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The I3I Model; Identifying Cultural Determinants of Information Sharing via C2 Information Technologies

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Topic (3) Information Sharing and Collaboration Processes and Behaviors

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Abstract

Nowadays, information sharing is critical in and between organizations. However, there is no more critical need for information sharing than during modern military and civil-military operations when international coalitions dynamically form. Such coalitions can be characterized by their highly dynamic and information rich environments and the great diversity of entities involved, each representing its own national, organizational and professional culture.

Differences in national, organizational and professional culture are increasingly recognized as key barriers to C2 information sharing. This paper identifies three dimensions in which cultural determinants influence the behaviors central to information sharing and the use of information technologies for sharing; Identification; Inter-relation and Interchange. An integrative model for the assessment of these behaviors is advanced and expanded by utilizing qualitative data gathered during NATO Response Force Exercises in cooperation with the NATO C2 Centre of Excellence. Implications for information sharing in a multi-national environment are proposed.

The proposed model enables a systematic identification of the highly complex and challenging process of C2 information sharing. This identification is a critical first step in developing a strategy and specific interventions to align cultures of different entities participating in dynamic coalitions in support of more effective information sharing, ultimately resulting in increased mission effectiveness.

Keywords: *Information sharing, C2 systems, Coalition, Cross-cultural, Information technology.*

1. Introduction

In modern coalition operations accurate and timely information is critical to successful collaboration, shared awareness and mission effectiveness. During coalition missions information is unevenly distributed through the coalition. Therefore, a key challenge is identifying and moving essential information from the source, where it is generated or resides, to the receiver, where it is required and used.

The larger, more geographically dispersed, and time critical the operation, the higher the importance of sharing adequate and timely information across national, organizational, and professional boundaries. It is this sharing of information that is considered critical to mission success in coalition operations. However, extensive information sharing within coalitions still appears to be the exception rather than the rule.

Advances in command and control (C2) systems and information technologies have vastly increased the opportunities for information sharing within and between entities involved in coalition operations. A large variety of national, organizational and coalition technologies are available to enable information flows. These new technologies can significantly enhance information sharing by lowering spatial and temporal barriers between coalition partners and improving access to required information. However, technology is only one component of more complex socio-technical systems, such as modern coalitions. Introducing new technologies does not inevitably result in significant improvements in information sharing. Even if the technical capabilities are available, technology alone does not increase sharing (Orlikowski, 1992). Individual, organizational, and cultural factors may be powerful barriers to effective information sharing. Therefore, it is important to acknowledge that information sharing is a multi-dimensional phenomenon.

Modern coalition operations invariably involve different nations, services (army, navy, air force, special forces, etc.) and even groups from civilian organizations. Assigned individuals from the entities involved in the operation have to collaborate to identify, synthesize, and disseminate information from multiple domains and resources under multiple stringent constraints (Sonnenwald & Pierce, 2000). However, each of these of these individuals represents his or her own culture. Three widely accepted levels of culture exist (e.g. Helmreich & Merritt, 1998): national (nation), organizational (service), and professional (discipline) culture. National cultural differences manifest themselves in combined operations and organizational cultural differences in joint operations. Professional cultural differences are apparent whenever different disciplines interact, and a combination of organizational and

professional cultural differences manifest in civil-military operations. Taking into account the importance of information sharing, it is vital to understand the cultural aspects of human information sharing behaviors.

The aim of this research project is to advance an integrated understanding of the determinants that facilitate or impede information sharing via information technologies across national, organizational, and professional boundaries. By following a combined literature review and a qualitative multiple case study we present in this paper an integrated model for assessing information sharing behaviors within joint combined coalitions. Acknowledging the multidimensionality of information sharing, we draw on insights from several disciplines and propose a three-dimensional model of information sharing behavior.

The paper is organized into six sections including this introduction. The next section proceeds by discussing the theoretical foundations of information sharing behavior and its significance in a cross-cultural context. The third section describes the multiple case study and the data gathering activities conducted to validate and complement the existing literature. The fourth section proposes the I3I information sharing model based on a synthesis of the literature and initial empirical findings. The fifth section reveals the significance of information sharing in a multi-national context based on a well known cultural theory. The last section concludes with some implications of the study and future directions.

2. Culture and information sharing

Culture has been defined in many ways, but it is principally viewed as the fundamental system of meanings shared by members of a specific society (Hofstede, 1984; Schwartz, 1999). A widespread accepted definition of culture is provided by Hofstede (2001), who defines culture as *'the collective mental programming of the mind that distinguishes one group or category of people from another'*. Culture theory has been used in a substantial variety of research areas to explain an extensive array of behavioral phenomena. In the area of C2, however, only a limited amount of research has addressed cultural influences, mostly focused on decision making (Holt, 2003; Klein, Pongonis & Klein, 2000; Lindgren & Smith, 2006; Noble, Sander & Obenshain, 2000; Siemieniuch & Sinclair, 2006) rather than information sharing. Van den Heuvel, Grant and Soeters (2008) recognized the importance of culture in C2 information sharing.

Each of the three generally acknowledged levels of culture could individually and collectively influence the cultural value orientations and behaviors exhibited by an individual, organization or system; national, organizational, and professional culture. As Leidner and Kayworth (2006) state, culture at different levels exerts a subtle and yet powerful influence on individuals and organizations. Information flows and information technologies are often closely intertwined with culture. Modern coalition operations are characterized by their myriad of information flows and technologies, as well as by their cultural heterogeneity. Cultural differences can have an impact on the effectiveness and efficiency of information sharing and information technology use in coalitions.

