



HAL
open science

TOWARDS A CONTINGENCY THEORY OF COLLABORATIVE PLANNING INITIATIVES IN SUPPLY NETWORKS

Pamela Danese

► **To cite this version:**

Pamela Danese. TOWARDS A CONTINGENCY THEORY OF COLLABORATIVE PLANNING INITIATIVES IN SUPPLY NETWORKS. *International Journal of Production Research*, 2010, pp.1. 10.1080/00207540903555510 . hal-00573860

HAL Id: hal-00573860

<https://hal.science/hal-00573860>

Submitted on 5 Mar 2011

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



**TOWARDS A CONTINGENCY THEORY OF COLLABORATIVE
PLANNING INITIATIVES IN SUPPLY NETWORKS**

Journal:	<i>International Journal of Production Research</i>
Manuscript ID:	TPRS-2009-IJPR-0865.R1
Manuscript Type:	Original Manuscript
Date Submitted by the Author:	30-Nov-2009
Complete List of Authors:	Danese, Pamela; University of Padova, Department of Management and Engineering
Keywords:	SUPPLY CHAIN MANAGEMENT, INTEGRATION, NETWORKS, FORECASTING
Keywords (user):	



1
2
3 **TOWARDS A CONTINGENCY THEORY OF COLLABORATIVE PLANNING**
4
5 **INITIATIVES IN SUPPLY NETWORKS**
6
7
8
9

10
11
12 Pamela Danese (Corresponding author)

13
14 Assistant Professor, PhD

15
16 Department of Management and Engineering

17
18 University of Padova

19
20 Stradella S. Nicola, 3

21
22 36100 Vicenza, Italy

23
24
25 Tel +39 0444 998703 – Fax +39 0444 998884

26
27
28 E-mail: pamela.danese@unipd.it
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 **Title of the paper: TOWARDS A CONTINGENCY THEORY OF COLLABORATIVE**
4
5 **PLANNING INITIATIVES IN SUPPLY NETWORKS**
6
7
8

9
10 **Abstract**
11

12 There has been increased interest in supply chain (SC) collaboration in recent years, as a process
13 that promotes inter-company cooperation in different business areas. This paper focuses on
14 collaborative planning initiatives adopted to support demand and supply planning in supply
15 networks. Since companies implement several different forms of collaborative planning initiatives,
16 this paper intends to examine the relevant contingency effects that lead firms to choose a precise
17 collaborative planning initiative. Ten cases were analysed to investigate the research question.
18 Results found indicate that specific contextual conditions – i.e. goals of the collaboration, demand
19 elasticity, product diversity and supply network spatial complexity - can affect the level of the
20 collaboration in collaborative planning initiatives. Three different levels of collaboration are
21 identified (i.e. communication, limited collaboration and full collaboration) - depending on the level
22 of integration (i.e. whether companies simply exchange data/information, or synchronize and jointly
23 decide their plans) and multiplexity (i.e. the number of business areas involved in the
24 collaboration). It emerges that, while the goals of the collaboration influence the level of integration
25 between companies; the elasticity of demand can determine the level of multiplexity. Furthermore,
26 the research found that product diversity (i.e. whether companies sell different products) and a high
27 supply network spatial complexity could limit the level of multiplexity in the collaboration.
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50

51
52
53 **Keywords:** Supply chain management; integration; networks; forecasting
54

55 **Word count: 6485**
56
57
58
59
60

TOWARDS A CONTINGENCY THEORY OF COLLABORATIVE PLANNING INITIATIVES IN SUPPLY NETWORKS

1. INTRODUCTION

Supply chain (SC) collaboration has been described in the literature as a process that promotes: inter-organisational cooperation, joint work, openness, the creation of inter-company decision making routines, information and knowledge sharing, and customer-supplier intimacy (Mentzer et al. 2000, McCarthy and Golicic 2001). Some authors also refer to this concept with the term SC integration, and highlight especially the importance of creating and coordinating processes seamlessly across the supply network (Flynn and Flynn 1999, Handfield and Nichols 1999, Frohlich and Westbrook 2001, Sahin and Robinson 2005). This means that companies should behave as a part of a unified system and coordinate with each other toward common objectives (Mentzer et al. 2000, Romano 2003, Arshinder and Deshmukh 2008).

There are several areas in which SC collaboration can take place, such as new product development, demand management, order fulfillment, quality management, customer service management (Cooper et al. 1997, Slack et al. 2004). Similarly to other studies (Barratt and Oliveria 2001, Larsen et al. 2003), this paper focuses on inter-company collaborative planning initiatives implemented to support demand and supply planning. These initiatives include a variety of integration practices between the supplier (or manufacturer) and the manufacturer (or customer) to jointly manage demand and supply plans, such as sales forecasts, delivery, purchasing or promotion plans. A number of collaborative-based techniques in this field are worthy of mention, such as Vendor Managed Inventory (VMI), Continuous Replenishment (CR), or Collaborative Planning Forecasting and Replenishment (CPFR) (Barratt and Oliveria 2001, Danese 2006, Småros 2007). These techniques lever on information sharing and joint planning to radically reduce inventories within the supply network while improving customer service. In recent years, we have witnessed a growing

1
2
3 excitement and increasing top management attention on these subjects, as a consequence of the
4
5 impressive results achieved by successful programs in supply networks coordinated by large, high-
6
7 performing focal firms, such as Wal-Mart, Procter & Gamble, Henkel and Dell Computer (Seifert
8
9 2003, Sridharan et al. 2005).

10
11
12 Although these cases demonstrate that collaborative planning initiatives in supply networks
13
14 contribute to improved supply network performance, some authors maintain that these practices
15
16 cannot be considered a one-best-way recipe for all companies (Van Donk and van der Vaart 2004,
17
18 Arshinder and Deshmukh 2008, Sari 2008, Welker et al. 2008). Over the years, knowledge about
19
20 these promising practices has matured and learning about them has taken place, and, as a
21
22 consequence, doubts have been raised as to their universal applicability.
23
24

25
26
27 Therefore, it is essential to investigate the conditions under which the different forms of
28
29 collaborative planning initiatives in supply networks can be beneficial. Despite the importance of
30
31 this issue, there is still little empirical research which directly addresses the question: How do
32
33 contextual factors affect collaborative planning initiatives in supply networks? (Ho et al. 2002,
34
35 Mouritsen et al. 2003).

36
37
38 This study intends to fill this gap, by examining the relevant contingency effects that lead firms to
39
40 choose different collaborative planning initiatives.
41
42

43
44 From a theoretical point of view, a contingency theory of collaborative planning initiatives in
45
46 supply networks significantly contributes to the advancement of theory, since it shows that different
47
48 forms of collaborative planning initiatives may be important under different conditions. In fact,
49
50 companies implement different collaborative planning initiatives to integrate demand and supply
51
52 plans, but the reasons why companies choose different types of collaboration practices are still not
53
54 clear. The purpose is to open an interesting debate on this issue, by introducing explanations of how
55
56 specific contextual conditions can influence the applicability of collaborative planning initiatives.
57
58

59
60 From a practitioner's perspective, if companies are to truly engage in a collaborative planning
initiative and understand how to implement it, a contingency theory of collaborative planning

1
2
3 initiatives can be valuable to develop mechanisms for proactive managerial action. In fact it can
4 suggest to managers how to select the most appropriate action to be taken when implementing the
5 collaboration through the analysis of the context where it should be implemented.
6
7

8
9
10 The paper is organized as follows. First, it analyses existing literature on collaborative planning
11 initiatives, and contingency factors that can influence the implementation of different collaborative
12 planning initiatives. The following section introduces the research methodology and case profiles.
13 Then, the paper describes the analyses conducted to answer the research questions and develop the
14 results. Results found are presented in the form of propositions. Research implications are then
15 discussed. The article ends with conclusions and suggestions for future research.
16
17
18
19
20
21
22
23
24
25
26

