*5th International Conference on Industrial Engineering and Industrial Management*
*XV Congreso de Ingeniería de Organización*
*Cartagena, 7 a 9 de Septiembre de 2011*

# Maturity model for the Structural Elements of Coordination Mechanisms on the collaborative planning process

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**Palabras clave:** Maturity model. Collaborative processes

## 1. Introduction

Collaborative Planning (CP) can be defined as a joint decision making process for aligning plans of individual Supply Chains (SC) members with the aim of achieving a certain degree of coordination (Stadler, 2009). Coordination means identification and classification of existing interdependencies (Li et al., 2002). Different coordination processes manage different types of interdependencies. Coordination should be considered different from integration in that where coordination takes the target for granted, integration often involves determining this target simultaneously with the aligning of allocation decisions (Oliva and Watson, 2010). Typical features of supply chain coordination processes include demand planning (DP), supply planning (SP), available-to-promise/ capacity-to-promise (ATP/CTP), manufacturing planning, distribution planning (DP), etc. Generally, the execution of process depends on proper information management. Coordination mechanisms in supply chain should be tools by which, every member of a supply chain can achieve more benefits. Thus, organizations need to develop strategically aligned capabilities not only within the company itself, but also among the organizations that are part of its value-adding networks. Additionally, processes are now viewed as assets requiring investment and development as they mature. Thus the concept of process maturity is becoming increasingly important as firms adopt a process view of the organization (Lockamy and McCormack, 2004).

Maturity models describe the evolution of a specific entity over time. MMs have been developed to assess specific areas against a norm. The entity collaboration level in a SC can evolve over time, and MM can show and measure this evolution. It can offer benefits to Structural Elements of Coordination Mechanisms.

The objective of this paper is to develop a maturity model for the structural elements of coordination mechanisms on the collaborative planning process to be aware of the current situation and identify the next steps to improve the process.

The paper is structured as follows: firstly, section 2 offers a review of maturity models. Section 3 defines the structural elements of CP coordination mechanisms. Next, Section 4

proposes a maturity model for the structural elements of coordination mechanisms on the collaborative planning process; it describes the key practices that correspond to each maturity level. Finally, the conclusions are given in section 5.

## 2. Literature Review Maturity Models

Maturity as a measure to evaluate the capabilities of an organisation in regards to a certain discipline has become popular since the Capability Maturity Model (CMM) proposed by the Software Engineering Institute at Carnegie Mellon University (Paulk, 1993). Whilst the original CMM has a specific focus on the evaluation of software development processes, this model has been varied and extended in a number of approaches and is now applied for the evaluation of IT Infrastructure Management, Enterprise Architecture Management and Knowledge Management to name a few.

The maturity model analyzed have been: The capability maturity model (CMM) (Paulk, 1993; 2009), business and IT alignment is Luftman's Maturity Model (Luftman, 2000), ICoNOs maturity model (Santana, 2006), Levels of Information Systems Interoperability' (LISI) (C4ISR, 1998), EIMM (ATHENA, 2003) and Supply Chain Management Maturity Model, SCM-MM (Lockamy and McCormack, 2004).

The capability maturity model (CMM), have been developed to present sets of recommended practices in a number of key process areas that have been shown to enhance software-development and maintenance capability. The Software CMM has been retired in favour of the CMM Integration (CMMI) model. CMM introduced the concept of five maturity levels defined by cumulative requirements. Luftman's MM discusses an approach for assessing the maturity of the business-IT alignment. The structure of the ICoNOs MM is based on CMMI, the relationship of network organizations when studied in perspective of business-IT alignment (B-ITa). LISI defines the five levels of interoperability relating the kinds of systems involved in the interoperability process. EIMM deals specifically with enterprise assessment, which mainly concerns the organisational barriers to interoperability. The SCM-MM conceptualizes how process maturity relates to the supply chain operations reference (SCOR) framework; the five stages of maturity show the progression of activities toward effective SCM and process maturity.

Table 1.1 shows a comparative analyse of maturity levels of different maturity models. Furthermore, the key areas in each maturity model are displayed in the table 1.2

Each of the key areas is assessed using the scheme of five levels. For example, in Luftman's MM "Understanding of business by IT" under the Communications Maturity criterion, the five levels are: Level 1: IT management lacks understanding, Level 2: Limited understanding by IT management, Level 3: Good understanding by IT management, Level 4: Understanding encouraged among IT staff and Level 5: Understanding required of all IT staff.

The interpretation of each maturity level will be different for each key area or criterion. This rating system will help the entity to assess their level of alignment. They will ultimately decide which of the following definitions best describes your business practices.

