of the task to be done (interdependency between the projects, and task analyzability). Accordingly, it has been argued that focusing on a single dimension of context fails to accommodate the various sets of requirements that the context poses for the organizational structure (Gresov, 1989; Donaldson, 2001).

The propositions presented above are also partly in line with the prominent studies in contingency theory (McCann and Galbtaith, 1981; Van de Ven et al., 1976; Lawrence and Lorsch, 1967; Blau, 1970; Burns and Stalker, 1961; Duncan, 1973; Tushman and Nadler, 1978; Tushman, 1979). Donaldson (2001) synthesizes the three dominant contingency factors identified in earlier studies that define the organizational structure and way of coordination as task uncertainty, task interdependence, and organizational size. The results of this study reflect the two partly conflicting and different theories of how organizations are structured and the causes for it; the bureaucracy theory and the organic theory (Figure 17).

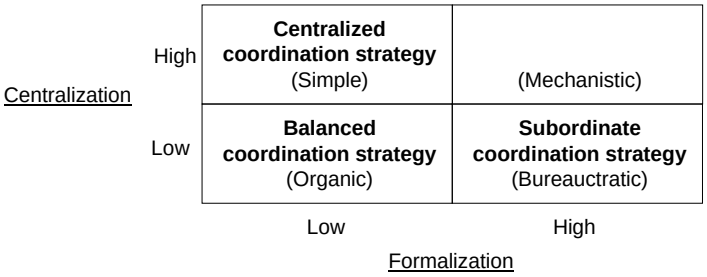


Figure 17 Coordination strategies in the organic and bureaucratic theory frame

According to the bureaucracy theory, the size of the organization is the principal factor that determinates the adopted organizational structures and the respective coordination. Organization size is related to formalization through a higher importance of rules and procedures in organizing. For example Blau (1970) found that organizations use more bureaucratic structuring (e.g. rules) as they grow larger. In the present study the size can be regarded to be equal to the number of projects, which also reflects the quantity of coordinated "sub-systems". The previous results by Blau (1970) support the findings of the present study, which clearly indicate that the high number of projects among other factors is related to a higher importance of utilizing the impersonal mode of coordination. Similar supporting results have been achieved also by Kraut and Streeter (1995) who show that project size correlates positively with coordination through formal impersonal procedures. The subordinate coordination strategy characterized by strong emphasis on formal coordination mechanisms and hierarchical referral is according to the results

of the present study related to large programs with a high number of projects (proposition 1.1) and can be regarded to resemble the bureaucratic structure in the organization theory. The centralized coordination strategy, instead, is proposed to relate to a low number of projects (propositions 1.3), and resembles a simple structure with centralized decision making. The balanced coordination strategy is also related to small size (proposition 1.2), but does not clearly resemble either of the classical structural organizational forms, bureaucratic or simple structure, but is characterized by a relatively low level of formality and low level of centralization.

The organic theory makes a distinction between organic and mechanistic structures, the organic structure being characterized by a low level of centralization and formalization, and the mechanistic structure with a high level of formalization and centralization. The balanced coordination strategy characterized by emphasis on informal need-based direct contacts between the project teams resembles the organic structure. Several previous studies have shown that task uncertainty and task interdependence are positively correlated with the utilization of the organic and participatory structure (Burns and Stalker, 1961; Duncan, 1973; Van de Ven, 1976; Tushman and Nadler, 1978; Tushman, 1979). Increase in either one of both of the above mentioned factors leads to an increased need to process information. As a consequence, less hierarchical and more intensive modes of coordination are adopted (Gresov, 1989). For example Gresov (1989) has shown that work units facing either high task uncertainty or high horizontal dependence are more likely to adopt organic designs than units facing either low task uncertainty or low horizontal dependence. Also Andres and Zmud (2001) distinguish between mechanistic and organic coordination strategies in the project context, and according to them the organic coordination strategy is highly effective in the case of highly interdependent tasks. In their study, the characteristics of organic coordination strategy, such as informal communication and cooperative decision-making, seem to fit with observations from the centralized strategy and balanced strategy, which are both related to coordination of highly interdependent project teams. In a similar vein, the results of this study suggest that high interdependency between the project teams is related to the utilization of either the balanced or centralized coordination strategy, in which the importance of a formal impersonal mode of coordination is lower than in the subordinate strategy cluster, and the importance of participative group mode of coordination is higher than in the subordinate strategy cluster.

6.3 Constraining factors and performance

The outcomes of the case programs were analyzed from two different perspectives: effectiveness perspective and learning and innovations-perspective. The findings of cross-case comparisons suggest that the three different coordination strategies do not differ in either one of the performance perspectives. In other words, none of the coordination strategy case clusters was observed to include only case programs

with superior performance to case programs in other coordination strategy clusters. This result is summarized in the form of a proposition as follows:

> *Proposition 2: Each of the three coordination strategies, centralized, balanced and subordinate, when fit with the coordination requirements, are equally effective and provide equal potential for learning and innovation in programs*

Pfeffer (1997) argues that those organizations that have structures that more closely match or fit the requirements of the context will be more effective than those that do not. In addition, the farther the organization is away from the fit, the greater is its misfit and the lower its resulting performance is expected to be. Van de Ven and Drazin (1985) propose that in the case of the organizational structure being fit with the contingency variables, the performance is equally good independently on the level of the contingency factor. This argument, when interpreted to the context of this study, supports the findings of this study by stating that all coordination strategies when fit with the needs of coordination (or antecedent factors) produce equal performance. In addition, proposition 2 is also partly supported by the previous empirical findings of Liberatore and Wenghong (2004) who show that neither vertical nor horizontal coordination correlates directly with project performance. Their findings indicate the existence of several alternative ways to organize coordination, some being more based on hierarchical referral, as in the subordinate strategy, and others more on direct horizontal interaction, as in the group and balanced strategies. Furthermore, their empirical findings give support to the contingency perspective adopted within this study.