Systematic research focusing on information sharing and information systems in a cross-cultural context is scarce. Although existing insights contribute to the understanding of the factors that influence information sharing via technology, Van den Heuvel et al. (2008) illustrated several deficiencies regarding their applicability in modern coalition operations. In general, most of the research that investigated cultural specific factors affecting information sharing processes across national or organizational boundaries conceptualized it as one single act rather than a multistage or multidimensional process. Such conceptualization obscures the role that cultural specific factors may play at different dimensions of the information sharing process.

Research from multiple disciplines examined information sharing behavior and managed to elucidate factors that support or hinder information sharing between individuals and organizations. However, despite its universally recognized importance, an integrated understanding of information sharing from multiple perspectives is lacking. We acknowledge the multidimensionality of information sharing behavior, and assess determinants originating from different

disciplines in an integrated manner. This enables a more comprehensive understanding of information sharing behavior in socio-technical contexts.

2.1 Definitions

Information and information sharing are pervasive concepts. Research in both the knowledge management and information science domains following Ackoff (1989) distinguish data, information, and knowledge. A comprehensive discussion about the nature of information and its relation with knowledge and data is beyond the scope of this paper. Although it is important to distinguish between knowledge and information (e.g. Nonaka, 1994; Davenport & Prusak, 1998), what gets transmitted electronically is either data or information (Jarvenpaa & Staples, 2000). Organizational and information systems literature generally refers to information as a desirable resource and to information sharing as a desirable behavior. In this paper, information is defined as *a data object that is generated and can be identified, stored, protected, moved and retrieved by members of a coalition by means of information technologies*. Accordingly, information sharing is defined as *the process of making information available to other members of the coalition*. This sharing can be done via direct communication, or indirectly via some information repository. Drawing on Lee, Vogel, and Limayem's (2003) and Jarvenpaa and Leidner (1999), a dynamic coalition is defined as *a cyberspace supported by C2 information technologies, centred upon communication and information sharing of assigned individuals representing a nation, a service and/or a discipline, to generate specific domain information, resulting in a relationship being built up*. Furthermore, the coalition is *temporary, geographically dispersed and culturally diverse*. The notion of temporariness describes coalitions whose members may have never worked together before and may not expect to work together again as a coalition.

2.2 Theoretical framing

Conceptual models and theories addressing information sharing employed in the literature are diverse and based on insights from various disciplines. Building on social exchange theory (Kelley & Thibaut, 1978), Constant, Kiesler and Sproull (1994) advanced a theory of information sharing in order to understand the determinants that support or constrain information sharing in technologically advanced organizations. The grounding in social exchange theory implies that social exchanges of information are similar to economic exchanges in the sense that there is an expectation of some future return for sharing. But unlike economic exchanges, there is no understanding of the value of what has been shared and no clear expectation of the exact future return. The theory goes beyond communications and information exchanges among personal contacts to include organizationally remote individuals. According to Constant et al., information sharing is affected by rational self-interest as well as the social and organizational context. Moreover, organizational culture and policies, as well as personal factors, influence an individual's attitude regarding information sharing. The notion of interdependence in social exchange theory is of significance when addressing information sharing in coalition operations. Concerns individuals have regarding the development and maintenance of information sharing relationships, the balance of power, and the norms of reciprocity is regulated by organizational and social contexts. Following this, the stronger the influence of the organizational context, the less likely an individual's information sharing behavior is driven by task or personal factors and more likely to be driven by social and organizational factors. Based on the Constant et al.'s information sharing theory, Jarvenpaa and Staples (2000) and Staples and Jarvenpaa (2000) explored the antecedents of collaborative technology for information sharing both within and between organizations. The suggested research model they proposed included cultural variables, task and technology related variables and individual attitudes and beliefs. Kolekofski and Heminger (2003) proposed a model that defines the influences on an individual's intent to share information, based upon the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). TRA proposes that an individual's behavior is determined by his or her intention to perform the behavior and that this intention is, in turn, a function of attitude toward the behavior and the social environment. Kolekofski and Heminger's study explored individuals' beliefs and attitudes about sharing organizational information and highlighted the role of an individual's attitude towards information sharing. Bock, Zmud, Kim and Lee (2005) also employed TRA augmenting it with extrinsic

motivators, social-psychological forces, and organizational climate factors in order to develop and integrative understanding of the factors supporting or inhibiting individual's sharing intentions

From another perspective, a variety of theories and models have been developed and used to explain technology use and adoption in diverse organizational settings by exploring individual attitudes and task-technology related factors. Davis, Bagozzi and Warshaw (1989) extended TRA and developed a theory of technology acceptance focusing on individual acceptance and usage of technology. Davis et al.'s Theory Acceptance Model (TAM) theorizes that an individual's behavioral intention to use a technology is determined by two beliefs; perceived usefulness and perceived ease of use. Venkatesh and Davis (2000) extended this theory by including constructs spanning social influence processes and cognitive instrumental processes in order to explain technology usage. Venkatesh et al. (2003) formulated a unified model of user acceptance of information technology that integrates essential elements from eight prominent information technology acceptance models. Moreover, Venkatesh et al. confirmed the significant moderating influence of experience, voluntariness, gender, and age. Goodhue and Thompson (1995) developed a general theory of task-technology fit (TTF), emphasizing the interactions between the task, the technology, and the individual. TTF advocates the congruence between task requirements, individual abilities, and the functionality of the technology.

Because of its grounding in influential theories of social-psychology, social exchange theory, and TRA, fundamental information systems theories, technology acceptance and TTF, the literature discussed provides a robust basis for developing an integrated theory of information sharing via information technologies.

2.3 Culture and Information

Research from a variety of areas (e.g. Steinwachs, 1999; De Long and Fahey, 2000; Ford, Connelly & Meister, 2003; Leidner and Kayworth, 2006; Shin, Ishman & Sanders, 2007) demonstrated that culture and information, information flows and information technologies are inextricably linked in organizations. Based on a multidisciplinary literature review Van den Heuvel et al. (2008) described in which way culture affects information sharing via C2 systems. By drawing on this research we define *identification, inter-relation* and *interchange* as the major dimensions affecting information sharing behavior in technologically advanced organizations.