The analyzed models nearly match in maturity levels; they are all based on the CMM. However, we must emphasize that the domains or key areas where they apply these models are different because the measure target is different.

**Table 1.1** Comparative analyse of maturity levels:

| CMMI | Luftman's MM | ICoNOs MM | LISI | EIMM | SCM-MM |
|---|---|---|---|---|---|
| Level 1: Initial | Level 1: Initial/Ad Hoc Process | Level 1: Incomplete | Level 0 – Isolated systems | Level 0: Performed | Ad-hoc |
| Level 2: Repeteable | Level 2: Committed Process | Level 2: Isolated | Level 1 – Connected. Peer-to-peer | Level 1: Modelled | Defined |
| Level 3: Defined | Level 3: Established Focused Process | Level 3: Standardized. | Level 2 – Functional. Distributed | Level 2: Integrated | Linked |
| Level 4: Managed | Level 4: Improved/Managed Process | Level 4: Quantitatively Managed | Level 3 – Domain. Integrated. | Level 3: Interoperable | Integrated |
| Level 5: Optimized | Level 5: Optimized | Level 5: Optimized | Level 4 – Enterprise. Universal | Level 4: Optimized | Extended |

**Table 1.2** Comparative analyse of key areas:

| CMMI | Luftman's MM | ICoNOs MM | LISI | EIMM | SCM-MM |
|---|---|---|---|---|---|
| 1. Process Management<br>2. Project Management<br>3. Engineering<br>4. Support | 1. Communications<br>2. Competency/Value<br>3. Governance<br>4. Partnership<br>5. Scope & Architecture<br>6. Skills | 1. Partnering structure<br>2. IS architecture<br>3. Process architecture<br>4. Coordination. | 1. Levels of Information Systems Interoperability (Technology emphasis) | 1. Interoperability in the enterprise domain | 1. Supply chain management (in terms of predictability,<br>capability, control, effectiveness and efficiency) |

No known maturity models applied to coordination mechanisms for SC CP. A maturity model for the Structural Elements of Coordination Mechanisms on the collaborative planning process is proposed in following section. It is based on CMM levels and Structural Elements of CP Coordination Mechanisms defined above.

## 3. Structural Elements of CP Coordination Mechanisms

Alemany et al. (2010) proposes the structural elements that should be specified in order to characterize coordination mechanisms in a CP context. Through this characterization, an analysis of possible alternatives for implementing the interdependence relationships between SC members could be made:

**Number of decision-makers:** the number of SC members that are either under the responsibility of a SC planning domain at a certain planning temporal level or should coordinate and integrate the different plans (a mediator).

**Collaboration level:** it represents the degree of interest in decision makers' performance vs the SC performance as a whole.

**Interdependence relationships nature:** it makes reference to the sharing of power between SC decision makers; it could be or not homogeneous (non-hierarchical -*all the same power*- vs hierarchical).

**Interdependence relationships type:** because SC planning decisions could be made at different temporal levels and at each temporal level different decision-makers could exist, two different types of plans integration should be distinguished: temporal and spatial integration, respectively.

**Number of coordination mechanisms:** number of different protocols under which the decision-makers interact (unique vs. several -*different coordination mechanisms for different scenarios that can be adaptable*-).

**Information exchanged:** for each coordination mechanism the information exchanged can make reference to SC attributes and/or decision-makers' outputs (decisions).

**Information processing:** the exchanged information for each coordination mechanism could be incorporated in different ways by each decision-maker.

**Decision sequence characteristics:** define how the coordination mechanisms will be managed (beginning and sequence of decisions)

**Stopping criteria of the coordination mechanism:** in case negotiation exists, the conditions for ending a coordination mechanism could be defined (number of rounds, limited time and/or the achievement of a determined aspiration level of a private criteria or SC criteria).

## 4. Maturity model for the Structural Elements of Coordination Mechanisms on the collaborative planning process

In the maturity model proposed each of the structural elements will be assessed using the scheme of five levels: Initial, Repeatable, Defined, Managed and Optimized. The maturity model is detailed in the next table.