27 **2. COLLABORATIVE PLANNING INITIATIVES IN SUPPLY NETWORKS**

28
29 Collaborative planning initiatives in supply networks can greatly vary; they can range from the
30 simple passive exchange of data and information among companies, to the joint development of
31 plans and decision-making, based on the analysis of information exchanged (ECR 2001, 2002,
32 Småros 2007). Moreover, collaborative planning initiatives can involve different business areas, as
33 companies can collaborate to jointly establish promotions, or sales forecasts or order forecast plans,
34 or all these processes together (Barratt and Oliveira 2001, Larsen et al. 2003). One of the most
35 advanced collaborative planning initiatives is collaborative planning, forecasting and replenishment
36 (CPFR) (Barratt and Oliveira 2001). CPFR programs concern collaboration where two or more
37 companies jointly plan a number of promotional activities and work out synchronized forecasts, on
38 the basis of which the replenishment processes are determined (Larsen et al. 2003). According to
39 several authors (Aichlmayr 2000, Ireland and Bruce 2000, Barratt and Oliveira 2001, Seifert 2003),
40 CPFR can be considered the natural evolution for companies already implementing other
41 collaborative planning initiatives, such as Vendor Managed Inventory (VMI) or Continuous
42 Replenishment (CR). VMI is a technique developed in the mid 1980s whereby the manufacturer
43 (supplier) has the responsibility for managing customer's inventory, including the replenishment
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3 process. CR practice is similar to VMI, but in this case the manufacturer (supplier) can use POS
4 data to predict customer's future sales and manage the replenishment process. At the heart of the
5
6 CPFR process lies the aspiration to cover the gaps left by these collaborative planning initiatives.
7
8
9 As suggested by the CPFR model developed by the Voluntary Interindustry Commerce Standards
10 committee (VICS), CPFR has a more comprehensive focus that includes promotional, sales and
11
12 order forecast plans (VICS 2002). Moreover, collaboration deals with synchronizing the dialogue
13
14 between the parties, through joint decisions and exception management.
15
16
17

18
19 The belief that collaborative planning initiatives can take a number of different forms across supply
20 networks is widely diffused. Larsen et al. (2003) state that collaborative planning initiatives can be
21
22 implemented in various ways; as they can be differentiated both in terms of *multiplexity* of the
23
24 collaboration - indicating the number of business areas involved (e.g. definition of promotional,
25
26 sales forecast or order forecast plans) - and *level of integration* of business processes (e.g. degree of
27
28 discussion, co-ordination/synchronisation).
29
30
31
32

33
34 A similar perspective emerges from the Efficient Consumer Response (ECR) Guide on CPFR (ECR
35 2001). It suggests that the VICS model has indeed a "modular" structure since, in some
36
37 circumstances, it is not necessary to collaborate on promotional, sales and order forecast plans. For
38
39 example, Levi Strauss & Co. incorporates only certain aspects of the CPFR business process in to
40
41 its retail replenishment service, by creating joint order forecast plans and identifying exceptions (for
42
43 instance, over/under stock situations, execution problems) (Aviv 2001). Similarly, Danese et al.
44
45 (2004) report some interesting examples of pharmaceutical companies where manufacturing units
46
47 and distribution centers jointly manage only order forecast plans and solve the exceptions.
48
49
50
51
52
53
54

55 **3. CONTINGENCY FACTORS IN COLLABORATIVE PLANNING INITIATIVES**

56
57 A theory in supply chain management (SCM) literature that is often used to explain differences in
58
59 collaborative planning initiatives states that they depend on the existence of integration paths, which
60
evolve from basic to more advanced forms of collaboration (Spekman et al. 1998, ECR 2001,

1
2
3 Larsen *et al.* 2003, Seifert 2003). According to this theory, advanced collaboration practices can be
4
5 considered the natural evolution for companies that already implement more basic forms of
6
7 collaboration. Once a firm begins collaborating, it develops experience at cooperation and
8
9 reputation as a partner. Over time, the firm develops capabilities to interact with other firms and
10
11 strengthen trust with its partners, thus having the opportunity to enlarge its collaboration network or
12
13 increase integration with its partners. For instance, Larsen *et al.* (2003) suggest that CPFR can be
14
15 classified into three levels – basic, developed and advanced - depending on the depth of
16
17 collaboration; and argue that the basic CPFR is frequently the starting point for other collaborative
18
19 initiatives. Similarly, the ECR Guide on CPFR suggests the slogan: “think big, start small, and scale
20
21 intelligently” (ECR 2001, p.67). Thus, it is necessary to “start small”, focusing on only a few
22
23 processes in the early stage of the project’s development.
24
25
26
27
28

29 A fundamental criticism of this theory lies in the fact that it seems to suggest that collaborative
30
31 planning initiatives are context-free, only dependant on the experience and knowledge acquired
32
33 over time by companies. Instead, it is plausible to suppose that they can be seriously influenced by
34
35 several contextual factors that can drive companies’ choices of what type of collaborative planning
36
37 initiative should be implemented, given certain business conditions. Several firms for instance can
38
39 deliberately limit collaboration to basic practices (e.g. passive exchange of data and information),
40
41 even if the collaboration has reached an advanced stage of maturity.
42
43
44

45 In line with these considerations, in SCM literature, several authors maintain that some contextual
46
47 conditions can influence SC collaborations and the implementation of collaborative planning
48
49 initiatives.
50
51

52 In particular, the level of uncertainty in the context is usually considered a fundamental driver of SC
53
54 collaborations and collaborative planning initiatives (Davis 1993, Fisher 1997, Lee 2002, Sari 2008,
55
56 Welker *et al.* 2008, Wong and Boon-itt 2008). This is because a better collaboration reduces
57
58 uncertainty, and this in turn leads to greater operational performances. Environmental uncertainty
59
60 has often been linked to demand unpredictability (Davis 1993, Chen *et al.* 2000, Germain *et al.*

1
2
3 2008), i.e. the degree to which a firm can anticipate and forecast market trends. High levels of
4 demand unpredictability often arise from innovative products, and thus Fisher (1997) distinguishes
5 between innovative and functional products. Similarly Lee (2002) analyses demand fluctuations;
6
7
8 while Sari (2008) considers variability of customer demand. Another important source of
9 uncertainty considered is supply chain process variability which is linked to inconsistencies in the
10 flow of goods (Germain et al. 2008). Finally, Welker et al. (2008) distinguish between simple and
11 complex contexts (measured in terms of delivery times, order winners, variety of demand, type of
12 supply chain relationships, and product/process characteristics) and investigate the influence on the
13 level of information sharing (see also Van Donk and Van der Vaart 2004, 2005).

14
15
16
17
18
19
20
21
22
23
24
25 Taking for granted that the level of environmental uncertainty is positively related to the level of
26 collaboration between companies, research on how some contextual factors, sources of uncertainty,
27 can impact on specific aspects of collaborative planning initiatives is still scarce. As before
28 discussed, collaborative planning initiatives can depend from different choices: for instance, from
29 the decision to collaborate on many or few business processes, or from the degree of involvement of
30 actors in the collaboration (e.g. frequency of data exchange, joint decisions, etc.). Though previous
31 studies clarify that some contextual variables (e.g. uncertainty) impact on the level of collaboration
32 (i.e. low or high), they lack a precise explanation of how contextual factors can influence the
33 different aspects that characterise collaborative planning initiatives (e.g. number and type of
34 business areas involved, level of coordination and synchronisation, etc.).
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49

50 **4. RESEARCH METHODOLOGY AND CASE PROFILES**

51
52
53 The aim of this research is to uncover contingency effects in collaborative planning initiatives, by
54 investigating: what contextual variables are critical in influencing these initiatives and their effect.
55
56
57 A multiple-case study method was adopted to investigate the research question, as it is particularly
58 helpful for identifying and describing critical variables, and for discovering linkages between them
59
60 (Stuart et al. 2002). In particular, the implementation of different collaborative planning initiatives

1
2
3 in ten supply networks was examined. The inter-organisational level of analysis here is what Ritter
4 and Gemünden (2003) call the *portfolio level*, i.e. the unit of analysis is the network involved in the
5 collaboration. Taking a single firm as a starting point (namely the focal firm), it includes a special
6 subset of the focal firm's supply network, composed of all the actors that collaborate with the focal
7 firm according to a well-defined collaborative planning initiative (e.g. VMI or CPFR).

8
9
10
11
12
13
14
15 Table 1 provides, for each case selected, information on: members involved in the collaboration,
16 central company's and headquarters' location and products.