Culture dictates to what extent information is perceived as important or valuable (e.g. De Long & Fahey, 2000; Steinwachs, 1999). It embodies all the norms, rules or procedures about how information is to be distributed within and between organizations as are coalitions. Furthermore, culture dictates what information belongs to the source, what information remains in control of individuals or subunits at the source and what information is shared, or, on the contrary, is not shared with recipients. Culture thus shapes the extent to which an individual or organization defines information as shareable. We use the label *identification*, defining it as *the selection and valuation of information that may or may not be shared with coalition partners, or with assigned individuals representing these coalition partners.* Identification addresses individual attitudes and belief related factors toward information.

Culture also establishes the organizational context for social interaction (e.g. De Long & Fahey, 2000; Ford & Chan, 2003; Shin et al, 2007; Steinwachs, 1999). This signifies that culture affects the selection of recipients with which interaction takes place and the concerns individuals and organizations have regarding the development and maintenance of relationships, the balance of power and the norms of reciprocity amongst individuals and coalition partners. We label this dimension *inter-relation*, defined as *the selection and valuation of the recipients as coalition partners, or as assigned individuals representing these coalition partners.* Inter-relation thus is concerned with social and organizational related factors influencing information sharing behavior.

Finally, culture influences the readiness to use information technologies for sharing information (Jarvenpaa & Staples, 2000; Kolekofski & Heminger, 2003), the attitude toward information technologies (Alavi, Kayworth & Leidner, 2006; Lippert & Volkmar, 2007), information system success (Ishman, Pegels & Sanders, 2001) and information system

implementation across cultures (Shore & Venkatachalan, 1996). Furthermore, culture affects preferences regarding the information channel to be used (Steinwachs, 1999). Consequently, we label and define *interchange* as *the selection and valuation of the technology used for sharing information with coalition partners, or with assigned individuals representing these coalition partners.* Interchange involves technology related factors affecting information sharing behavior.

Identification, inter-relation and interchange exert significant influences on information sharing behavior. Figure 1 depicts a visual representation of Information Sharing (IS) behavior following the I3I dimensions.

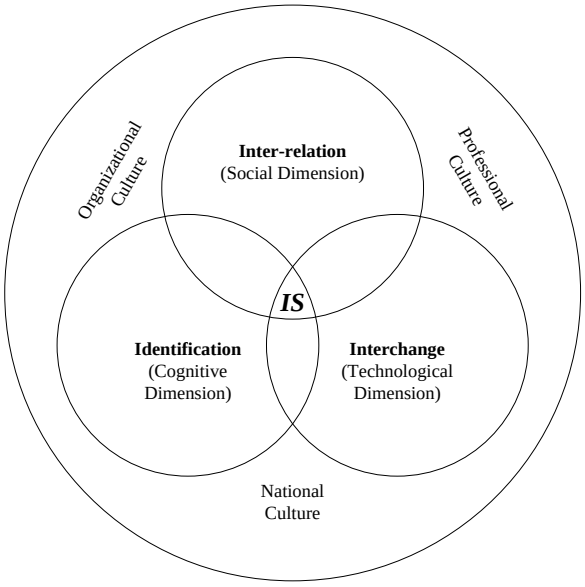

Figure 1: **Multiple dimensions of I3I Information Sharing**

As the figure shows, the three dimensions are interdependent and embedded within the different levels of culture. The interdependence notion implies that information sharing only occurs when *the conditions for I1, I2, and I3 are fulfilled and coexist within the individual*. Thus, individuals may be willing to identify and inter-relate, but the effort of using technologies for interchange may be too great. A barrier to information sharing then stems from the technology used rather than from the unwillingness to share. Conversely, unwillingness to identify or inter-relate may undermine the utility of such technologies.

Therefore, we emphasize that it is important to recognize that information sharing is a multidimensional behavior and not just a technology.

3. Validation

The existing understanding of the determinants that shape an individual's information sharing behavior across national and organizational boundaries in technologically advanced environments is fairly limited. It is scattered over a broad range of scientific disciplines and little mutual linkages exist. Given the under-researched and scattered character of the phenomenon, we employ a qualitative methodology based on a multiple case study to explore, elaborate and validate the proposed I3I model. The purpose of this validation is to check whether the determinants found in the literature are applicable to the complexity of real-world coalition operations, and to identify determinants that are lacking from the literature but pertinent to coalition operations. As the literature suggests (e.g. Dubé & Paré, 2003; Yin, 2003), case study research is particularly useful when the phenomenon of interest is of a broad and complex nature, and hence is best studied within the context it occurs. Coalition information sharing is such a phenomenon. We follow a positivist approach, implying an a priori assumption of discoverable factors explaining information sharing behavior. However, the case is exploratory as well, in the sense that the literature to date does not lend itself to the complexity and exceptional circumstances represented by modern coalition operations.