**Table 1.3** Maturity model for the Structural Elements of Coordination Mechanisms on the collaborative planning process

| Number of decision-makers | | | | |
|---|---|---|---|---|
| Initial | Repeatable | Defined | Managed | Optimized |
| Decision-makers have not | Some SC members have identified some | All SC members have identified some | Some SC members have identified their decision-makers for | All SC members have identified their decision-makers for |

| | | | | |
|---|---|---|---|---|
| been identified | of their decision-makers | of their decision-makers | all their SC tiers and mediators. | all their SC tiers and mediators. |

Collaboration level

| | | | | |
|---|---|---|---|---|
| Initial | Repeatable | Defined | Managed | Optimized |
| Hardly at all collaboration (self-interested partner that makes decisions mainly following its local goals) | Not very close collaboration (few partners put the SC goals before its local goals) | Close collaboration (balance) | Very close collaboration (some altruistic partners that puts the SC goals before its local goals) | Extremely collaboration (partners put the SC goals before its local goals) |

Interdependence relationships nature level

| | | | | |
|---|---|---|---|---|
| Initial | Repeatable | Defined | Managed | Optimized |
| The sharing of power between SC decision makers have not been defined | Some SC members have identified their piece of power (hierarchical or non-hierarchical) | All SC members have identified their piece of power | SC members try to improve the interdependence relationships | The interdependence relationships are clearly known and satisfying for all SC members |

Interdependence relationships type level

| | | | | |
|---|---|---|---|---|
| Initial | Repeatable | Defined | Managed | Optimized |
| Temporal and spatial coordination levels have not been defined | Some SC members have defined temporal and/or spatial coordination levels | Temporal and spatial coordination levels have been defined | SC members try to improve the defined temporal and spatial coordination levels | Temporal and spatial coordination levels have been defined and it is satisfactory for all SC members |

Number of coordination mechanisms

| | | | | |
|---|---|---|---|---|
| Initial | Repeatable | Defined | Managed | Optimized |
| It has not been clearly defined coordination protocol | A coordination protocol is defined | A coordination protocol is defined and other scenarios are identified | The coordination mechanisms works under pre-defined scenarios | The coordination mechanisms works under a not pre-defined scenarios due to the learning ability of the decision-makers |

Information exchanged

| | | | | |
|---|---|---|---|---|
| Initial | Repeatable | Defined | Managed | Optimized |
| Some participants shared information but has not yet been clearly established all the information needs of the collaborative planning process | The exchange information about SC attributes is defined | The exchange information about SC attributes and decision-makers' outputs (decisions, | The exchange information about SC attributes and decision-makers' outputs arrive to the correct decision-makers. | The exchange information about SC attributes and decision-makers' outputs arrive to the correct decision-makers at the right time |

| | | | | |
|---|---|---|---|---|
| | | criteria) are defined | | |
| Information processing | | | | |
| Initial | Repeatable | Defined | Managed | Optimized |
| The processing of the exchange information has not been defined | Some SC members have defined their processing of the exchange information | All SC members have defined their processing of the exchange information | All SC members have defined their processing of the exchange information and use them collecting exchange information and providing decision-makers' outputs | All SC members have defined their processing of the exchange information and use them in a intensive way |
| Decision sequence characteristics | | | | |
| Initial | Repeatable | Defined | Managed | Optimized |
| The beginning and sequence of decision has not been defined | The beginning and sequence of decision has been defined for some of the coordination mechanisms | The beginning and sequence of decision has been defined for all the coordination mechanisms | The beginning and sequence of decision has been defined and are used for all SC members | The beginning and sequence of decision has been defined, are used and satisfy all SC members |
| Stopping criteria of the coordination mechanism | | | | |
| Initial | Repeatable | Defined | Managed | Optimized |
| The stopping criteria has not been defined | The stopping criteria has been defined for some of the coordination mechanisms | The stopping criteria has been defined for all the coordination mechanisms | The stopping criteria has been defined and are used for all SC members | The stopping criteria has been defined, are used and satisfy all SC members |

The process to be followed will be: 1. Each of the structural element or key area is assessed individually by a designed team to determine the level of maturity on each one. 2. The evaluation team converges on a single assessment level for each of the key area. The discussions that ensue are extremely valuable in understanding both the current state of the organizations maturity and how the organization can best proceed to improve the maturity and 3. The evaluation team, after assessing each of the key areas from level one to five, uses the results to converge on an overall assessment level of the maturity for all key areas. They apply the next higher level of maturity as a roadmap to identify what they should do next.

## 5. Conclusions

In this paper, structural elements of coordination mechanisms have been defined as key areas to be assessed by maturity model application. Each maturity level associated to each structural element corresponds to a key practice to be used.

The proposal put forward has been developed and guided by the need to enhance coordination mechanisms on the collaborative planning process.

Maturity models provide a framework to define the basic and essential ingredients for establishing structural elements of coordination mechanisms, an understanding of the key practices that need to be fully embedded and developed within the organisation to achieve collaboration improvement and a mechanism to help identify risks and issues that need to manage.

The maturity model allows identifying the state on a collaborative planning process. It can be used in two aspects: 1) Historical evolution: It can be use to follow the historical evolution of the collaboration planning process and 2) Benchmarking: It can be use to compare mature model among other collaboration planning process (for instance: in other SC or the collaborative planning of other products).

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