What I have proposed so far within this study, based on the findings of the case studies, is that three dominant antecedents determine the adoption of a particular coordination strategy, and each of the three strategies if fit with the coordination requirements, provides equal effectiveness and potential for learning and innovation. The results of this study, however, show that the performance of the case programs within the same coordination strategy cluster may differ significantly, and the differences may be explained through constraining antecedent factors (see pp. 145-147). Therefore I propose that:

> *Proposition 3: Within the adopted coordination strategy, if fit with the dominant antecedent factors, the performance of the program is determined by constraining antecedent(s)*

The existence of constraining antecedent factors may be explained through multiple contingencies. There may be multiple contingencies that set different and sometimes conflicting requirements for the way organizations are structured (Child, 1972). The existence of conflicting contingencies has proven to lead to misfit with respect to at least one of the contingency factors, and further to lower performance. For example Gresov (1989) has shown that work units facing a conflicting context are less efficient than units facing unconflicted contexts. In addition, Andres and Zmud (2001) have shown that non-constraining

contingency configurations will lead to more successful projects than constraining contingency configurations. That is, in contexts in which the contingencies do not possess conflicting demands for the coordination of the project team, the projects are more successful than in contexts of conflicting contingencies. In the present study, the performance differences between the case programs could be explained through four distinct factors, namely task analyzability, task novelty, geographic dispersion, and the number of participating organizations. To summarize the findings of the empirical study I propose the following:

> *Proposition 3.1: In the case of the subordinate coordination strategy, other things being equal, the higher the task analyzability, the better the effectiveness of the program*
>
> *Proposition 3.2: In the case of the subordinate coordination strategy, other things being equal, the higher the task analyzability, the lower the potential for learning and innovations in the program*
>
> *Proposition 3.3: In the case of the balanced coordination strategy, other things being equal, the higher the task novelty, the lower the effectiveness of the program*
>
> *Proposition 3.4: In the case of the balanced coordination strategy, other things being equal, the higher the level of geographic dispersion, the lower the effectiveness of the program*
>
> *Proposition 3.5: In the case of the centralized coordination strategy, other things being equal, the higher the number of participating organizations, the better the potential for learning and innovation in the program*
>
> *Proposition 3.6: In the case of the centralized coordination strategy, other things being equal, the higher the geographic dispersion, the better the potential for learning and innovations in the program*

Gresov (1989) has examined the effects of two contextual factors on performance, namely horizontal interdependence and task uncertainty. Conflict situations arise due to either a high uncertainty – low horizontal dependence situation or a low uncertainty – high horizontal dependency situation, which are expected to lead to lower performance. Proposition 3.1 is a direct illustration of the multiple contingency model presented by Gresov (1989). Case Myy represents a case in which a rather mechanistic coordination structure (high emphasis on the impersonal mode of coordination and formal group mode of coordination) is fit with both low interdependency between the project teams and low task uncertainty (high task analyzability). However, in case Sigma the similar type of mechanistic coordination structure is not anymore able to cope with conflicting requirements of low interdependence between the projects and high task uncertainty (low task analyzability). This inherent conflict in the contingencies leads to lower performance from the meeting goals-perspective, as suggested by Gresov (1989). The findings of Moenart

et al. (1995) support proposition 3.1 by showing that in the innovation context the successful project teams are characterized by effective uncertainty reduction activities, such as decrease of task variability and increase of task analyzability.

Proposition 3.2 shows interestingly that even though the conflict in contingencies may produce decrease in performance as regards meeting the goals, it has controversy effects on learning and innovations. Conflict in contingencies seems to have in the case Sigma positive effect on learning and innovation. In case Sigma the high task uncertainty creates requirements for more organic and flexible coordination, which is provided by the current strategy adopted to cope with low interdependency and large size. Thus, a conflict arises between the nature of the task and the characteristics of the coordination strategy used to cope with the program task. In case Sigma the coordination strategy is to a great extent based on the utilization of vertical means of coordination, hierarchical referral, and formalization, whereas the task is rather unanalyzable and would require horizontal means of coordination and an organic structure. The inherent conflicts between the adopted coordination strategy and task characteristics enable the participants to acknowledge weaknesses of the current practices and enforce them to explore alternative solutions beyond their current operating milieu. This may lead to emergence of innovations and new technological knowledge. This explanation seems to be consistent with the studies that suggest conflicts to be related to higher innovativeness (Pondy, 1967; Pondy, 1969).

Propositions 3.3 and 3.4 are related to task novelty and geographic dispersion, with lower efficiency of the program in the case of the balanced coordination strategy. The previous research on coordination and management of project teams has revealed that physical proximity has positive effects on cross-functional coordination, which is positively correlated with the task and psychosocial outcomes of the project (Pinto et al., 1993). In addition, it has been shown that physical distance among project team members has negative effects on the success of the project team (Keller, 1986). Also the study of Van Fenema (2002) supports proposition 3.4 by reporting on several coordination challenges related to geographically dispersed programs. Some existing studies on single projects also support proposition 3.3 by showing that task novelty is related to project success. For example, McDonough (1993) has shown that the technological newness of the project task is negatively associated with meeting the time goals of the project. In addition, existing research indicates that technological novelty has a moderating effect on the speed of development and the success of the project, faster development leading to more successful outcomes in projects with low task novelty (Kessler and Bierly III, 2002; Chen et al., 2005).

Propositions 3.5 and 3.6 relate geographic dispersion and the number of participating organizations to higher potential for learning and innovation in the case of the centralized coordination strategy. Proposition 1.3 relates the utilization of the centralized coordination strategy with highly uncertain

situations (low task analyzability). Propositions 3.5 and 3.6, when combined with proposition 1.3 suggest that when facing a highly uncertain situation, program benefit from designing the program organization to include high variability of individuals of different backgrounds (cultural and organizational background). This argument is in line with dominant thinking in the product development and innovation management literature, in which the creation of cross-functional teams with high diversity of different kinds of individuals has been observed to represent one of the key factors for successful innovations and innovativeness of the organizations (Wheelwright and Clark, 1992b; Griffin, 1997b; Ernst, 2002). In case of the balanced coordination strategy each case program includes several participating organizations. Thus, the relation between the learning and innovation and utilization of the balanced coordination strategy can not be shown. Geographic dispersion in cases within the balanced coordination strategy cluster differs from localized development (case Delta) to dispersed development (Beta and Gamma) (see Table 17). Respective differences in learning and innovation capacity were not observed (Table 19), however. This observation would give a reason to argue that the effect of geographic dispersion on learning and innovation is higher in case of more uncertain programs.

As a summary of propositions 3.1-3.6 it can be said that from the design perspective, the existence of multiple concurrent "contingencies" has in many cases conflicting requirements for the way how interaction between project teams is organized in programs. These conflicting demands may lead to misfit with the selected coordination strategy and imply a decrease in performance, as suggested in multiple contingency studies (Gresov, 1989; Andres and Zmud; 2001). In addition, propositions 3.1-3.6 also reveal that even if a misfit between the coordination strategy and contingency factor may lead to decrease in performance from some perspective, e.g. meeting the goals, it may increase the performance from some other perspective, e.g. learning and innovation (see propositions 3.1 and 3.2).

6.4 Theoretical contribution

The results of this study offer several theoretical contributions that add to and extend the current knowledge. First, the results of this study contribute to the current knowledge in the management of multiple projects. The existing understanding on organizational dynamics in temporary systems is fairly limited into single projects or groups. The emergence of more and more complex products and services requires organizations to adopt respectively more complex forms to manage the development of these complex products and systems (Hoegl et al., 2004). Programs and complex projects have been recently acknowledged as effective means of implementing and managing complex intra- and interorganizational development efforts and gained increasing attention among academics and practitioners alike (e.g. Weinkauf et al., 2004; Wurst et al., 2001; Hoegl et al., 2004; Pellegrinelli, 2006; Vereecke et al., 2003; Lycett et al., 2004; Maylor et al., 2006; Martinsuo and Lehtonen, 2007). The results of this study show the

repertoires of horizontal activities of information exchange between project teams instead of the vertical, decision-making centric view on management that has been the focus in many previous studies (e.g. Cooper and Kleismith, 1987, 1996; Cooper, 1984; Cooper et al., 1999; Artto and Dietrich, 2004; Dietrich and Lehtonen, 2005). The perspective taken in this study serves a complementary view to the traditional vertical hierarchy-based model adopted from permanent organizations, but may not apply in all temporary development tasks that are characterized by a substantial amount of uncertainty.