3.1 Case description

Data was collected by multiple methods and at multiple cases in order to triangulate the findings (Yin, 2003) and increase their robustness (Herriott & Firestone, 1983). The multiple methods relied on participant observation (DeWalt & DeWalt, 2002) and semi-structured interviews. Data gathering took place during a series of three large-scale, joint, combined Command Post Computer-Aided Exercises (CPX/CAX). The exercises were aimed at the training and certification of the NATO Response Force (NRF). The NRF is a technologically advanced, coherent, high readiness, joint, multinational, force package consisting of land, air, sea and special forces components. NRF has

also been designated as a driving engine for the military transformation of NATO and serves as a medium for future improvements of NATO's capabilities. The NRF can be deployed wherever needed as directed by the North Atlantic Council, and is capable of performing missions worldwide across the whole spectrum of operations, including evacuations, disaster management, counterterrorism, and acting as an initial entry force for larger, follow on forces (Bialos & Koehl, 2005; NATO, 2008). The NRF command and control structure consists of a Joint Force Command (JFC) with subordinated Land, Air, Maritime and Special Operations Component Commands (LCC/ACC/MCC/ SOCC). One of the NRF's key features is that it combines different component commands into one force package. The NRF is based on a system of rotations. Forces participating in the NRF are drawn from the entire NATO Command and Force Structure, are assigned to the NRF on a rotational basis, and member countries commit land, air, naval or special forces components to the NRF for a six-month period. The assigned components originate from different countries and represent different services. This signifies a large set of different national and organizational cultures.

Every six months, a NRF Steadfast exercise is conducted to train and certify the NRF. Steadfast exercises generally involve approximately 600 personnel from various headquarters and units assigned to the current rotation of the NRF, representing the full spectrum of NATO nations. Exercise participants include individuals from virtually all NATO nations, but also from Partnership for Peace (PfP) nations, international organizations (IO) and non-governmental organizations (NGO) from various nations. During Steadfast Exercises the JFC and the CCs are deployed geographically dispersed on different locations across Europe. Information exchange within and between the Joint Force Command and the Component Commands (CC) occurs via a range of information technologies, varying from direct communication channels, to indirect channels as information repositories and advanced C2 technologies. Training and exercise events focus on the integration of the NRF assigned force command and the components in a fictitious scenario. The exercises aim to practice critical tasks in an expeditionary coalition operation in order to assess the adequacy of planning and force generation for the conduct of NRF operations. To achieve success, information sharing and the appropriate use of C2 information technologies for sharing are of vital importance.

In sum, and as stated by Bialos and Koehl (2005), the NRF facilitates *coalition* warfare through *technology transfer* and *information sharing*. The large diversity of cultures at different levels within the coalition makes the NRF a highly appropriate case site for exploring determinants of information sharing in a multi-national and multi-organizational context. Additionally, the NRF is technologically advanced and the Steadfast series are CAX. This implies that a large variety of information sharing technologies is deployed and ensures that the environment is technologically highly advanced. Furthermore, the rotation of the assigned components implies different components originating from different nations, and different technological infrastructures during each rotation, so enabling triangulation of the data.

3.2 Data collection

Data is gathered by the principal researcher in cooperation with the NATO Command and Control Centre of Excellence (C2CoE). The C2CoE is a NATO research and development organization, located in the Netherlands. The centre consists of a multinational and multiservice staff of subject matter experts (SME) on command and control. The mission of the C2CoE is *'to support Supreme Allied Commander Transformation (SACT) in his efforts to transform NATO by providing subject matter expertise on all aspects of the Command and Control process'* (C2CoE, n.d.). Moreover, the C2CoE is a national and international main source of expertise for transformation in the domain of C2. The centre has been requested by NATO Headquarters Allied Command Transformation (ACT) to conduct NATO Network Enabled Capability (NNEC) assessments of the NATO Response Forces (NRF). These NNEC assessments are conducted by teams of C2CoE SMEs during the NRF Steadfast exercises deployed at all exercise locations and using the principles described in the NATO Code of Best Practices for C2 Assessment (NATO SAS-026, 2002). The assessments primarily focus on information exchange and coordination between the various components of the operational environment

through the networking and information infrastructure. The data reported in this paper centres on three NRF Steadfast exercises and was collected between November 2007 and December 2008 during three ten-day site visits in respectively Naples (Italy), Ulsnes (Norway), and Solenzara (France). The principal researcher deployed with the C2CoE assessment team at the JFC level of the C2 structure, the main junction of information exchanges. The sites generally involved around 250 personnel originating from a variety of nations and services. During the visits the principal researcher observed the exercise participants at the deployed joint combined headquarters (HQ) of the coalition, visited the relevant cells, and attended several briefings and meetings. In addition, the researcher had frequent informal conversations with exercise participants. Furthermore, series of semi-structured interviews were conducted with exercise participants, representing the HQ's wide range of national and organizational cultures as well as the various hierarchical levels within the HQ (OF3-OF9). The interviewees were asked what they perceived to be the factors enabling or hindering information sharing in joint combined coalitions, the factors pertaining to the use and adoption of information technologies for sharing within these coalitions, and how these factors related to differences in the multiple levels of culture affecting the individuals involved in the sharing process.

3.3 Data Analysis

Initial data analysis involved several steps. First, the interview findings and observations were compared and checked with the SMEs from the assessment team, who dispersed to different locations, briefings and meetings individually, and interviewed different exercise participants. This method enabled a valid and more complete representation of the determinants under investigation. This comparison also guaranteed that the descriptions and analyses of the principal researcher concurred with these of SMEs on the area of C2 information sharing. Subsequently, the observational field notes were expanded, and the interviews were analyzed on the basis of extensive interview notes, following the structure of the interview protocol. Finally, the analyzed observational and interview data were combined, resulting in a preliminary data set that is used for the development of an integrated model of information sharing.

4. The I3I Model

Drawing on the initial findings of the empirical study we enquired initial proof for some determinants applicable to coalition information sharing that followed from the literature. Furthermore, we identified a number of salient determinants lacking from the literature but pertinent to coalition operations. The resulting set of dimensional determinants is described below and is presented in the I3I model as depicted in figure 2.

4.1 Identification

This first dimension of the I3I model addresses individual attitudes and belief related factors toward information. It is divided into three determinants; perceived information value, perceived information shareability, and information ownership.