17
18
19
20 *****

21
22 *Insert Table 1 about here*

23
24
25 *****

26 27 28 29 **4.1 Case selection**

30
31 The literal and theoretical replication issues guided the selection of the cases (Yin 1984).
32
33 Companies representative of different types of collaborative planning initiatives were selected.
34
35 Table 2 summarises for each case the main characteristics of the collaborative planning initiative
36 implemented, and classifies the collaborative planning initiatives into three levels of collaboration:
37
38 *communication, limited collaboration* and *full collaboration*, depending on: a) multiplexity and b)
39 level of integration (table 3). In this research, multiplexity refers to the number and type of business
40 areas involved in the collaboration (e.g. management of sales forecasts; management of order
41 forecasts; management of promotions) (Larsen et al. 2003). The level of integration depends
42 whether the collaborative planning initiative is based on mere data exchange (i.e. communication)
43 or, in addition to data exchange, on joint decisions and agreements on plans (i.e. collaboration).
44
45
46
47
48
49
50
51
52
53
54

55 *****

56
57 *Insert Table 2 about here*

58
59
60 *****

1
2
3 *****
4
5

6 *Insert Table 3 about here*
7

8 *****
9
10

11
12 It is worth noting that three of the central companies contacted collaborated differently in the
13 upstream and downstream networks, and this provided the opportunity to examine different
14 collaborative planning initiatives. For instance, central company 3 (table 2) collaborated with the
15 distribution centers (DCs) on a limited collaboration level, while its collaboration with the other
16 production/packaging plants consisted in just the exchange of data/information on stock levels and
17 available capacity (i.e. communication level).
18
19
20
21
22
23
24
25
26
27
28

29 **4.2 Data collection, reduction and analyses**

30

31 All data were gathered through company visits made from 2006 through 2009. Triangulation was
32 used to ensure research reliability by obtaining the same piece of information from different
33 sources: semi-structured interviews, documentation, archival records and direct observations. Data
34 collection focused on variables underlying this research (i.e. context and collaboration planning
35 initiatives), complemented with other issues enabling the understanding of the observed pattern of
36 use of collaborative planning initiatives, such as the history of use of the practices, and the
37 difficulties experienced by the companies in using them.
38
39
40
41
42
43
44
45
46
47

48 Data reduction allowed the information to be summarised and characterised from the masses of
49 material that case studies generated (McCutcheon and Meredith 1993). It consisted of the
50 characterisation of each case across the research variables (context and collaborative planning
51 initiatives). A set of items was used to characterise each variable, and each item was classified
52 according to a well-defined rule specified in Table 4. Central in defining these rules was the
53 comparison of data across the cases and literature.
54
55
56
57
58
59
60

Insert Table 4 about here

1
2
3
4
5
6
7
8
9
10
11
12
13 For characterising the variable “context”, four items were considered. As argued above, several
14 authors consider uncertainty as a crucial contextual factor that can influence collaborative planning
15 initiatives (Davis 1993, Fisher 1997, Lee 2002, Sari 2008, Welker et al. 2008, Wong and Boon-itt
16 2008). Studies mainly refer to demand uncertainty, measured as demand fluctuations and
17 unpredictability (Fisher 1997, Lee 2002, Germain et al. 2008, Sari 2008). In this research, elasticity
18 of demand was considered. In fact, demand uncertainty is usually magnified in those sectors where
19 promotions periodically generate a peak in demand sales, since demand elasticity is high. The
20 elasticity of demand was classified into high and low categories. By comparing cases, a clear
21 distinction was found between some contexts where the average increase of customers’ sales
22 volume during promotions was less than 40% (assigned to a low-class of demand elasticity) and
23 contexts where it was higher than 200% (assigned to a high-class of demand elasticity).
24
25
26
27
28
29
30
31
32
33
34
35
36
37

38 In addition, the goals of companies involved in the collaboration project were taken into account. In
39 fact, supply chain process variability, which influences the level of environmental uncertainty (see
40 Germain et al. 2008), can also depend on companies’ order winners and goals. Welker et al. (2008),
41 for instance, distinguish contexts by considering not only the variety of demand and product/process
42 characteristics, but also companies’ order winners, and investigate their influence on the level of
43 information sharing (see also Van Donk and Van der Vaart 2004, 2005). In accordance with
44 literature, the goals of the collaboration were distinguished into “efficiency” and “responsiveness”
45 (Forrester 1961, Disney and Towill 2002, Småros 2007).
46
47
48
49
50
51
52
53
54
55
56

57 Finally, two further contextual factors were analysed that can influence collaborative planning
58 initiatives: the position of companies within a supply chain and supply network spatial complexity.
59
60

In fact, these circumstances can determine the competences possessed by companies on final market

1
2
3 dynamics and thus their contribution in defining supply and demand plans. The product-diversity
4 item takes into consideration the position of companies within a supply chain, i.e. whether
5 collaborating companies sold the same or a different product. Moreover, a clear distinction was
6 found between local and international networks: the first ones characterised by an average physical
7 distance of a few dozens or hundreds of kilometers between firm(s) in the upstream network and the
8 markets served by the firm(s) in the downstream network; the latter by an average physical distance
9 of thousands of kilometers.

10
11
12
13
14
15
16
17
18
19
20 Finally, the collaborative planning initiatives were distinguished in terms of levels of collaboration,
21 classified as communication, limited collaboration and full collaboration (see table 3). Each level
22 differs for level of integration and multiplexity.

23
24
25
26
27 Data reduction was used for both the within-case and cross-case analysis. Within-case analysis gave
28 the researcher the possibility to become intimately familiar with each case as a stand-alone entity
29 (Voss et al. 2002). This facilitated the comparison of the ten cases. Cross-case analysis was
30 conducted by structuring the data through two-variable matrices (see next section). An effective
31 approach was to pick a group of cases and to search for similarities and differences with other
32 groups (Voss et al. 2002).

33 34 35 36 37 38 39 40 41 42 43 44 **5. ANALYSIS AND RESULTS**

45
46 This section compares the ten cases in order to identify some possible links between the context and
47 collaborative planning initiatives implemented.

48
49
50 As suggested by Yin (1984), given the high number of cases examined, analyses of cases and
51 results found are here presented in terms of cross-case analysis, and thus information from
52 individual cases is dispersed throughout this section. In particular, the discussion is based on the
53 comparison of the ten cases, through two-variable matrices. Results are then summarized in the
54 form of propositions.

1
2
3 In the two-variable matrix of table 5, cases are classified according to the variables “level of the
4 collaboration” and “goals of the collaboration” (efficiency vs. responsiveness). Evidence from cases
5 and interviews suggested that interesting relationships could be found. In particular, as emerges
6 from the visual pattern of table 5, it seems that when an efficiency strategy prevails, a collaboration
7 based on the mere communication of data suffices to guarantee achievement of the goals. In
8 contrast, when the priority of a company is to make its supply network more responsive, a deeper
9 collaboration is then necessary. In particular, the collaborative planning initiative should be based
10 on discussions, joint decisions, agreements on plans, and thus on a higher level of integration.
11
12
13
14
15
16
17
18
19
20
21
22
23
24

25 *****

26
27 *Insert Table 5 about here*
28

29 *****

30
31 The richness of data collected helped to better understand the rationale behind this link. Cases A
32 and B are useful to explain the meaning of the relationship found between level of integration and
33 goals of the collaboration (table 6).
34
35
36
37
38
39
40
41

42 *****

43 *Insert Table 6 about here*
44

45 *****

46
47
48
49 The following proposition summarizes what emerged from cross-case analysis, and from
50 information collected during the interviews.
51
52

53 *Proposition 1: The level of integration depends on the goals of the collaboration. In particular:*

- 54 • *Proposition 1a: When the goal of the collaboration is efficiency, companies tend to limit*
55 *the collaborative planning initiative to data exchange (i.e. communication level,*
56 *characterised by low integration);*
57
58
59
60

- 1
2
3
4
5
6
7
8
9
- *Proposition 1b: When the goal of the collaboration is responsiveness, companies tend to collaborate on a full or limited collaboration level (i.e. high integration).*

10
11
12
13
14
15
16
17
18
19
20
21
22
23
24

However, given the goals of the collaboration, it seems that other factors play a crucial role in choosing the business processes that are to be involved in the collaborative planning initiative, and thus the level of multiplexity of the collaboration. In fact, the matrix of Table 5 does not help us to understand why companies, whose goal is responsiveness, choose to collaborate on a full-level rather than limited-level of collaboration. Differences in elasticity of demand, product diversity, and supply network spatial complexity help us to better understand this (Table 7).