Secondly, this study extends the existing knowledge on coordination. Coordination between individuals, teams, and organizational units has been studied relatively extensively (e.g. Lawrence and Lorsch, 1967; Van de Ven et al., 1976; Tsai, 2002; Hage et al., 1971; Souder and Moenart, 1992; Griffin and Hauser, 1996; Moenart and Souder, 1996; Nihtilä, 1999). However, only a few studies have focused on coordination between project teams in programs (Hoegl et al., 2002). In this study I have observed empirically several different coordination mechanisms and describe their use in a complex multi-project setting. In addition, previous studies on coordination have often focused on measuring the use of different coordination mechanisms and how different contingency factors affect their usage (e.g. Adler, 1995; Van de Ven et al., 1976, Van Fenema, 2002; Kraut and Streeter, 1995; Liberatore and Wenghong, 2004; Daft and Lengel, 1986; Tushman and Nadler, 1978; Rice, 1992). What is often neglected is the fact that organizations, whether projects or more permanent ones, seldom rely on single mechanisms to ensure proper coordination. Rather, they utilize a portfolio or collection of different mechanisms. In this study I have responded to this lack of understanding by identifying three different coordination strategies that reflect the actual patterns of behavior and underlying logic of coordination between project teams. I have also identified salient antecedent factors that could be considered as design parameters when setting up multi-project development programs, and constraining contingency factors that affect the performance of programs. Through these findings the study supports the view that coordination should be tailored according to situational needs.

Thirdly, the results of the study make a valuable contribution to the discussion on multiple contingencies (Gresov, 1989; Andres and Zmud, 2001). The outcomes of this study reveal several combinations of situational factors that may lead to lower performance in goal achievement or learning and innovation. This lower performance can be explained theoretically through the conflicting demands that distinct situational factors pose to the program organization. These identified constraining factors complement the existing understanding on the relations between multiple contingencies and their effects on performance. Moreover, the results of the study reveal that the proposed straightforward and singular relation between performance and fit that is utilized in many studies (Donaldson, 2001) is rather limited. Based on a careful comparison of case programs, this study shows that the relationship between fit and performance depends

on the perspective taken in the performance. The study shows that even if the coordination strategy fits with the contingencies, the performance effects may be either positive or negative, depending on the viewpoint taken (propositions 3.1 and 3.2).

6.5 Managerial implications

The study shows how programs can be coordinated in different ways and thereby gives guidelines for program managers to establish deliberate strategies for managing interaction between different project teams. The results of this study provide a set of useful propositions for managers and organizational designers, to be utilized when planning and setting up complex development tasks. The results of the study help managers responsible for organizing and leading large scale organizational changes to conceptualize some of the most essential design parameters and to understand their relations to a specific repertoire of mechanisms through which the necessary information exchange between the teams is ensured. In addition, the study reveals a set of constraining factors and enablers that within a selected strategy have an effect on goal achievement and learning and innovation, and the nature of these relations. Moreover, the study provides program managers a description of a collection of actual coordination mechanisms to be used when designing the program task (Table 12). In addition to empirically observed coordination mechanisms, the study contains an extensive list of different means for coordination, derived from the literature (Table 2). Furthermore, in-depth description of seven case programs provides valuable knowledge on the potential challenges related to managing and organizing different types of organizational change initiatives. The observations from the interview data offer valuable understanding on how institutional and cultural differences between the participating actors may result in severe communicational and co-operational boundaries between project teams. This understanding on the dynamics and potential challenges related to organizing programs can help program managers to design their programs to be more effective, and thereby avoid costly overruns caused by challenges that tend to multiply in a network of interdependent projects. In order to provide practical benefit for managers responsible for or working with large organizational changes, programs or complex projects, I have summarized some of the above mentioned findings in the form of a contingency table (Table 21).

One of the first design decisions of a program manager, when planning a program, concerns the structure of a program. The structure of a program reflects often the architecture of the end "product" and how its development is organized. The program manager is responsible for deciding how the high level vision-type goal of a program should be broken down into concrete sub-goals or objectives, which are again implemented by projects. This planning decision should reveal also the number of projects in the program, and the extent to which projects are interdependent on each other. The number of project teams, interdependencies between the project teams related to work processes, goals, or resources, and

uncertainty related to goals and means respectively define what kinds of portfolio of coordination mechanisms need to be applied in the program. In this stage of program development the results of the present study may be applied in deliberate manner to guide the program manager how to organize interaction and ensure the sufficient information exchange between the project teams.

As the goals and work processes of different project teams are highly interdependent the selection is made between balanced coordination strategy model and centralized strategy model. On the other hand, if the work in project teams and goals of the projects are relatively independent the subordinate strategy represents an effective alternative for organizing coordination.

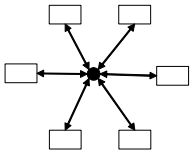
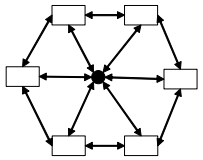
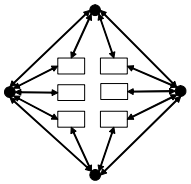
In case of the centralized strategy the frequent face-to-face interaction between different project teams is important because of a high uncertainty related to the goals and interdependencies between projects that make the multi-project entity sensitive to conflicts, misunderstandings and information gaps. Different types of formal and informal group meetings e.g. the steering group meetings, informal lunch meetings, results approval workshops, kick-of workshops, and informal gatherings should be established in order to facilitate and coordinate inter-team interaction. The program manager should co-locate at least the key individuals of the program (e.g. project managers), if possible, to facilitate informal information exchange activities and enhance inter-team interaction. Otherwise, the inter-project interaction should be rather limited in order to guarantee effective accomplishment of the tasks in the project teams. In the centralized strategy the responsibility of coordination should be remained as a key task of a program manager.

In case of the balanced strategy the responsibility of interaction is partly allocated to project team managers. Program manager should establish a variety of different mechanisms to support and encourage direct interaction between the project teams. Group meetings e.g. biweekly steering group meetings between different project teams are needed to resolve the emerging conflicts and following the advancement of the project teams. In order to make the interaction between projects more effective direct inter-project contacts should also be supported by placing project managers as responsible for dealing with interdependencies between the projects and by establishing a liaison person who deliver information and knowledge between project teams, and a coordinator who sends information requests for project teams and takes care of delivering this information for other teams. In addition, the interaction should be partly formalized by circulating documents, plans, and different types of reports in order to decrease the costs of coordination.