4.1.1 Perceived information value

Despite the importance of mutually sharing information, information is still perceived as being a valuable asset (Jarvenpaa & Staples, 2001). Individuals may be less willing to share information easily if the perceived value attributed to that information is high. The sharing of information then becomes a process mediated by decisions about what information to share with whom under what conditions. The importance of adequate information in coalition operations and the value attributed to nations and individuals who possess this information imply a notion of power around information. Valuable information is perceived as a source of power within joint combined coalitions. Kolekofski and Heminger (2003) acknowledged the notion of value and power of information as an instrumentality of sharing of information. If individuals perceive that power comes from the information they possess, it is likely to lead to information hoarding instead of information sharing because sharing may lead to a loss of ownership and power. As Davenport et al., 1992 state, power can inhibit information sharing in technologically advanced organizations. Holt (2003) endorses this human propensity to hoard information to preserve power, which runs counter to the requirements of coalition operations. By extension, perceived information value is defined as the value and resulting power attached to information, stemming from the possession of this information that others require or desire.

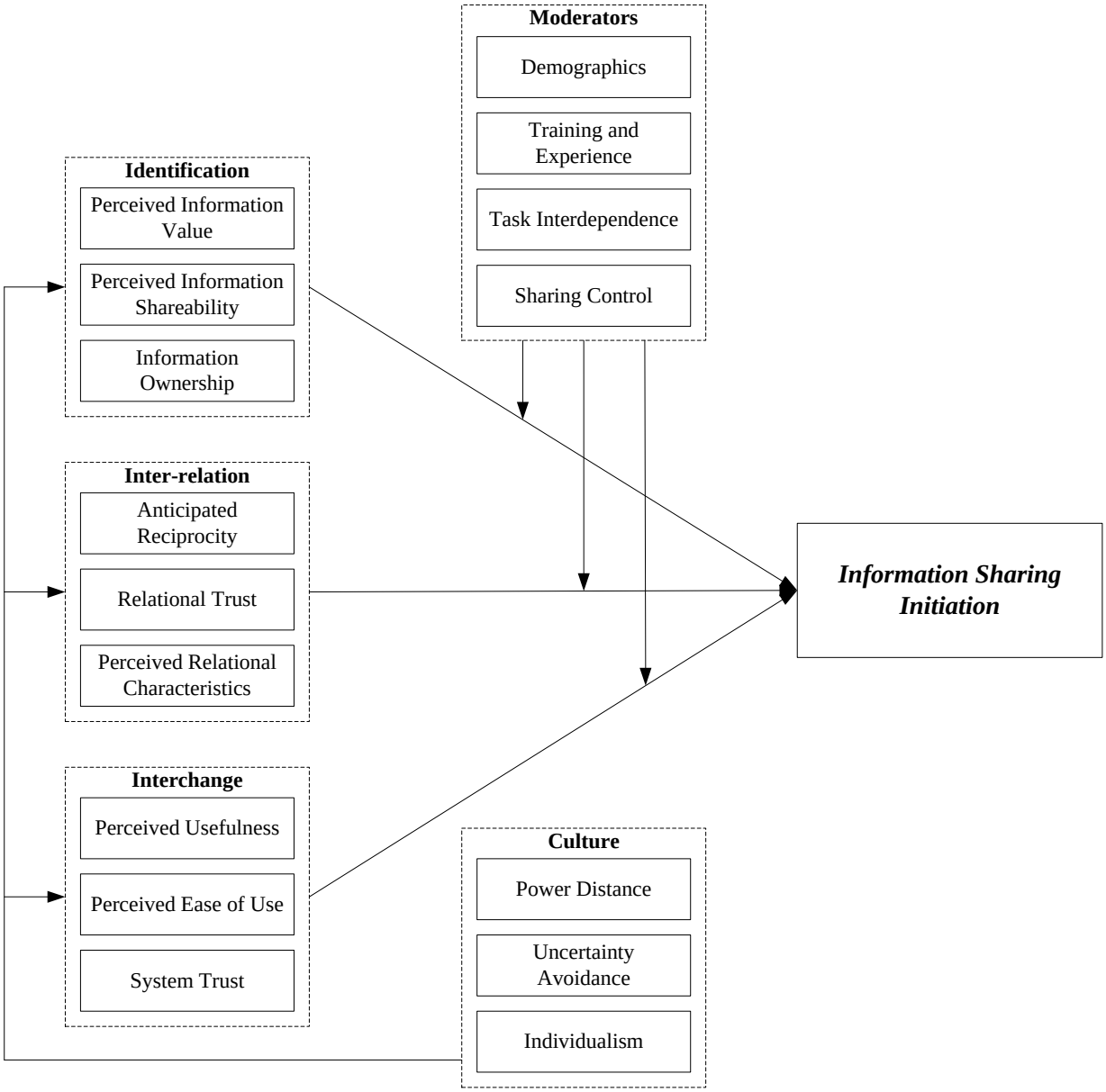

Figure 2: **The I3I Model**

4.1.2 Perceived information shareability

Dynamic coalitions can be characterized by the large diversity of national and organizational entities involved. Each of these entities may, aside of the common interest, exhibit different national or organizational interests. Furthermore, the temporariness of dynamic coalitions implies that coalition partners can be allies in one operation, and adversaries in another. These notions raise challenging issues with respect to the security and classification of information. In order to avoid risks of unauthorized disclosure, nations and services involved in the coalition determine their own disclosure policies, security directives and classification procedures. Differences in these policies, directives and procedures may hamper effective information sharing. Perceived information shareability is defined as the extent to which an individual perceives the information to be shareable. This also implies flexibility regarding downgrading or declassifying secure and classified information.