25
26
27
28
29
30

Insert Table 7 about here

31
32
33
34
35
36
37
38
39
40
41
42
43
44

High demand elasticity is an important distinguishing feature of cases H and I, indicated in Table 7 with the acronym HDE. In cases H and I, product shelf prices can significantly influence customer behavior, hence demand elasticity in the event of price variations is very high. In company 6's stores (case I), sales volume could increase by up to 300 percent during a promotion; in the stores of company 5's customers (case H) it varied between 200 and 300 percent. As stated by the supply chain manager of central company 6:

45
46
47
48
49
50
51
52
53

'demand uncertainty in the food industry is low. Nevertheless, as a result of events such as promotions, there is a high level of demand fluctuations and this can lead to significant waste and losses within the supply network. Through collaboration on sales and promotional plans supply chain efficiency and responsiveness can significantly improve'.

54
55
56
57
58
59
60

Company 5's and 6's managers consider interpreting demand changes and satisfying final market needs as crucial factors to achieve competitive advantage, and, as a consequence, responsiveness to demand changes is a priority. Promotional events are one of the major problems for these companies as they generate massive swings in demand. For this reason, in recent years, they have

1
2
3 decided to launch a collaborative planning initiative with the aim of improving service level during
4 promotions. In both cases, the collaborative planning initiative follows the procedure suggested by
5 the CPFR technique (see table 2), and thus partners in the collaboration network jointly define
6 promotional, sales and order forecast plans. Managers agree that this type of collaboration
7 significantly contributes to improving forecast accuracy during promotions as lots of information
8 from different sources is considered and discussed when elaborating sales and order forecast plans.
9 Moreover, thanks to a prompt communication and analysis of POS data, producers can better react
10 in the event of demand changes.
11
12
13
14
15
16
17
18
19
20

21 Thus, the following proposition is suggested:

- 22 • *Proposition 2: The level of multiplexity in collaborative planning initiatives depends on*
23 *demand elasticity. In particular, when demand elasticity is high companies tend to*
24 *collaborate on a full collaboration level.*
25
26
27
28
29
30
31
32
33

34 However, from the comparison of cases, it emerges also that full collaboration is efficacious only
35 when partners have an in-depth knowledge of the final market, and thus can contribute with their
36 competence to improving promotion management and sales forecast plans.
37
38
39

40 Table 7 shows, for instance, that cases H and I are similar to cases L and F in terms of demand
41 elasticity (i.e. HDE), but differ in product diversity and spatial complexity. In fact, in cases H and I,
42 partners sell the same product (i.e. SP) and are located in the same country (i.e. low spatial
43 complexity – LSC). These contextual factors favor the development of a certain knowledge of the
44 final market, even if a partner in the collaboration does not sell its products directly to final
45 consumers. Central company 5 (case H), located in Brussels, for instance, sells and markets
46 consumer and soft goods to retailers located in Belgium who then distribute the products in the
47 Belgian region. Thus the spatial complexity is indeed low. The same considerations can be drawn
48 for the collaborative planning initiative between company 6 and its suppliers. Company 6 is a food
49 retailer that collaborates with its suppliers following the CPFR technique. Managers within
50
51
52
53
54
55
56
57
58
59
60

1
2
3 company 6 - located in Belgium - interact with local suppliers to define promotions and the sales
4
5 forecast plans of company 6's supermarkets located in Belgium, on the basis of which order
6
7 forecast plans are established. It seems that the contribution of partners positioned upstream in the
8
9 network when defining promotional and sales forecast plans is significant only when they have a
10
11 thorough knowledge of market dynamics.
12
13

14
15 A comparison with cases L and F can help to better understand the influence of product diversity
16
17 and spatial complexity on collaborative planning initiatives. Unlike cases H and I, case L companies
18
19 involved in the collaboration sell and market different products. This seems to limit the opportunity
20
21 for joint promotional and sales forecast plans to be established. Central company 7 produces and
22
23 sells corrugated cardboards while its customers produced and sold food. In such situation, it is
24
25 unfeasible for members positioned upstream in the network to participate in the definition of the
26
27 promotional and sales forecast plans of its customers. Similarly, central company 4 (case F) does
28
29 not collaborate with its DCs/distributors in jointly defining promotional plans and sales forecasts. In
30
31 fact, in the managers' opinion, this would not offer particular benefits. The distributors, located
32
33 worldwide, in fact have the possibility to collect information and data on the market they serve and
34
35 to elaborate accurate sales forecasts without collaborating with the central company, located far
36
37 from the DCs it replenishes.
38
39
40
41
42

43 Finally, the following proposition summarizes the impact of product diversity and spatial
44
45 complexity on the level of multiplexity in a collaboration.
46
47

- 48 • *Proposition 3: Product diversity and a high supply network spatial complexity limit the*
49
50 *level of multiplexity in collaborative planning initiatives.*
51
52

53 54 55 **5.1. The proposed contingency model**

56
57 Propositions 1, 2, and 3 explain how the context can influence the different collaborative planning
58
59 initiatives that should be implemented. By simultaneously considering the impact of all the
60

1
2
3 contextual variables analysed, some contexts can be identified and an ideal configuration of
4 collaborative planning initiatives for each of these can be defined (table 8).
5
6
7
8
9

10 *****

11
12 *Insert Table 8 about here*

13 *****

14
15
16
17
18
19
20 It emerges that companies collaborate on a full-collaboration approach (i.e. characterised by an high
21 level of multiplexity and integration) when the main goal is to increase companies' responsiveness to
22 demand changes, companies sell and market the same products, demand elasticity in the event of
23 price variation is high, and spatial complexity among partners is low. These are all necessary
24 conditions for collaborating on a full collaboration level. Instead, when the main goal is to increase
25 companies' responsiveness, but one of the other conditions is not satisfied (e.g. companies sell
26 different products, demand elasticity is low, or spatial complexity is high), companies should limit
27 their collaboration to a limited-collaboration approach (i.e. low level of multiplexity and high level
28 of integration). Finally, when companies aim to reduce their costs (e.g. inventory costs), in any case,
29 collaboration should be limited to data communication – e.g. companies exchange data on order
30 forecast plans, stock levels, sales plans, etc.
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

48 **6. DISCUSSION**

49 **6.1 The value of contingency theory for interpreting collaborative planning initiatives**

50
51
52 The contingency model developed in this research suggests that in some circumstances it is not
53 necessary to increase the level of the collaboration by adopting a full-collaboration approach.
54
55

56
57 In this way, the present study complements the theory on integration paths, according to which
58 companies should evolve from basic to more advanced forms of collaboration (Spekman et al. 1998,
59 Barratt and Oliveira 2001, ECR 2001, Larsen et al. 2003, Seifert 2003). Over time, firms should
60

1
2
3 develop capabilities for interacting with other firms and strengthen trust with their partners, thus
4
5 having the opportunity to increase collaboration with their partners. It is understandable that
6
7 companies can arrive at the use of certain practices via a process of cumulative competence building
8
9 and experimentation. However, this research demonstrates that, when implementing collaborative
10
11 planning initiatives, the main objective of companies is not in any case to maximize the level of
12
13 collaboration, as the type of products involved in the collaboration, and the characteristics of
14
15 demand or the spatial complexity of the collaboration network can determine the more appropriate
16
17 and convenient level of collaboration to be adopted.
18
19
20

21
22 In line with Das et al.'s study (2006) on the relationship between integration and performances, this
23
24 research supports that collaborating with other partners can cause increased costs of coordination
25
26 and inflexibility. It is convenient to increase the level of collaboration only when these costs are
27
28 offset by more gains. For example, the results found demonstrate that when a producer is far from
29
30 the markets it serves (i.e. high spatial complexity), it does not have an in-depth knowledge of the
31
32 final market dynamics, and thus the benefit of collaborating with DCs in defining promotions and
33
34 sale forecast plans is very low, compared to the increase in the coordination costs. Thus, coherently
35
36 with Das et al.'s study (2006), it can be argued that an excess of investment in collaborative
37
38 planning initiatives can be harmful, and that an ideal profile of collaboration can be identified. This
39
40 research suggests the ideal configuration of collaborative planning initiative to be adopted under
41
42 different contexts (see table 8).
43
44
45
46
47
48
49

50 **6.2 The level of uncertainty as driver of collaborative planning initiatives: the role of goals** 51 52 **and demand elasticity**

53
54 With regard to the influence of environmental uncertainty on collaborative planning initiatives,
55
56 research findings confirm that the goals of the collaboration and demand elasticity are important
57
58 sources of uncertainty that drive companies towards more intense forms of collaboration (Chen et al.
59
60 2000, Lee 2002, Germain et al. 2008, Welker et al. 2008). However, this research also found that it is