In case of the subordinate strategy the work in each project team is relatively independent from other project teams, and therefore the direct interaction between the project teams is not frequent or critical in means of achieving the objectives of the program. The main part of the information exchange between project teams should, therefore, take place through the vertical chain of command. In case of very large

number of projects, program should be divided into sub-programs in order to make the entity manageable. Program manager should construct the inter-team information exchange through already existing decision-making structure of the parent organization. This would also guarantee the resource availability for projects and to overcome the resistance in the parent organization. In addition, program manager should establish a systematic process and formal rules that define how the reporting takes place. The formal reporting process could be supported by an information database or by IT enabled reporting tool. The information exchange should be supported by establishing liaison roles in the decision making bodies at different levels. A liaison person should act as a steering group member in several projects. Because of low level of interdependency between the projects the focus of coordination should not be the management of workflow or resource dependencies, but rather to identify "hidden" interdependencies that are not visible through directly analyzing operative work in and between projects. For example possibility windows to utilize the results of a one project more widely in the organization and identification of the overlapping work packages are examples of the issues that are focal areas for coordinative actions. In addition, overall visibility of the program entity to the top management of the parent organization is one of the key justifications of additional coordination activities within the program.

Table 21 Interpretation of the findings: Contingency table for the organizational design of programs[1]

Coordination strategy	Centralized strategy 	Balanced strategy 	Subordinate strategy 
Description	• Inter-project interaction highly centralized, emphasis on different types of formal and informal group meetings • Program manager has high control over actual development activities	• Inter-project interaction ensured through the utilization of a variety of different types of practices such as: group meetings, liaison persons, direct contacts and database • Decision-making power localized into projects	• Inter-project interaction through formal hierarchical channels • Program structure resembles the parent organization's structure
Design parameters	• Low number of concurrent projects • High interdependency between project tasks • High uncertainty related to the dynamics of the system and technology	• Low number of concurrent projects • High interdependency between the project tasks • Low/moderate uncertainty related to the dynamics of the system and technology	• High number of concurrent projects • Low interdependency between project tasks
Constraining/enabling "causalities"	• The higher the number of participating organizations, the higher the potential for learning and innovation	• The higher the novelty of the technologies and goals of the program to the organization, the lower the ability to meet the goals • The higher the geographic distribution of the program, the lower the ability to meet the goals	• The higher the uncertainty related to the dynamics of the system and technology, the lower the ability to meet the goals • The higher the uncertainty related to the dynamics of the system and technology, the higher the potential for learning and innovation

[1] The information in the table represents the researcher's suggestions and interpretations of the findings derived from the case studies, not empirically tested laws or causalities.

6.6 Validity and reliability of the study

The quality of empirically oriented social research can be judged through the concepts of construct validity, internal validity, external validity, and reliability (Yin 1994). Moreover, several tactics have been suggested to increase the quality of the research (see e.g. Jick, 1979; Yin, 1994; Patton, 1999). The above mentioned concepts and their role in this research are discussed below.

6.6.1 Construct validity

According to Meyer (2001), construct validity means that there is substantial evidence that the theoretical paradigm correctly corresponds with the observations. In other words, you actually measure/observe what you claim to measure/observe. In case study research, like this, the mechanisms to improve the construct validity differ from that utilized in survey research. The principal component of this study was the coordination strategy, which was defined as the logic through which coordination is exercised, including the repertory of coordination mechanisms applied and relative importance of different coordination modes. The utilization of standardized research questions in a semi-structured interview allowed to focus the interviews, as well as flexible and responsible interaction between the interviewer and the respondents, as suggested by Sykes (1990). The researcher's personal presence in almost every interview enabled the researcher to ensure that the respondents discussed inter-project coordination. In addition, the utilization of multiple informants as multiple sources of evidence enhanced the construct validity in the case of coordination strategy. The construct validity related to uncertainty, complexity and performance, measured with a survey form, was ensured by constructing the measures on previously utilized and proposed items in the literature, as suggested by Bagozzi et al. (1991). In addition, the filling process of the survey form was tape-recorded, which gave the respondents an opportunity to comment on the questions that they felt difficult to answer.

One of the limitations of this study is related to the oversimplification of the coordination strategy construct. In this research I wanted to ground the coordination strategy concept on actual practices utilized, as well as several informants' perceptions on which of those practices were valuable, judged from the information exchange and knowledge sharing perspective. The coordination strategy construct did not differentiate between different types of information and their purpose. Nor did the study take into account the characters of individual actors engaged in the information exchange activity. Therefore the resulting coordination strategy constructs average the observations and rather than reveal individuals' perceptions, indicate the overall dynamics/structure of the system (program).

6.6.2 Internal validity

The concept internal validity means that the postulated relationships between the research concepts are valid (Meyer, 2001). Within this study, two distinct types of relations are relevant to be examined from the internal validity perspective: relationships between antecedent factors and coordination strategies, and relationships between antecedent factors and performance indicators within a distinct strategy. In both cases, the logic of reasoning for the existence of the relationship is based on a simple comparison of the case programs with each other. This method is widely used and generally accepted among researchers who have successfully utilized case study methodology (e.g. Eisenhardt, 1989; Yin, 1994; Pelled and Adler, 1994; Adler, 1995; Van Fenema, 2002).

In this study the collected data is cross-sectional, which partly limits the validation of causal relationships. It is, however, possible to validate the causal statements by analyzing the interview data and finding statements that support the proposed causalities. In this study this kind of analysis has not, however, been applied. Thus, one of the limitations of this study is related to the causality of the observed relations, especially between the antecedent factors and coordination strategies. The analysis frame does not make it possible to verify the causalities, but only make it valid to observe relationships. This limitation is not, however, a unique property of this study. This dilemma has also been recognized among the researchers of the structural contingency theory, i.e. whether the structure of the organization defines the appropriate strategy or vise versa (Miller, 1986). In the case of the relationship between the (constraining) antecedent factors and performance indicators, the problem of internal validity does not exist in this study, because the concluding propositions concern only the existence of the relationship, not the causalities.

In addition, I have approached the research problem merely from the information processing and system level perspectives. This may have limited the emergence of alternative explanations for the observed behavior. Thus, the adoption of other types of theoretical frames, for example principal agent theory (Jensen and Meckling, 1976), structuration theory (Giddens, 1984), or transaction costs approach (Williamson, 1981), could have provided complementary or rivalry explanations for the observed behavior. The utilization of the principal agent theory would complement the current understanding of coordination by including the self-interests of interdependent actors as an important part of the analysis. The analysis of coordination through the structuration theory would as well extend the view of coordination by acknowledging that not only is the agents' behavior affected and controlled by the adopted coordination practices, but the practices are also molded by the agents' action. Finally, the transaction cost approach would focus on coordination efficiency by examining the comparative costs of different constellations of coordination and related task characteristics. The efficiency perspective would

provide a complementary perspective on the observed performance differences between the case programs.