4.1.3 Information ownership

Constant et al. (1994) discovered a link between the type of information and an individual's attitude about sharing it, and proposed that information sharing is affected by organizational norms of property rights. Beliefs of organizational ownership relate to whether information created by an individual is believed to be owned by the organization. These beliefs

about property rights affect information sharing. Jarvenpaa and Staples (2001) established that individuals' beliefs about information ownership were significantly related to the sharing of information, and individuals can attribute ownership to themselves, to the organization, or to both. Consequently, contradictory incentives to share information and to withhold it exist simultaneously. Following Jarvenpaa and Staples (2001), coalitions have a need for managing information at a collective level, whereas individuals have a need for using information as a component of his or her individual power base. As the literature suggests (Constant et al., 1994; Staples & Jarvenpaa, 2000), sharing information that individuals possess makes them feel needed and appreciated by providing them a sense of competence or control over their environment. Individuals thus might be reluctant to share information for fear of losing ownership. Conversely, if individuals perceive that their professional success is related with the information they share, this information will be shared more easily.

4.2 Inter-relation

Besides factors involving the information itself, relational factors affect the information sharing process. The subsequent dimension, inter-relation, is characterized by three determinants; anticipated reciprocity, relational trust, and perceived relational characteristics.

4.2.1 Anticipated reciprocity

As stated above, information is viewed as a valuable and powerful asset that should not be shared heedlessly. Drawing on social exchange theory, reciprocity is considered to be a significant determinant of information sharing. Nations, as well as individuals, involved in information sharing processes anticipate being able to acquire or benefit from the value created by their involvement. Accordingly, nations and individuals are motivated to share information with the coalition, or with certain coalition partners, with the anticipation that the same value of information will be received in return. Following Bock et al. (2005), an anticipated reciprocal inter-relation represents an individual's desire to maintain ongoing relationships with other individuals, specifically with regard to information provision and reception. However, temporariness of dynamic coalitions often implies the lack of such relationships of reciprocity, formed by continuous processes of information exchanges.

4.2.2 Relational trust

When facing decisions to what extent valuable information is shared with whom, judgements about the trustworthiness of the recipients become relevant. Trust is a broad and multi-faceted concept that has been widely studied in many disciplines. In the light of coalition information sharing, relational trust affects the way information is shared between coalition partners. Regardless of any formal information sharing procedures or requirements, information will not be shared without trust in the recipient. Trust is considered of critical importance to the development of information exchange relationships, and it evolves through mutually satisfying exchange interactions. Consequently, not complying with an anticipated reciprocity is regarded as untrustworthy behavior. Furthermore, trust within dynamic coalitions is highly fragile and temporary (Jarvenpaa & Leidner, 1999).

4.2.3 Perceived relational characteristics

Sharing of information, especially valuable information requires some sort of relationship. As Kolekofski and Heminger (2003) state, these relationships themselves influence information sharing. Sharing information then becomes a function of the kind of relationship the source has with the recipient. Relational characteristics involve the strength and the hierarchical disposition of relational ties. Information flows are affected by the strength of ties. Strong ties are important for sharing valuable information across boundaries. The hierarchical disposition of the relational tie implies the power and status of the information source compared to the recipient, i.e. their relative positions in the formal structure of the coalition. De Long and Fahey (2000) revealed that status differences impede cross-functional information sharing. Huber (1982) acknowledged that individuals of low status and power tend to direct information to individuals with more status and power, and that individuals of high status and power tend to communicate more with their equals than with persons of lower status and power.

4.3 Interchange

The final dimension, interchange, models the behavioral intention to use an information technology as a function of three attitudinal

determinants of individuals; perceived usefulness, perceived ease of use, and system trust.

4.3.1 Perceived usefulness

Empirical research (e.g. Davis et al., 1989; Venkatesh & Davis, 2000) shows that the perceived benefits of using an effective and efficient information technology encourage individuals to use the technology. Individuals may not be inclined to use certain technologies for sharing information if they believe the technology does not help them in their information sharing task. Accordingly, perceived usefulness is defined as an individual's perception of information sharing performance when using a particular system. If an individual believes that using the system will not help him or her to attain gains in information sharing, information may not be shared.

4.3.2 Perceived ease of use

In time critical and information rich contexts, the effort that an individual may allocate to the various activities for which he or she is responsible is a finite resource. Perceived ease of use refers to individual perceptions that using the system would be free of effort. Accordingly, a high degree of difficulty associated with using a certain technology for sharing information may be a barrier to information sharing.

4.3.3 System trust

Even if a technology is perceived as useful and easy to use, it may not be used if an individual believes that it is untrustworthy. Risks associated with unauthorized disclosure, information leakage, and confidentiality and security violations affect whether and how users use technologies for sharing. Individuals who distrust the technology or system may be disinclined to utilize it for the purpose and in the manner in which it was originally designed. That is protecting and defending the information that is being shared via these technologies. Perceived system trust is defined as having confidence in and entrusting the system to share information in the intended way with no risk for unauthorized disclosure, information leakage and confidentiality or security violations.

4.4 Moderating variables

In order to ensure robust results across contexts, some moderating factors emerged from the literature and the data set. These moderators need to be addressed in the I3I model.

4.4.1 Demographics

Empirical research from several disciplines revealed that demographics, such as gender and age affect information sharing behaviors. Similarly, gender and age are found to affect the use of information sharing technologies. Drawing from these findings, it can be expected that influences of the proposed I3I determinants are moderated by age and gender.

4.4.2 Training and experience

Drawing on the theory of reasoned action (Fishbein and Ajzen, 1975), individuals may employ the knowledge they gained from prior experience to form their intentions regarding information sharing and the use of technologies for sharing. Accordingly, following Constant et al. (1994), the amount of experience and training are found to have an indirect positive effect on information sharing. Experience is defined by the amount of time individuals have regarding information sharing processes and the use of certain technologies for sharing in dynamic coalitions. Training is a predecessor of experience.