1
2
3 important to distinguish between these two different sources of uncertainty and how each of them
4
5 impacts on the different aspects of collaborative planning initiatives. In fact, in this study, an
6
7 important variable characterising collaborative planning initiatives is the level of collaboration which
8
9 depends on: the level of multiplexity (i.e. number and type of business areas involved in the
10
11 collaboration) and level of integration (i.e. communication vs. collaboration through joint decisions
12
13 and synchronisation of plans).
14
15

16
17 From the analysed cases, it emerges that, while the goals of the collaboration influence the level of
18
19 integration between companies (see proposition 1); the elasticity of demand can determine the level
20
21 of multiplexity (see proposition 2).
22
23

24
25 When the goal of the collaboration is to improve efficiency, the collaborative planning initiative can
26
27 be based just on the exchange of data and information (i.e. low level of integration), as this allows the
28
29 bullwhip effect to be limited, thus reducing costs, as pointed out by several authors (Cachon and
30
31 Fisher 2000, Yu et al. 2001, Dejonckheere et al. 2004, Wu and Cheng 2008). However, when
32
33 companies want to increase their responsiveness to demand changes then a collaborative planning
34
35 initiative based on the synchronisation of plans and exceptions management is necessary. The result
36
37 is an increased level of integration between companies. This is consistent with the study of Småros
38
39 (2007) which concluded that the desire to improve responsiveness is one of the major triggers of
40
41 CPFR collaborations.
42
43
44

45
46 Instead, the level of multiplexity is mainly determined by the elasticity of demand. A high demand
47
48 elasticity causes fluctuations in demand in the event of promotions. As a consequence, companies
49
50 involved in the collaboration, as well as jointly defining the order forecast plans, often collaborate
51
52 to jointly decide promotions in the stores and sales forecast plans, through an intense exchange of
53
54 data and opinions on future demand. As a consequence, the level of multiplexity increases. This
55
56 result is in line with several cases described in the SCM literature. For instance, Spartan Stores, a
57
58 grocery chain, shut down its VMI project after 1 year due to vendors' inability to deal with product
59
60 promotions (Simchi-Levi et al. 2000). In addition, Ralph Drayer, manager at Procter & Gamble,

1
2
3 after the implementation of CR, argued that although CR had provided a better approach to
4 replenishment, there was still a lot of work to do in relation to promotions (Barratt and Oliveira
5
6
7
8 2001).
9

10 11 12 **6.3 Product diversity and supply network spatial complexity as barriers to multiplexity in** 13 **collaborative planning initiatives** 14

15
16
17 Another result of this research concerns the role of product diversity and supply network spatial
18 complexity in influencing collaborative planning initiatives. By analysing the effect of these
19 variables, this study suggests that some factors can act as barriers to the collaboration and moderate
20 the relationship between uncertainty and collaborative planning initiatives. In fact, in some cases
21 (e.g. L and F), even if the goal of the collaboration was responsiveness to demand changes and
22 demand elasticity was high, companies decided to limit multiplexity in the collaborative planning
23 initiative, by jointly defining only order forecast plans. This means that, in some contexts, even if
24 the environmental uncertainty is high, given certain contextual conditions, collaborative planning
25 initiatives remain limited to less advanced forms.
26
27
28
29
30
31
32
33
34
35
36
37

38
39 In particular, proposition 3 suggests that product diversity and supply network spatial complexity
40 can act as barriers, and thus limit the level of multiplexity in collaborative planning initiatives. In
41 fact, upstream members can participate in the process of promotion and sales forecast definition,
42 only if they have an in-depth knowledge of final market dynamics. Cases analysed demonstrate that
43 this depends on the *position* of a company within the supply chain (e.g. a raw material supplier has
44 usually no competence on final market dynamics), and from the *physical distance* between the
45 company and market where products are sold. These results are in contrast with some SCM studies
46 according to which advanced collaboration techniques (such as CPFR), once implemented in the
47 downstream network, can be easily extended also upstream, independently of actors' position in the
48 supply chain, or the geographical distance between companies and final market served (ECR 2001,
49
50
51
52
53
54
55
56
57
58
59
60
VICS 2002). Instead, results found suggest that a company should collaborate in a different way

1
2
3 upstream with suppliers or downstream with distribution centers/retailers, and thus, collaborative
4
5 planning initiatives should not only vary across sectors/contexts because the environmental
6
7 uncertainty differs, but also along a supply chain. Or if two companies operate in the same sector or
8
9 in a similar context but the configuration of their collaboration network is international vs. local, the
10
11 collaborative planning initiatives adopted will differ.
12
13
14

15 16 17 **7. CONCLUSIONS AND FUTURE RESEARCH** 18

19
20 Literature provides only a partial understanding of the reasons that lead a company to implement a
21
22 well defined collaborative planning initiative. This article intends to advance research on this issue
23
24 by proposing a contingency theory of collaborative planning initiatives. Using data from ten case
25
26 studies, this research provides a set of propositions that analyse in detail the impact of context on
27
28 collaborative planning initiatives. Three levels of collaboration are identified (i.e. communication,
29
30 limited collaboration and full collaboration) - depending on the level of integration (i.e. whether
31
32 companies simply exchange data/information, or synchronise and jointly decide their plans) and
33
34 multiplexity (i.e. the number of business areas involved in the collaboration). They are found to be
35
36 associated with the goals of the collaboration (efficiency vs. responsiveness strategy) and demand
37
38 elasticity. Companies analysed attempted to implement a full collaboration approach, based on the
39
40 joint management of promotions, sales and order forecast plans, when they intended to improve
41
42 their responsiveness in the event of demand changes and they faced a high level of demand
43
44 elasticity. Furthermore, the research found that product diversity (i.e. whether companies sell
45
46 different products) and a high supply network spatial complexity could limit the level of
47
48 multiplexity in the collaboration. In fact, in these contexts, the collaboration is usually limited to the
49
50 order forecast definition process, since collaborating on promotions or sales forecast plans does not
51
52 lead to particular benefits, since upstream members do not have competence on final markets
53
54 dynamics. Finally, it was found that when companies' main goal is efficiency, collaborative
55
56 planning initiatives should be limited to a communication level (i.e. companies exchange data and
57
58
59
60

1
2
3 information but do not synchronise/discuss their plans). In fact, the cases analysed demonstrated
4
5 that a collaborative planning initiative based on exceptions management, synchronisation and
6
7 discussion of plans is especially useful only when companies aim to improve their responsiveness.
8
9

10 The links found between the contextual variables analysed and collaborative planning initiatives can
11
12 provide managers with important levers for action. In fact, they help to determine which is the most
13
14 appropriate form of collaborative planning initiative to be implemented. As previously discussed,
15
16 one widespread SCM theory states that companies follow integration paths that evolve towards
17
18 advanced collaborative planning initiatives. The risk of this theory is that it can lead us to consider
19
20 advanced forms of collaboration, such as the CPFR, as the natural evolution for companies already
21
22 implementing other collaborative planning initiatives. Instead, the links found between the above
23
24 mentioned contextual variables and collaborative planning initiatives demonstrate that, under
25
26 certain conditions, a company could decide to limit the collaboration to basic practices.
27
28
29

30 An additional important implication for managers, deriving from the adoption of the contingency
31
32 perspective, is that it provides practitioners with a framework to understand the changes necessary
33
34 in collaborative planning initiatives, as they anticipate changes in the environment and company
35
36 strategy. By foreseeing the implications of these changes, the company will be in a position to make
37
38 a series of planned changes in the collaborative planning initiative rather than being forced into
39
40 reactionary, rushed changes when it finds that the old collaborative planning initiative does not fit
41
42 with the new contingency factors.
43
44
45
46

47 Research findings provide insights that could be of interest to managers working in firms operating
48
49 in different sectors and positioned in different supply network echelons (e.g. suppliers,
50
51 manufacturers, distributors). However, the opportunity to use the contingency model proposed in
52
53 this research as a managerial tool calls for the testing of results within larger samples of supply
54
55 networks, whose central companies are representative of a broader range of industries and
56
57 countries. In fact, although the replication logic adopted in this research permits analytical
58
59 generalization, it is worth noting that the analysed case studies are limited to a relatively small
60