6.6.3 External validity

External validity refers to how generalizable the results of the study are outside the particular empirical setting (Yin, 1994). This study represents an inductive journey to the underlying logics that describe coordination between interdependent project teams, and antecedent factors related to the utilization of these specific strategies and constrain the performance of the program. Thus, it is out of the scope of this research to test the validity of the inductively derived propositions. The investigation of external validity in this dissertation should instead concern the validity and quality of the logic and process through which the propositions are derived. My first attempt to increase the external validity of the study was study to choose multiple case studies as the research methodology instead of a single case. I assumed that observing the similarities in behavior in multiple different contexts would increase the generalizability of the findings. In addition, I deliberately chose to select the case programs from 6 organizations representing different types of industries and operating in dissimilar institutional environments (Table). On the basis of these design choices, I can argue that the identified and proposed coordination strategies exist and are valid in different types of organizational contexts. Second, the existence of the coordination strategies and antecedent factors is based on observations made in more than one case in each strategy. In addition, the logic of argumentation follows the recommended case study logic (Eisenhardt, 1989). The principal means of evaluating the generalizability of the results of this study is, however, based on comparing the findings with the existing literature.

From the empirical perspective, one of the limitations of the study concerns the observed relations between the constraining antecedent factors and the performance of the case programs. Some of these observed relations, unlike the relations between the antecedent factors and utilization of specific coordination strategies, are based on the observation of the existence or absence of qualities in single cases. These single case-based observations do not provide evidence from a larger set of programs and thereby may be considered to limit the external validity of the related propositions (3.1-3.5).

6.6.4 Reliability

Reliability in empirical studies can be defined as consistency of measurement (Bollen, 1989). The reliability of quantitative measures related to complexity, uncertainty and performance were tested by analyzing the internal consistency of the measures through Cronbach's Alpha-values. The test values indicated that the measures utilized in this study are reliable. Moreover, the reliability of the study was ensured by utilizing multiple informants, and standard questions in the interviews. In addition, the

informants for the case studies were chosen carefully on the basis of preliminary discussions with program managers and company representatives. Furthermore, I tried to interview all the key informants within each case program in order to get as holistic and truthful a picture of the reality as possible, and thereby ensure the reliability of the study.

Despite of the described procedures that ensure the reliability of measurement, the question still arises whether some other researcher would have ended with similar results by analyzing the measured data. Unlike in a purely quantitative study, the reliability of the results in this study is to some extent also dependent on the researcher who interprets the data at hand. Facing the fact that the amount of qualitative data is often so extensive that only part of it can be utilized, the researcher is obligated to make choices on which parts of the data are interesting and significant for the purposes of the study. In this study my "selections" were mainly guided by Galbraith's (1973) information processing perspective on coordination. Thus, the focus of this study is on the mechanisms that directly or indirectly enhance information and knowledge exchange between the interdependent project teams. As a result of this selection, coordinative practices such as reward systems, values and culture, were scoped out of the investigation. Thus, a researcher who is specialized in these issues would probably have reasoned differently than I did in this study. This can thus be argued to be one of the limitations of the reliability of this study.

The second limitation related to reliability concerns the identified coordination strategies. Within that process, case clustering represents one of the most essential parts of the study, because it forms a ground for strategy identification, and further conclusions on the related antecedent factors. The method of case clustering was not based on the utilization of a statistical method, but consisted of logical reasoning guided by in-depth understanding of the interviews and tables of frequencies related to different coordination modes in the case programs. The reasoning process was inductive and included several discussions with research colleagues in order to ensure that the case clusters would form rational entities. However, it can be argued that clustering the cases based on inductive reasoning increase the impact of the researcher's interpretation when analyzing the data. Thus, this can be regarded as a factor that limits the reliability of this study.

6.7 Directions for future research

This study revealed several interesting issues that could be further investigated in the future. First, the existence of the identified coordination strategies and related propositions should be confirmed through extending the examination to a larger population of program-type temporary organizations. A complementary interesting question for this confirmatory research would be whether there are additional

strategies that I could not identify through this study. Second, the findings of the study suggest that the existing research model could be expanded to include the concepts differentiation and conflict. The empirical case material provided an indication of institutional controversies that were a result of organizational diversity, i.e. differences in the participants' praxis, background, and the way they perceived the task. The existence of conflicts and institutional controversies has been argued to have negative unforeseen cost effects, especially in the global project context (Orr, 2005). Thus future research should be targeted to understand coordination mechanisms that could be utilized to mitigate the effects of such organizational complexities. Moreover, this extended empirical investigation could include the concept of coordination as such as a focus of analysis. The concept of coordination would indicate the extent to which the coordination itself takes place and thereby enable analyzing the direct effect of coordination on results of a program.

Third, in addition to coordination between project teams, the examination could be expanded to the whole network of different actors, which typically in the global delivery projects include other types of stakeholders, potentially having a strong influence on the success of the program.[18] Relevant research questions in the complex global multi-project context could be how the information asymmetries and institutional differences affect the interaction and information sharing practices between the participating actors. From the coordination perspective, the examination of risk concept would provide a fairly unexplored area. The relevant research questions could be what kinds of risks exist in a globally dispersed network of institutionally differentiated actors and how the risks are coordinated and managed in such a context. The coordination practices have been to some extent tried to explain through risks, but not in the global context (Nidumolu, 1996).

Moreover, the institutionalization of the coordination activities in temporary organizations would serve a fruitful basis for additional research. The observation of the examined seven case programs suggests that the coordination activities form practices as the program evolve. The interaction between project teams seems to change during the development process, leaving some of the most significant mechanisms alive and discarding the practices that are ineffective. The data from the interviews also revealed that inter-team communication and cooperation barriers and "project-centricity" seem to diminish through the creation of shared values and culture. Thus, the examination of coordination from the process perspective would provide additional understanding on the dynamics of coordination practices in the multi-project context. An interesting research theme would be the elements and processes of institutionalization in temporary

[18] A step towards this direction was taken in "Global Projects, Business Networks, and Project Business Workshop", Stanford University 24th -25th April, 2007.

organizations, i.e. how the rules, norms and cultural beliefs develop in the programs and projects, and how institutionalization affects the collaborative behavior of the actors of the temporal organization. The examination of such themes would extend the current institutional theory (Scott, 2003; Dimaggio and Powell, 1983) to the context of temporary organizations, or form a prominent basis for a new theory of "provisional institutions".

One option for future research could also be investigating how the coordination strategies change and evolve during the life-cycle of the program. It is expected that uncertainty and complexity do not remain constant but could also be produced by the program. This would lead to a need to modify the existing strategy or even change strategy as the program unfolds. This examination of changes in coordination strategies would require adding the process as a key analytical concept that guide the selection of proper methods for data acquisition and the analysis of empirical data.