4.4.3 Task interdependence

Another moderating variable is task interdependence. Drawing on Tushman and Nadler (1978), task interdependence is defined as the extent to which an individual depends on other individuals to perform a task effectively. As Goodhue and Thompson's (1995) theory of technology fit suggests, those whose work involves tasks that are interdependent of others may be motivated to use information sharing technologies more than those who act alone. Jarvenpaa and Staples (2000) identified a strong positive relationship between task interdependence and the use of information technologies for sharing information. The more interdependent an individual's work is on others, the higher the needs of self-interest and reciprocity are, and therefore the more likely the individual is to share. The degree of task interdependence is thus associated with the need for mutual information sharing. Individuals in dynamic coalitions whose work depends highly on others, including the type of information they need, will have a higher degree of identification, inter-relation and interchange.

4.4.4 Perceived sharing control

The diversity of nations and services involved in dynamic coalitions implies a diversity of formal policies and procedures that permit or forbid information to be shared with different parts of the coalition. Consequently, these formal procedures or norms established by nation or service heavily determine the information sharing process. Even if positive conditions regarding identification, inter-relation, and interchange exist, information sharing does not occur if the assigned individual is hindered by these organizational barriers. Moderators following from formalized organizational norms or rules may mitigate or break through negative influences of the I3I determinants, but they also may enforce positive influences. These norms or rules are a reflection of information sharing behaviors at the organizational level and influence such behaviors at the individual level. Drawing on Ajzen's (1991) notion of perceived behavioral control, perceived sharing control is defined as the beliefs regarding opportunities required to permit the identification, inter-relation and interchange of information.

5. Implications of I3I information sharing in a multinational environment

To reveal to what extent *national* culture and information sharing may be intertwined, we now link the I3I theory of information sharing with a widely accepted theory of national culture. Culture is a challenging variable to research, in part because of the numerous different definitions and measures of culture. While a number of the available theories and operationalizations of national culture are valuable and add to the understanding of national culture and its influence on information sharing, the single work that has most influenced the development of cross-cultural research has been the seminal study that was carried out by Dutch social psychologist, Geert Hofstede (1984). Despite being subject to criticisms and the emergence of alternative approaches (e.g. Schwartz, 1999, 2006; Inglehart, 1997), Hofstede's theory remains a leading and widely used paradigm of national culture. Therefore in this paper we use Hofstede's theory to demonstrate some of the implications of differences in national cultures affecting cross-boundary information sharing within multinational dynamic coalitions. Hofstede (1984, 1991, 2001) provides a framework for assessing national cultural differences on five dimensions; power distance, uncertainty avoidance, individualism, masculinity, and long term orientation. Of these five dimensions, we use power distance (PD), uncertainty avoidance (UA) and individualism to illustrate some potential implications of cross-boundary information sharing. The central theoretical proposition is that the *selected cultural dimensions that differentiate between coalition partners are predictive of differences between individuals representing these coalition partners in their ways of identifying, inter-relating and interchanging information during modern coalition operations*.

5.1 Power distance

Power distance is the extent to which the less powerful individuals of institutions and organizations within a culture expect and accept an unequal distribution of power. High PD cultures are characterized by decisions being made by superiors without consultation with subordinates, and subordinates preferring this practice. In high PD cultures, superiors and subordinates consider bypassing to be insubordination, whereas in low PD cultures subordinates expect, and are expected to bypass their bosses frequently in order to accomplish their tasks, e.g. information sharing. Low appraisal is placed on information that exists within the lower levels of the coalition. Accordingly, information may be more likely to flow vertically from the top down and less horizontally. Conversely, low PD cultures may have more bottom-up information sharing as individuals within the lower ranks feel more comfortable in sharing information with higher officers. In high power distance cultures, individuals with status or high ranks in the hierarchy wield considerable power and lines of authority, with command and responsibility being clearly defined. The introduction of new C2 information technologies, often results in new processes and procedures. These lines then are often challenged. New technologies might provide operators from lower ranks with access to previously inaccessible and protected information. In cultures in which individuals are separated by high PD, these leveling effects of certain information technologies may not be desirable. Whether or not information sharing occurs at all may also be influenced by culture. Within high PD cultures, if flag officers consider

information sharing as important, it is more likely to occur. In low PD cultures this is less likely to be the case. Consequently, in high PD cultures, information sharing may be inhibited, and information hoarding could be present. Identification may be more challenging. Inter-relation occurs in a vertical way, resulting in the persistence of stovepipes, with interchange being disencouraged. Thus, cross-boundary coalition information sharing initiation in high PD cultures is more problematic

5.2 Uncertainty avoidance

Uncertainty avoidance refers to the extent to which individuals of a culture feel threatened by uncertain or unknown situations. High UA cultures are characterized by having formal rules and sanctions for deviant behavior. Ambiguous situations are avoided by providing greater certainty and predictability. Uncertainty is reduced by establishing formal policies and procedures. A higher need for security results in more rigid security and classification procedures. This hampers information sharing in high UA cultures. In low UA cultures, individuals may exhibit a somewhat greater willingness to declassify and share valuable information. Consequently, the risks associated with the unauthorized disclosure or leakage of valuable information may raise a larger barrier in high UA cultures. Furthermore, UA affects the way in which individuals are willing to use technologies for their information sharing tasks. In high UA cultures, change and innovation, associated with the introduction of technologies, are not valued. The anxiety level of commanders and operators may be raised, resulting in resistance to abandoning the systems and procedures with which they are experienced and feel secure. Accordingly, cultures characterized by a high level of UA may be less willing to identify, inter-relate and interchange than low UA cultures.