1
2
3 sample and only a few industries. Future research is needed to confirm or refine the domain of
4
5 applicability of the research findings by ascertaining whether they replicate in other industries.
6
7
8 Finally, it is worth noting that contingency-theory based studies have several limitations. In fact, the
9
10 contingency perspective assumes that practices are adopted due to efficiency factors; but companies
11
12 often deviate from contingency-determined patterns due to non-efficiency pressures that could also
13
14 lead to the low use of efficient practices. For example, powerful external organizations
15
16 (associations, governmental regulations, etc.) may exert political pressures discouraging or
17
18 encouraging the use of certain practices. Hence, as suggested by Sousa and Voss (2008),
19
20 institutional theory emerges as a promising theoretical perspective to explain deviations from
21
22 contingency-determined patterns. Linked to this, a further shortcoming of contingency theory is that
23
24 it does not contemplate the development of capabilities as an important source of performance. The
25
26 capabilities paradigm is rooted in the resource-based view of the firm (Barney, 1991), and provides
27
28 a relevant explanation for why some firms may deliberately choose not to adopt efficient practices
29
30 and rather opt to invest in the generation of slack resources that are difficult to imitate, and thus
31
32 represent a source of competitive advantage. Future research should examine the relative
33
34 explanatory power and interplay of contingency, institutional, resource-based or other theoretical
35
36 arguments in best SC collaboration practice adoption and use.
37
38
39
40
41
42
43
44

45 46 **ACKNOWLEDGMENTS**

47
48 Research funded by University of Padova - Project CPDA083831
49
50
51
52
53
54
55
56
57
58
59
60

REFERENCES

- 1
2
3
4
5
6 Aichlmayr, M., 2000. DC Mart: Who manages inventory in a value chain? *Transportation &*
7
8 *Distribution*, 41 (10), 60-65.
9
- 10 Arshinder, A.K. and Deshmukh, S.G., 2008. Supply Chain Coordination: Perspectives, Empirical
11
12 Studies and Research Directions. *International Journal of Production Economics*, 115(2), 316-
13
14 335.
15
- 16
17 Aviv, Y., 2001. The effect of Collaborative Forecasting on Supply Chain Performance.
18
19 *Management Science*, 47 (10), 1326-1343.
20
21
- 22 Barney, J., 1991. Firm resources and sustained competitive advantage. *Journal of Management*,
23
24 17(1), 99-120.
25
26
- 27 Barratt, M.A and Oliveira, A., 2001. Exploring the experiences of collaborative planning initiatives.
28
29 *International Journal of Physical Distribution & Logistics Management*, 31 (4), 266-289.
30
31
- 32 Cachon, G.P. and Fisher, M., 2000. Supply chain inventory management and the value of shared
33
34 information. *Management Science*, 46 (8), 1032-1048.
35
36
- 37 Chen, F., Drezner, Z., Ryan, J.K. and Simchi-Levi, D., 2000. Quantifying the bullwhip effect in a
38
39 simple supply chain: the impact of forecasting, lead times and information. *Management*
40
41 *Science*, 46 (3), 436-443.
42
43
- 44 Cooper, M.C., Lambert and D.M, Pagh, J.D., 1997. Supply Chain Management: More Than a New
45
46 Name for Logistics. *The International Journal of Logistics Management*, 81, 1-13.
47
48
- 49 Danese, P., 2006. Collaboration forms, information and communication technologies, and
50
51 coordination mechanisms in CPFR. *International Journal of Production Research*, 44(16), 3207-
52
53 3226.
54
- 55 Danese, P., Romano, P. and Vinelli, A., 2004. Managing business processes across supply
56
57 networks: The role of coordination mechanisms. *Journal of Purchasing and Supply*
58
59 *Management*, 10 (5), 165-177.
60

- 1
2
3 Das, A., Narasimhan, R. and Talluri, S., 2006. Supplier integration – Finding an optimal
4 configuration. *Journal of Operations Management*, 24, 563-582.
5
6
7
8 Davis, T., 1993. Effective Supply Chain Management. *Sloan Management Review*, 34 (4), 35-46.
9
10 Dejonckheere, J., Disney, S.M., Lambrecht, M.R. and Towill, D.R., 2004. The impact of
11 information enrichment on the bullwhip effect in supply chains: A control engineering
12 perspective. *European Journal of Operational Research*, 153 (3), 727-750.
13
14
15
16
17 Disney, S.M and Towill, D.R., 2002. A Discrete transfer function model to determine the dynamic
18 stability of a vendor managed inventory supply chain. *International Journal of Production*
19 *Research*, 40(1), 179-204.
20
21
22
23
24 Efficient Consumer Response (ECR), 2001. A Guide to CPFR implementation. ECR Europe
25 facilitated by Accenture.
26
27
28
29 Efficient Consumer Response (ECR), 2002. European CPFR Insights. ECR Europe facilitated by
30 Accenture.
31
32
33
34 Fisher, M.L., 1997. What is the Right Supply Chain for Your Product? *Harvard Business Review*,
35 75 (2), March-April, 105-116.
36
37
38
39 Flynn, B.B. and Flynn, J., 1999. Information-processing alternatives for coping with manufacturing
40 environment complexity. *Decision Sciences*, 17 (3), 249-269.
41
42
43
44 Forrester, J.W, 1961. *Industrial Dynamics*. MIT Press, Cambridge, MA.
45
46 Frohlich, M. and Westbrook, R., 2001. Arcs of integration: an international study of supply chain
47 strategies. *Journal of Operations Management*, 19, 185-200.
48
49
50
51 Germain, R., Claycomb, C. and Dröge, C., 2008. Supply chain variability, organizational structure,
52 and performance: The moderating effect of demand unpredictability. *Journal of Operations*
53 *Management*, 26, 557-570.
54
55
56
57
58 Handfield, R.B. and Nichols, E.L., 1999. *Introduction to Supply Chain Management*. Prentice-Hall,
59 Upper Saddle River, NJ.
60

- 1
2
3 Ho, D.C.K., Au, K.F. and Newton, E., 2002. Empirical research on supply chain management: a
4 critical review and recommendations. *International Journal of Production Research*, 40 (17),
5 4415-4430.
6
7
8
9
10 Ireland, R. and Bruce, R., 2000. Only the beginning of collaboration. *Supply Chain Management*
11 *Review*, September/October, 80-88.
12
13
14
15 Larsen, T.S., Thernøe, C. and Andresen, C., 2003. Supply Chain Collaboration: Theoretical
16 perspective and empirical evidence. *International Journal of Physical Distribution & Logistics*
17 *Management*, 33 (6), 531-549.
18
19
20
21
22 Lee, H., 2002. Aligning supply chain strategies with product uncertainties. *California Management*
23 *Review*, 44(3), 105- 119.
24
25
26
27 McCarthy, T.M. and Golicic, S.L., 2001. Implementing collaborative forecasting to improve supply
28 chain performance. *International Journal of Physical Distribution & Logistics Management*,
29 32(6), 431-454.
30
31
32
33
34 McCutcheon, D.M and Meredith, J.R., 1993. Conducting case study research in operations
35 management. *Journal of Operations Management*, 11, 239-256.
36
37
38
39 Mentzer, J.T., Foggin, J.H. and Golicic, S.L., 2000. Collaboration – The Enablers, Impediments,
40 and Benefits. *Supply Chain Management Review*, September/October, 52-58.
41
42
43
44 Mouritsen, J., Skjott-Larsen, T. and Kotzab, H., 2003. Exploring the contours of supply chain
45 management. *Integrated Manufacturing Systems*, 14 (8), 686-695.
46
47
48
49 Ritter, T. and Gemunden H.G., 2003. Interorganizational relationships and networks: An overview.
50 *Journal of Business Research*, 56, 691-697.
51
52
53
54 Romano, P., 2003. Coordination and integration mechanisms to manage logistics processes across
55 supply networks. *Journal of Purchasing and Supply Management*, 9, 119-134.
56
57
58
59 Sahin, F. and Robinson, E.P., 2005. Information sharing and coordination in make-to-order supply
60 chains. *Journal of Operations Management*, 23, 579-598.