A further examination of conflicting contingencies would also provide an interesting area for future research. In this study I was able to identify some of them and their impact on the performance of the case programs. From the future research and managerial perspective it would be beneficial to unveil more of these and their impacts on different dimensions of performance, and through well-structured survey research to verify their existence in a larger set of temporary organizations. Additional participative action-oriented research or simulation modeling could be initiated in order to find new innovative ways to cope in situations of multiple conflicting situational factors. Some authors have started such innovative research work to find novel solutions to coordinate the tasks in projects more effectively and to design complex project organizations (Jin and Levitt, 1996; Nasrallah et al., 2003).

Finally, in this study the act of coordination is related to the exchange of information and knowledge from the system perspective. An interesting object for future research would be to focus on individual actors as the locus of examination. This research focus would include characteristics of individual actors and thrust between the actors as important explaining factors of adopted coordination strategies. This research could reveal whether the coordination strategy that the individual actor chooses to obey is only dependent on organizational characteristics or the nature of the task, or also on the actor's personal characteristics, such as values, background and orientation. This research would provide an intriguing interplay between the organizational characteristics, task characteristics and individual characteristics that direct the behavior in organizations.

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APPENDIXES

Appendix 1: Cover letter for the interviews (in finnish)

Teemme Teknillisessä korkeakoulussa tutkimusta aiheesta muutos- ja kehitysohjelmien johtaminen. Tutkimusprojektissa (http://pb.hut.fi/program_management.htm) keräämme aineistoa useasta suomalaisesta organisaatiosta tapaustutkimusta varten. Tutkimuksen avulla pyritään kartoittamaan tehokkaita ohjelmajohtamisen menetelmiä erilaisille kehitys ja muutosohjelmille.

Tutkimuksen tapaukset edustavat tuotekehitysohjelmia tai organisaation sisäisiä kehitysohjelmia. Tyypillisiä tapauksia (caseja) ovat organisaation sisäisten toimintatapojen uudistaminen tai tietojärjestelmän implementointi ja uuden tuotteen kehittäminen. Nämä esimerkit edustavat koko organisaatiota koskevia ja osittain jopa strategisia muutostoimenpiteitä, joita toteutetaan projekti-/ ohjelmamuotoisesti.

Keräämme aineistoa tapaustutkimusta varten haastattelujen avulla. Haastattelut tehdään pääosin kahden tutkijan tiimillä ja yhden haastattelun kesto on noin 45-60 min. Haastatteluajankohta olisi syyskuu-loka-marraskuu. Haastattelemme 4-10 henkilöä per ohjelma (pääasiallisesti projektipäälliköitä ja ohjelman vetäjää), jotka ovat osallistuneet ohjelman tai sen jonkun osan läpivientiin tai ohjelman ohjausryhmän työskentelyyn. Haastattelun tuloksia käsitellään anonyymisti ja luottamuksellisesti.

Aikomuksenamme on järjestää loppusyksyllä 2005 tai alkuvuodesta 2006 seminaari, jossa esittelisimme tutkimuksen tuloksia. Osallistuminen ko haastattelututkimukseen on organisaatioille täysin maksutonta ja oikeuttaa osallistumaan syksyn seminaariin ilmaiseksi.

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Appendix 2: Interview form

Name of the informant:

Date:

Organization:

Interviewees:

a. BACKGROUND INFORMATION - INFORMANT

1. Describe your position in the organization, and work history
2. How does you work is related to programs and program management?
3. What is your previous experience on working in programs or projects?

From now on the interview will focus on a selected case program X in which the informant has been participated.

b. BACKGROUND INFORMANTION – PROGRAM

4. Why was the program initiated?
5. What was the goal of the program/your project in the program?
6. When did the program get started and when it did end (is planned to end)?
7. What is the current situation of the program?
8. What is/was your role in the program?
9. Describe the advancement of the program – what kinds of different phases you can recognize?

c. PROGRAM ORGANIZATION

10. Describe the program organization – how many individuals participated in the execution of the program at minimum and at maximum?
11. What kinds of different parties/stakeholders were included in the program?
12. What was the role of different parties / stakeholders in the program?
13. How many projects / separate work entities did the program include?
14. How many of them were executed concurrently at maximum?
15. Does the organization has experience of executing similar kinds of programs before this program?
16. Have you participated in similar kind of program in some role?

d. COMMUNICATION AND COOPERATION

17. How was the communication and cooperation among the projects organized in the program?
18. How was the communication organized between the projects and decision-makers in the program?
19. How was the communication with stakeholders organized in the program?

APPENDIX 2: Cont.

e. INTER-PROJECT INTERACES

20. Describe the projects /entities in the program – what was the goal of each entity and how did they relate to each other?
21. Was there dedicated manager for each project/entity?
22. How often your project was in contact with other projects? **(for project managers)**
23. Draw a picture of the program organization with projects. Use arrows to indicate interdependencies between the projects in the program. Two projects are defined as interdependent if the execution of either or them is affected or affect by the other project. Describe the nature and strength of the linkages verbally. Evaluate the strength of the linkages in 1 to 5 scale 1 referring weak interdependency and 5 indicating very strong interdependency.
24. How were the interdependencies between the projects managed in the program?
25. What kind of information was changed between the projects?
26. What were the most important mechanisms for information exchange between the projects? By important I mean the most significant from your perspective in enabling exchange of information and increasing mutual understanding. Mention at least the three most important ones and specify the order of importance if possible.
27. What were the most significant factors that prevented the information between the projects in the program?
28. What were the most important factors that enabled information exchange between the projects in the program?
29. Did the communication practices change during the program, and if so how?

f. INTERFACES BETWEEN DECISION-MAKERS AND PROJECTS

30. Describe what kinds of decision-making structures were related to the program?
31. How often the decision-makers were in contact with projects?
32. Give an example of information exchanged between the decision-makers and projects
33. What were the most important mechanisms for information exchange between decision-makers and projects? Mention at least the three most important ones if possible.
34. What were the most significant factors that prevented the information between decision-makers and projects in the program?
35. What were the most important factors that enabled information exchange between decision-makers and projects in the program?
36. Did the communication practices between decision-makers and projects change during the program, and if so how?

APPENDIX 2 : Cont.

g. INTERFACE BETWEEN THE PROGRAM/PROJECTS AND OTHER STAKEHOLDERS

37. Describe what kinds of other stakeholders were related to the program? Describe the stakeholders that affected the work in the program/projects.
38. Give an example of information exchanged between the stakeholders and the program/projects.
39. What were the most important mechanisms for information exchange between stakeholders and projects? Mention at least the three most important ones if possible.
40. What were the most significant factors that prevented the information between stakeholders and the program/projects?
41. What were the most important factors that enabled information exchange between stakeholders and the program/projects?
42. Did the communication practices change during the program, and if so how?

h. PROGRAM SUCCESSFUKLLNESS

43. Did you perceive that the program was successful /has been successful so far?
44. Why you perceive that the program has been successful / has not been successful?