5.3 Individualism

Individualism, contrasted with collectivism, is the extent to which individuals are integrated into groups. Individualist cultures represent loose ties between individuals where the interests of individuals prevail over the interests of the group and the independence of individuals is emphasized. Individual accomplishments are valued whereas in collectivist cultures the group's well being and common goals and objectives are valued more. Collectivist cultures are characterized by tight social networks in which individuals strongly distinguish between their own group and other groups. Individualist cultures may have more difficulty in information sharing, since valuable information is seen as a source of individual power and an instrument for his or her success. Conversely, collectivist cultures may be more willing to initiate information sharing because information sharing is construed as beneficial for the collective. Individuals behave in a manner that maintains the harmony of the coalition. The stronger the cultural context supporting collectivism, the more likely an individual will be willing to share information. Thus, individualist cultures are less willing to initiate information sharing, resulting in a lower degree of identification, inter-relation and interchange. Therefore, cross-boundary coalition information sharing initiation in individualist cultures may be more problematic.

5.4 Implications

By combining measurements culture with contextually specific I3I dimensions of information sharing, it is possible to generate and test a myriad of propositions about cross-cultural differences relating to information sharing within dynamic coalitions. For instance, individuals from cultures high on both PD and UA, such as the former Yugoslavia and Southern Mediterranean and Latin American countries, tend to view their organizations as pyramids of individuals where everyone in the organization knows who shares with whom, and formal lines of information sharing run vertically. This may result in the persistence of stovepipes, hampering cross-boundary information sharing in those countries. Conversely, in cultures low in PD and UA, such as Denmark and Sweden, the lack of hierarchy and the expectation and encouragement of risk taking, cross-functional and cross-boundary information sharing is stimulated. Individuals from highly individualistic cultures, such as the United States, Great Britain and Australia, tend to emphasize individual interests and achievements. Information in these countries is shared more for power related and reciprocal reasons. This may result in hoarding information in order to retain power and control. Furthermore, individuals from cultures high in individualism and PD, such as Belgium and Southern Mediterranean countries Italy, France and Spain, may be disinclined to share information not only to preserve power, but also

because of insubordination from bypassing the chain of command. This may result in the hampering of cross-boundary and cross-functional information sharing. These are just some of the potential implications of cultural differences affecting coalition information sharing.

6. Conclusions and future directions

The objective of this paper was to advance an integrated understanding of the factors that facilitate or impede information sharing via information technologies across national and organizational boundaries. By following a combined literature review drawing on insights from several disciplines and a qualitative multiple case study we emphasized the importance of recognizing the multi-dimensionality of coalition information sharing. We developed an initial integrated model for assessing information sharing behaviors within joint combined coalitions. First, we recalled the relevance of the research project by describing the importance of information sharing in modern coalition operations, characterized by their vastness of information flows and technologies, as well as their cultural heterogeneity. Then, we discussed the theoretical foundations of information sharing behavior and its significance in a cross-cultural context. Subsequently, we synthesized a number of salient determinants of information sharing from both prior literature and from preliminary qualitative empirical data. The process of synthesis focused on capturing the dominant determinants applicable to information sharing in dynamic coalitions. Finally, we demonstrated some potential implications of information sharing in a multi-national environment. The insights provided in this paper advance our collective understanding of information sharing in dynamic coalitions. The objective of the I3I model is not to delineate all inherent determinants of coalition information sharing. However, because of its grounding in influential theories from several relevant disciplines, and in empirical data, the I3I model can be seen as a robust theory for explaining a substantial variance in cross-boundary information sharing at the individual level.

The need for an integrated assessment of coalition information sharing is stressed. While the separate importance of each of the I3I dimensions has long been recognized across various research disciplines, their simultaneous effects have yet to be examined and assessed empirically. Although modern information sharing technologies provide the promise of significantly increased information sharing across boundaries within a coalition this is not unarguably the case. Therefore, it is of the utmost importance to recognize that information sharing is a behavior and not a technology. The presence of different cultures may raise significant barriers to information flows between cultures. Understanding the process of information sharing at the individual level, is one step toward a better understanding of information sharing as a whole in coalitions. The current paper demonstrates some potential implications of information sharing across national boundaries from the individual perspective and at the national level of culture. However, multiple levels of culture exist. Therefore, due to the presence of these multiple levels, and their relative saliency at a given moment, it is inappropriate to assume that national culture is the sole influence and that the individual level is the sole level of analysis. The overarching research project addresses all levels of culture and both levels of analysis.

The I3I theory of information sharing offers a myriad of research opportunities. When the data of the multiple case study discussed in this paper have been fully analyzed, a research report presenting the descriptive findings and the finalized I3I model will be published. In order to further validate the I3I model and explore its implications within joint and combined coalitions, a program of experimentation has been developed. Both qualitative and quantitative research methodologies will be employed. Data gathered by conducting in-depth interviews with experienced C2 information sharing SMEs, multiple qualitative case studies and quantitative surveys will enable a refinement of the I3I model and an exploration of its implications. The research project is in close cooperation with the NATO C2 Centre of Excellence and Tilburg University, The Netherlands.

Along with its scientific relevance, findings from the research project will be significant for forces and civil organizations participating in modern dynamic coalition operations. Some practical insights are worth mentioning. The I3I

theory indicates that information sharing is more successful when multiple dimensions are assessed before technology based solutions are implemented. Commanders that are trying to achieve efficient and effective mutual coalition information sharing can use the results of the research project to focus their efforts on activities that will have the greatest impact on increasing the sharing of information. A systematical assessment of the three dimensions may suggest specific actions commanders can take to evaluate the different aspects of culture most likely to hamper coalition information sharing. Results from these evaluations can be woven into training and educational programs across countries and services so that all levels of future decision makers gain awareness of the impacts of cultural differences on coalition information sharing. Implementation of C2 information technologies may be tailored to the values and cultural preferences of the individuals in each of the countries and services where the systems will be used. In conclusion, we think that this research project will advance the understanding of information sharing behaviors in culturally diverse and technologically advanced organizations.

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