- 1
2
3 Sari, K., 2008. On the benefits of CPFR and VMI: A comparative simulation study. *International*
4
5 *Journal of Production Economics*, 113, 575-586
6
7
8 Seifert, D., 2003. *Collaborative Planning, Forecasting and Replenishment: How to create a Supply*
9
10 *Chain Advantage*. AMACOM, New York.
11
12 Simchi-Levi, D., Kaminsky P. and Simchi-Levi, E., 2000. *Designing and Managing the Supply*
13
14 *Chain*. Second ed., McGraw-Hill, IL.
15
16
17 Slack, N., Chambers, S. and Johnston, R., 2004. *Operations Management*. Fourth Edition, Prentice
18
19 Hall, London.
20
21
22 Småros J., 2007. Forecasting collaboration in the European grocery sector: Observations from a
23
24 case study. *Journal of Operations Management*, 25, 702-716.
25
26
27 Sousa, R. and Voss, C.A., 2008. Contingency research in operations management practices. *Journal*
28
29 *of Operations Management*, 26, 697-713.
30
31
32 Spekman, R.E., Kamauff, J.W. and Myhr, N., 1998. An empirical investigation into supply chain
33
34 management: A perspective on partnerships. *International Journal of Physical Distribution &*
35
36 *Logistics Management*, 28 (8), 630-650.
37
38
39 Sridharan, U.V., Caines, W.R. and Patterson, C.C., 2005. Implementation of supply chain
40
41 management and its impact on the value of firms. *Supply Chain Management: An International*
42
43 *Journal*, 5(2), 71-77.
44
45
46 Stuart, I., McCutcheon, D., Handfield, R., McLachlin, R, Samson, D., 2002. Effective case
47
48 research in operations management: a process perspective. *Journal of Operations Management*,
49
50 20, 419-433.
51
52
53 van Donk, D.P. and van der Vaart, T., 2004. Business conditions, shared resources and integrative
54
55 practices in the supply chain. *Journal of Purchasing & Supply Management*, 10, 107-116.
56
57
58 van Donk, D.P. and van der Vaart, T., 2005. A case of shared resources, uncertainty and supply
59
60 chain integration in the process industry. *International Journal of Production Economics*, 96, 97-
108.

- 1
2
3 Voluntary Interindustry Commerce Standards (VICS) (2002). *Collaborative Planning, Forecasting*
4 *& Replenishment Guidelines*. Version 2.0, available at <http://www.cpfr.org>.
5
6
7
8 Voss, C., Tsikriktsis, N. and Frohlic, M., 2002. Case research in operations management.
9
10 *International Journal of Operations and Production Management*, 22(2), 195-219.
11
12
13 Welker, G.A., van der Vaart, T. and van Donk, D.P., 2008. The influence of business conditions on
14
15 supply chain information-sharing mechanisms: A study among supply chain links of SMEs.
16
17 *International Journal of Production Economics*, 113, 706-720.
18
19
20 Wong, C.Y. and Boon-itt, S., 2008. The influence of institutional norms and environmental
21
22 uncertainty on supply chain integration in the Thai automotive industry. *International Journal of*
23
24 *Production Economics*, 115, 400-410.
25
26
27 Wu, Y.U. and Cheng, T.C.E., 2008. The impact of information sharing in a multiple-echelon supply
28
29 chain. *International Journal of Production Economics*, 115, 1-11.
30
31
32 Yin, R.K., 1984. *Case Study Research, Design and Methods*. Sage Publications, Beverly Hills, CA.
33
34
35 Yu, Z., Yan, H. and Cheng, T.C.E., 2001. Benefits of information sharing with supply chain
36
37 partnerships. *Industrial Management and Data Systems*, 101 (3), 114-119.
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Table 1. Overview of the cases

Case	Supply network members involved in the collaboration	Headquarters and central company location	Products	Interviewees
A	<ul style="list-style-type: none"> Central company 1: manufacturing unit (MU) producing starter batteries Several distribution centers (DCs) (independent and owned) 	Headquarters: Italy MU: Italy	Starter batteries	Logistics Operations manager and planners (company 1); external consultant involved in the implementation of the collaboration project; area managers (company 1), factory manager (DC)
B	<ul style="list-style-type: none"> Central company 2: MU producing injectable cephalosporins Owned DCs located worldwide and directly replenished by company 2 	Headquarters: UK MU: Italy	Medicines	Logistics Director and production planners (company 2); product managers (DC)
C	<ul style="list-style-type: none"> Central company 2 Owned and independent suppliers 			Logistics Director and buyers (company 2); factory managers and planners (suppliers of labels and active agents)
D	<ul style="list-style-type: none"> Central company 3: MU producing an anaesthetic and responsible for the final packaging of an antibiotic Owned and independent DCs 	Headquarters: UK MU: Italy	Medicines	Logistics Director and planners (company 3); product team's members (DC)
E	<ul style="list-style-type: none"> Central company 3 Production and packaging plants (owned and independent) 			Logistics Director (company 3); factory managers (production and packaging plants)
F	<ul style="list-style-type: none"> Central company 4: MU producing and distributing air conditioners Distributors 	Headquarters: Sweden MU: Italy	Air conditioners	Sales manager, Comfort & Refrigeration Business Unit managers and product manager (company 4); factory managers (distributors)
G	<ul style="list-style-type: none"> Central company 4 Suppliers of engines and copper 			Factory managers and planners (company 4); factory managers and planners (suppliers of engines and copper)
H	<ul style="list-style-type: none"> Central company 5: sales company(SC) (located in Belgium) selling and marketing consumer and soft goods Large customers (retailers) 	Headquarters: Sweden SC: Belgium	Consumer and soft goods	Customer Supply Chain Manager and sales managers (company 5); external consultant involved in CPFR implementation; supply chain manager (retailer)
I	<ul style="list-style-type: none"> Central company 6: subsidiary of a food retailer located in Belgium, responsible for establishing promotional plans for the local supermarkets and for managing the replenishment of the Belgian DC Three suppliers producing fats and margarines; candy bars and feminine hygiene products 	Headquarters: Belgium Subsidiary: Belgium	Food	Supply chain manager (company 6); external consultant involved in CPFR implementation; factory manager and planners within supplier plant producing fats and margarines
L	<ul style="list-style-type: none"> Central company 7: MU producing corrugated cardboards for product transport Some customers (food producers) 	Headquarters: Belgium MU: Belgium	Corrugated cardboards	Chief Supply Chain Officer and planners (company 7); factory manager and planners within a customer's plant

Table 2. Collaborative planning initiatives

Case	Collaborative planning initiative	Level of collaboration
A	The collaboration is mainly based on the exchange of data and information (i.e. <i>communication level</i>). Company 1 can read and extract DCs' stock and sales data. By using this data, the MU forecasts what retailers will require to the DCs, and elaborates the order forecast plans of the DCs, by taking into account DCs' stock levels. However, sales and order forecast plans elaborated by central company 1 are not communicated nor shared with DCs.	Communication
B	Central company 2 receives stock level data and sales forecast plans from fifty DCs. On the basis of this data the central system proposes the replenishment plans, suggesting dates to the central company for the deliveries of final products to each distribution center. The deliveries are decided in order for the stock level at the DCs' facilities to fall within a jointly established range (called VMI min-max range). Replenishment plans have then to be confirmed by the planners within both the central company and the DCs. If a DC does not confirm the plans, or asks for additional orders that fall within the frozen planning horizon, the central company proposes – on the basis of a what-if analysis – alternative delivery plans by estimating the impact of any order time/volume change on the plans of the downstream supply network members. This type of collaborative planning initiative can be classified as <i>limited collaboration</i> , as parties jointly develop the plans, but the collaboration is limited to order forecast definition process.	Limited collaboration
C	Every Monday morning, company 2's planners send to two packaging material suppliers and to the active agent supplier the order forecast plan that includes a 5-month planning period. The suppliers consider the order forecasts that fall within the frozen period as firmed orders. Thus the collaborative planning initiative is at a <i>communication level</i> .	Communication
D	Central company 3 receives sales forecasts and stock level data from about thirty DCs. The delivery plans, elaborated by the MU, are proposed to the DCs that can confirm the plans or ask for modifying, anticipating or postponing the orders. Similarly to case B, DCs' stock levels have to fall within a range jointly established by the MU and the DCs. When order forecast exceptions occur (e.g. a DC asks for anticipating an order), the MU, on the basis of what-if analyses, can propose alternative delivery plans, thanks to the flexibility due to the jointly agreed stock level range. As the MU and DCs jointly define the order forecast plans and solve order forecast exceptions, this type of information processing can be classified as <i>limited collaboration</i> .	Limited collaboration
E	MU decides the production and delivery plans for all the production and packaging plants (more than twenty) included within the supply network of the antibiotic packaged and distributed by company 3. The collaboration between the MU and production and packaging plants is mainly based on the exchange of data and information (i.e. <i>communication level</i>), as the MU reads stock levels and available capacity of production and packaging plants, and communicate production and delivery plans to them. Exceptions are not discussed nor shared, while plans are centrally decided by the MU.	Communication
F	Central company 4 receives stock level and sales forecast data from four distributors, each of which sells and distributes air conditioners in a specific market. Both company 4 and the distributors elaborate order forecast plans (i.e. deliveries of air conditioners to the distributors) that are then compared to identify exceptions. The exceptions are then solved to achieve a final common order forecast plan. This case is an example of <i>limited collaboration</i> .	Limited collaboration
G	Company 4 elaborates and sends its raw material order forecast plans to four suppliers, producing aluminium (two suppliers), and copper (two suppliers). Each supplier uses this data to organize product deliveries, and plan its production. Thus collaboration is limited to a mere data communication (i.e. <i>communication level</i>).	Communication