Thank you for your contribution to this research!

Appendix 3: Questionnaire form

Name of the respondents and organization:

Name of the program/project:

Role in the program:

A. Project manager, B. Program manager, C. Steering group member/management group member, D. Sponsor of the program, E. Representative of the business, F. Some else_____

i. PROGRAM AND UNCERTAINTY

Please, take stand on the following statements by circling the right alternative. **Scale 1 = totally disagree, 7 = totally agree.**

1. At the beginning of the program the inter-project interdependencies affecting the execution of the projects were clear

1 2 3 4 5 6 7

2. At the beginning of the program the interdependencies on relevant stakeholders were clear

1 2 3 4 5 6 7

3. At the beginning of the program the working methods needed to achieve the goals were clear

1 2 3 4 5 6 7

4. At the beginning of the program there were clear schedule for the program and projects

1 2 3 4 5 6 7

5. At the beginning of the program there were budget defined for the projects

1 2 3 4 5 6 7

6. At the beginning of the program there were measurable goals defined related to the outcomes of the projects

1 2 3 4 5 6 7

7. At the beginning of the program there were defined resource and competence requirements related to the projects

1 2 3 4 5 6 7

8. The planned outcomes of the program/projects differ technologically significantly from the previous programs/projects in the organization

1 2 3 4 5 6 7

Appendix 3: Questionnaire form (Cont.)

9. The technology / methods used in execution of the projects /program differ significantly from the ones used in the previous programs /projects executed in the organization

1 2 3 4 5 6 7

10. The resource and competence needs related to the program/projects differ significantly from the ones related to previous programs /projects executed in the organization

1 2 3 4 5 6 7

11. Program include much more interdependencies to other projects than previous programs /projects executed in the organization

1 2 3 4 5 6 7

12. Program/projects include much more interdependencies to stakeholders than previous programs /projects executed in the organization

1 2 3 4 5 6 7

Evaluate the changes made to planned outcomes of the projects /program

13. How many major changes were made related to planned outcome of the program?_____

14. How many major changes were made related to planned organization/working practices of the program?_____

15. How many major changes were made related to planned schedule of the program?_____

16. How many major changes were made related to planned budget of the program?_____

Circle the right alternative. **Scale 1 = not at all, 7 = very often.**

17. How often the interdependencies between the projects changed during the program?

1 2 3 4 5 6 7

18. How often the interdependencies on stakeholders changed during the program

1 2 3 4 5 6 7

II. COORDINATION EFFECTIVENESS

Please, take stand on the following statements by circling the right alternative. **Scale 1 = totally disagree, 7 = totally agree.**

19. I was well aware of the situation of the projects during the program

1 2 3 4 5 6 7

20. I was well aware of the inter-project interdependencies during the program

1 2 3 4 5 6 7

Appendix 3: Questionnaire form (Cont.)

21. Different stakeholders were well aware of the situation of the projects during the program

1 2 3 4 5 6 7

22. Decision makers were well aware of the situation of the projects during the program

1 2 3 4 5 6 7

23. Communication between the projects was sufficient

1 2 3 4 5 6 7

24. Communication between the projects and decision-makers was sufficient

1 2 3 4 5 6 7

25. Communication between the projects and (other) stakeholders was sufficient

1 2 3 4 5 6 7

26. Overlapping work was done in the projects

1 2 3 4 5 6 7

27. There was frequently a need to redone the work in projects

1 2 3 4 5 6 7

28. The program proceeded in a crisis-mode, its' progress was not in control

1 2 3 4 5 6 7

29. The outcomes of the projects integrated/has been integrated well together

1 2 3 4 5 6 7

30. The projects get the required information from the decision-makers easily and quickly

1 2 3 4 5 6 7

31. The reporting was excessively heavy

1 2 3 4 5 6 7

32. The information exchange between the projects was ineffective

1 2 3 4 5 6 7

33. Enough attention was paid to inter-project dependencies

1 2 3 4 5 6 7

34. Stakeholders were not listened enough during the program

1 2 3 4 5 6 7

III. PROGRAM OUTCOMES

Please, take stand on the following statements by circling the right alternative. **Scale 1 = totally disagree, 7 = totally agree.**

Effectiveness of the program

35. Program produced/has produced planned outcomes

1 2 3 4 5 6 7

Appendix 3: Questionnaire form (Cont.)

36. Program managed to stay / has managed so far to stay within the planned budget

1 2 3 4 5 6 7

37. Program managed to stay / has managed so far to stay within the planned schedule

1 2 3 4 5 6 7

38. The program success well as an entity

1 2 3 4 5 6 7

39. My own project managed to achieve the planned objectives **(for project managers)**

1 2 3 4 5 6 7

40. My projects managed to stat within the budget requirements **(for project managers)**

1 2 3 4 5 6 7

41. My project managed to stay within the planned schedule **(for project managers)**

1 2 3 4 5 6 7

42. The use of resources was effective in the program

1 2 3 4 5 6 7

<u>Impacts on customers and end-users</u>

43. The outcome of the program responded the needs of customers/end-users

1 2 3 4 5 6 7

44. The end-users perceived that the implementation process has been successful

1 2 3 4 5 6 7

45. The results of the program was adopted well by the organization

1 2 3 4 5 6 7

46. The execution of the program lead to internal conflicts within the organization

1 2 3 4 5 6 7

<u>Learning and innovations</u>

47. New business opportunities were recognized as a consequence of the program

1 2 3 4 5 6 7

48. The program produced technological innovations for the organization

1 2 3 4 5 6 7

49. The program produced new technological know-how to organization

1 2 3 4 5 6 7

50. The program produced innovations related to project management / project work

1 2 3 4 5 6 7

51. The program increased the know-how related to project work in organization

1 2 3 4 5 6 7

Appendix 3: Questionnaire form (Cont.)

Business impacts

52. Program produced planned benefits for the business

1 2 3 4 5 6 7

53. Effectiveness of the organization decreased as a consequence of the program

1 2 3 4 5 6 7

54. The outcome of the program responded to the strategic needs of the organization at the end of the program

1 2 3 4 5 6 7

55. The program did not produce benefits that would be worth of its costs

1 2 3 4 5 6 7

IV. ENABLERS AND PREVENTORS

56. Mention the three most important factors that have enabled the proceeding of the program. Rank the importance of the factors as follows: 1 = the most important, 2 = the second most important, 3 = the third most important

Factors	Importance
_____	_____
_____	_____
_____	_____

57. Mention the three most important factors that have prevented the proceeding of the program. Rank the importance of the factors as follows: 1 = the most important, 2 = the second most important, 3 = the third most important

Factors	Importance
_____	_____
_____	_____
_____	_____

Appendix 4: Summary of the key observations in the case programs

Case	Key observations[19]	
Alpha	1.1	High differentiation between the project teams
	1.2	"Project centricity" and communication boundaries between the project teams
	1.3	Program manger participates into the development work
	1.4	Power centralized to the program manager
	1.5	Emphasis on group meetings and co-location in order enhance information exchange
	1.6	Program organization's structure reflects both developed system and development process itself
	1.7	Resources on full-time and part-time basis
	1.8	Direct contacts between project teams rare at the beginning
Beta	1.9	Project managers responsible for the identification and management of interdependencies
	1.10	Program organization's structure reflects developed interdependent systems
	1.11	Direct contacts between project teams frequent
	1.12	Weekly group meetings important for information exchange
	1.13	Highly collaborative culture, low level of differentiation
	1.14	Utilization of formal processes and tools to support project work
	1.15	Resources on full-time basis
	1.16	Well defined roles and responsibilities
Gamma	1.17	Program organization's structure reflects the development process
	1.18	Program manger participates into the development work
	1.19	Highly collaborative culture among the participants and project teams
	1.20	Low hierarchy management ideology, power decentralized to responsible project managers
	1.21	Group meetings important for information exchange and problem solving
	1.22	Program manager and consultant served as integrative persons to complement direct inter-team contacting
	1.23	Resources on full-time and part-time basis
	1.24	Well defined roles and responsibilities
Delta	1.25	Decision making power localized on project managers
	1.26	Resources on full-time and part-time basis
	1.27	Program highly integrated to the parent organization
	1.28	Program organization's structure reflects both developed system and development process itself
	1.29	Strong organizational boundaries between the project teams
	1.30	Information exchange between the teams based on group meetings and utilization of shared resources
	1.31	Well defined roles and responsibilities
Epsilon	1.32	Young individuals recruited intentionally in order to enhance innovativeness
	1.33	Rigid organizational structure with well defined roles and responsibilities
	1.34	Several changes in organizational structure
	1.35	Resources on both full time and part time basis
	1.36	Very strong organizational boundaries emerged between project teams
	1.37	Communicational silos and conflicts between project teams
	1.38	Information exchange limited to group meetings
	1.39	Power centralized to program manager

[19] Observations based on the interview data

Appendix 4: Summary of the key observations in the case programs (Cont.)

Case	Key observations	
Myy	1.40	Resources only part time basis
	1.41	Power localized to several functional/ divisional manager responsible for the project type entities
	1.42	Program structure resembles the hierarchical structure of the parent organization
	1.43	Project type task-entities highly differentiated on each others
	1.44	Interaction between the task entities rare, existing organizational culture does not support collaboration between the entities
	1.45	Development activities organized through smaller work team/project before the initiation of the actual program
	1.46	Tasks supported by the formal information system and by detailed plans
Sigma	1.47	Program organization's structure resembles the hierarchical structure of the parent organization
	1.48	Power localized to several divisional manager each responsible for the group of several projects
	1.49	Direct contacts also between project teams rare / focused within a small group of projects
	1.50	Resources only part time basis
	1.51	Information exchange among projects in different decision-making committees through liaison persons
	1.52	Management of the program based on regular monitoring process, formality emphasized

Appendix 5: Importance of the coordination mechanisms

Case	GROUP MODE OF COORDINATION		INDIVIDUAL MODE OF COORDINATION		ELECTRONIC MODE OF COORDINATION		IMPERSONAL MODE OF COORDINATION	
	Coordination mechanism	NoM	Coordination mechanism	NoM	Coordination mechanism	NoM	Coordination mechanism	NoM
Alpha (n = 5)	Weekly status review meetings	4	Direct contacts via phone or face to face	2	Information exchange between project teams through E-mail	3		
	Co-location, informal information exchange	3						
	Informal inter-project group meetings	1						
	Workshops for results approval	1						
	TOTAL	9		2		3		0
Beta (n = 6)	Weekly status review meetings	5	Direct f-to-f contacts, phone	4	Information exchange between project teams through E-mail	3	Use of reports/documentation to share data	2
	Open space office	1					Project plan as integrative map	1
	Informal inter-project meetings	1						
	TOTAL	7		4		3		3
Gamma (n = 6)	Work meeting between the teams	4	Direct face to face contacts between project managers	2	Information exchange between project teams through E-mail	4	Functionality reports and testing documents	1
	Coordination group meetings	4	Program manager worked in the projects	1				
	Co-location	1	External consultant worked as a facilitator delivering required information between the project teams	1				
	TOTAL	9		4		4		1
Delta (n = 6)	Informal weekly meetings of the core group	6	Weekly meetings between information management director and each project manager	1	Information exchange between project teams through E-mail	2	Common database	2
	Coordination group meetings	4	Use of same IT and system experts in different projects	1				
	Quality group meetings	1	Project manager's participation into other project's weekly meetings	1				
	TOTAL	11		3		2		2

NoM refers to the number of informants mentioned the mechanism to belong to the three most important mechanisms

Appendix 5 (cont)

Case	GROUP MODE OF COORDINATION		INDIVIDUAL MODE OF COORDINATION		E-MAIL MODE OF COORDINATION		IMPERSONAL MODE OF COORDINATION	
	Coordination mechanism	NoM	Coordination mechanism	NoM	Coordination mechanism	NoM	Coordination mechanism	NoM
Epsilon	Coordination group meeting (biweekly)	5	Informal face to face discussions	1				
(n = 5)	Informal meetings between project teams	2						
	Brown bag lunch							
	Co-location	2						
	Other peoples dicussion group (this vanished when the project organization	1						
	Kick off meetings	1						
	TOTAL	11		1		0		0
Myy	Facilitator network meetings	4	Program manager served as a messanger delivering information between the divisions and functions	4			Documentation about the process in intranet	2
(n = 6)	Information exchange in the management boards/implementation	3	Use of facilitators to share understanding between the organizational groups	3			IT tool that enabled the follow up of how the project proceeds in different parts of the organization/Implementation	2
	Arranged meetings between different divisions and functions	2	Individuals participate into other areas Simple days in order to deliver information between different areas	2			Process itself serves as an integratin tool	2
	Informal loose network meetings of business developers (discussions on how to implement developed practices in different divisions)/Implementation	1	Direct face to face contacts	1			Use of sales plans to direct the logistic and orders	1
	Fomal development team meetings/development phase	1					Schedules for implementation, strategy clock	1
	TOTAL	11		10		0		8
Sigma (n = 11)	Divisional management board meetings, business unit management board meetings, and strategic management	7	Use of same (liaison) persons in several projects	5			Reporting system	4
	Weekly meeting between director and project managers	1	Direct contact to other projects if necessary	2			The information is preserved in the intranet	1
	Common meeting arranged for the project manbagers of the program	1						
	TOTAL	9		7		0		5

NoM refers to the number of informants mentioned the mechanism to belong to the three most important mechanisms