(continue)

Table 2. Collaborative planning initiatives

Case	Collaborative planning initiative	Level of collaboration
H	Every year, central company 5 and customers involved in the collaboration jointly establish a promotional plan (e.g. promotions to be made in the shops, in what periods, how many stock-keeping units (SKUs) will be included), that is reviewed every 3 months. Then, by using customers' sales data and promotional plan, both the central company and each customer estimate the sales forecast plans (i.e. demand of final customers). Discrepancies in the plans are discussed to obtain a common sales forecast plan. By considering stock level data and common sales forecast plan, both the central company and each customer elaborate an order forecast plan. Again, by comparing the plans, exceptions (e.g. significant differences) are identified and solved. Hence, the collaborative planning initiative is at a <i>full collaboration</i> level, as companies jointly define promotional, and sales and order forecast plans. Initially, company 5 collaborated on a full collaboration level with few partners, but, in 2005, decided to extend the collaboration to several other customers.	Full collaboration
I	Similarly to case H, the collaborative planning initiative is at a <i>full collaboration</i> level. The joint promotional plan is established every year. It mainly concerns decisions on promotional events (i.e. promotional period and SKUs to be involved). This plan is then reviewed and detailed during the year. Every week, on Friday, suppliers and company 6 elaborate independent sales forecast plans, by using supermarkets's POS data of the last two years, and promotional plans. Afterwards, suppliers' and company 6's sales forecasts are compared. They can't differ more than a certain percentage. Otherwise, an exception occurs. Every Monday, company 6 and its suppliers try to solve the exceptions found by analyzing POS data. Similarly, companies collaborate in defining order forecast plans. Every Tuesday, each company elaborates its order forecast plan, and every Wednesday companies collaborate to solve order forecast exceptions. The collaboration initially involved three suppliers; then was extended to include several other partners.	Full collaboraton
L	Customers weekly send to company 7 their corrugated cardboards gross requirement plans. By considering customers' stock level of corrugated cardboards, both the central company and customers elaborate deliveries of corrugated cardboards to be made. Exceptions are identified through the comparison of plans. The collaborative planning initiative is at <i>limited collaboration</i> level, as the collaboration concerns just the order forecast definition process.	Limited collaboration

Table 3. Summary characteristics of three levels of collaboration

		<i>Characteristics</i>	<i>Level of integration and multiplexity</i>
LEVEL OF COLLABORATION	Communication	Companies collaborate simply by exchanging data and information with trading partners. The types of data exchanged can differ. For example, a company can receive order forecast plans from its customers. Alternatively, a company can receive stock level and consumption data (or sales forecasts) from its customers and decide customers' order plans (e.g. VMI or CR). In all cases the collaboration is simply a sort of data communication. Indeed parties do not jointly develop promotional, sales or order forecast plans (i.e. low level of integration).	Low level of integration
	Limited collaboration	Limited collaboration differs from communication by taking the collaboration a little further than mere data exchange. Parties jointly develop order forecast plans and manage exceptions (e.g. discrepancies in the plans). The collaboration is limited to order forecast definition process (i.e. low level of multiplexity and high level of integration).	High level of integration Low level of multiplexity
	Full collaboration	Compared to limited collaboration, full collaboration is characterized by an increased number of areas in which companies collaborate. The collaboration includes the joint development of promotional, sales and order forecast plans, and sales/order forecast exception management, as suggested by CPFR technique (high level of multiplexity and high level of integration).	High level of integration High level of multiplexity

Table 4. Data reduction

Variable	Characterisation	Rating
Context	Elasticity of demand	<i>Low</i> (LDE) (less than 40%) or <i>high</i> (HDE) (more than 200%)
	Goals	<i>Strategy of efficiency</i> (companies aim to reduce costs (e.g. investments in stocks) without penalizing service levels) or <i>strategy of responsiveness</i> (the main purpose is to make the supply network more reactive to demand changes)
	Product diversity	<i>Same products</i> (SP) (companies involved in the collaboration sell the same products) or <i>different products</i> (DP) (companies sell different products)
	Supply network spatial complexity	<i>Low</i> (LSC) (few dozens or hundreds of kilometers); <i>high</i> (HSC) (thousands of kilometers)
Collaborative planning initiative	Level of collaboration	<i>Communication, limited collaboration, full collaboration</i>

Table 5. Relationship between the level of the collaboration and goals

		Level of collaboration and integration		
		Communication Low level of integration	Limited Collaboration High level of integration	Full Collaboration High level of integration
Goal	Responsiveness	/	<ul style="list-style-type: none"> ▪ CASE B ▪ CASE D ▪ CASE L ▪ CASE F 	<ul style="list-style-type: none"> ▪ CASE I ▪ CASE H
	Efficiency	<ul style="list-style-type: none"> ▪ CASE A ▪ CASE C ▪ CASE G ▪ CASE E 	/	/

Table 6. Links between goals and level of the collaboration in cases A and B

	Goals	Level of the collaboration	Main conclusion
Case A	Strategy of efficiency: In the last years the pressure for reducing component prices in the automotive industry has significantly increased and led company 1 to pursue a strategy aimed at containing production costs.	Communication level: In the 2002, company 1 launched a collaborative planning initiatives, based on the communication of distribution centers' (DCs) data (sales and stock levels) to company 1.	The collaboration allowed to increase company 1's "visibility", thus limiting the "bullwhip" effect and minimizing inventories of products within company 1's warehouse.
Case B	Strategy of responsiveness: Company 2 is the sole responsible for the whole production process of injectable cephalosporins and for their distribution throughout the world. For this reason, for company 2, being responsive in case of demand changes is essential.	Limited collaboration: Final deliveries plans are jointly defined by the DCs and central company 2, by taking into account also the additional orders that fall within the frozen planning horizon	Responsiveness is the result of an high level of integration between the central company and DCs, based on a two-way interaction and frequent discussions to reach an agreement on final delivery plans.

Table 7. Relationship between product diversity, elasticity of demand, spatial complexity, and multiplexity in the collaborative planning initiatives

		Product diversity, demand elasticity, spatial complexity	
		(SP, HDE, LSC)	DP or LDE or HSC
Level of collaboration and multiplexity	Full collaboration High multiplexity	<ul style="list-style-type: none"> ▪ CASE H (SP, HDE, LSC) ▪ CASE I (SP, HDE, LSC) 	
	Limited collaboration Low multiplexity		<ul style="list-style-type: none"> ▪ CASE L (DP, HDE, LSC) ▪ CASE B (SP, LDE, HSC) ▪ CASE D (SP, LDE, LSC) ▪ CASE F (SP, HDE, HSC)

Note: the ratings were obtained by applying the data reduction rules specified in table 4

Table 8 – Contexts and collaborative planning initiatives

Contexts	Collaborative planning initiatives	Level of integration and multiplexity
- Goal of the collaboration: efficiency	Companies exchange data and information (e.g. POS data) with the aim of minimizing inventories.	Low level of integration
- Goal of the collaboration: responsiveness - Elasticity of demand: low, or spatial complexity: high, or product diversity: different products	Parties jointly develop order forecast plans and manage exceptions. Collaborating on sales forecast plans and promotions is not a priority, since demand elasticity is low. Moreover product diversity or a high supply network spatial complexity limit the collaboration to order forecast definition process.	High level of integration Low level of multiplexity
- Goal of the collaboration: responsiveness - Elasticity of demand: high - Spatial complexity: low - Product diversity: same product	Companies collaborate to jointly manage promotional, sales and order forecast plans. Collaborating on promotions and sale forecast plans is necessary, because demand elasticity is high. However, companies in the upstream network can participate in the process of promotion and sales forecast definition, only if they have an in-depth knowledge of final market dynamics (i.e. when the spatial complexity is low and companies participating in the collaboration sell the same product).	High level of integration High level of multiplexity