Value chain integration – a framework for assessment

Inger Gamme[1], Bjørn Andersen[2], Håkon Raabe[1] and Daryl Powell[1,2]

[1] SINTEF Manufacturing AS, Raufoss, Norway
[2] Norwegian University of Science and Technology, Trondheim, Norway
hakon.raabe@sintef.no

Abstract. Despite an abundance of research on the topic, firms continue to struggle with integrating their value chains in order to create and deliver more value to customers. Silo-thinking (rather than systems-thinking) is a typical symptom of poorly integrated value chains. In this paper, we explore the enablers of better value chain integration, before developing and presenting a framework that can be used for assessing the maturity of value chain integration in organizations. We draw on practical insights from a multiple case study of several diverse companies currently working with the systematic integration of their value chains.

Keywords: Value chain integration, Maturity assessment, Multiple case study.

1 Introduction

A greater level of value chain integration promises firms increased productivity, better quality performance, reduced costs, and a higher level of customer satisfaction [1]. Yet organizations often struggle to integrate their value chains due to specific factors, such as the presence of a "silo-culture" as well as a lack of documentation or systematization [2, 3]. Defending silos over teamwork has recently emerged as a symptom of big company disease [4]. Moreover, having little flexibility in written descriptions and infrastructure could also lead to unreliable integration processes, particularly if employees choose to create their own routines besides those described in the system. Value creating processes must act together and there should be aligned and balanced intra-organizational coordination capabilities, in order to achieve a value chain that is well-managed [5]. Such a well-managed value chain is referred to as an *integrated value chain* that provides optimized value for the customer [6, 7]. As such, focusing on the interfaces between functions or process steps has been relevant for decades. Literature has various interpretations of the term "integration", the content and framing are varying, and few authors present a formal definition [3, 8]. The main purpose of this article is to extend existing knowledge identifying the enablers and disablers of integration within the value chain for different sectors. By studying what enables value chain integration, and which mechanisms are used to facilitate integration in five different organizations within different sectors in Norway, the following research questions will be addressed:

Research question (RQ) 1: *What are the enablers of better value chain integration?*
RQ2: *How can firms increase the degree of integration throughout the value chain?*

2 Theoretical background: Enablers for achieving integration in value chains.

Much of the existing literature defines integration solely based on the construct of information flow. However, other studies operationalize the concept to include both cooperation and collaboration. On the basis of mainstream operations management research, [9] formulates the following definition:

"*Integration is a process of interaction and collaboration in which manufacturing, purchasing and logistics work together in a cooperative manner to arrive at mutually acceptable outcomes for their organization.*"

This definition is based on the two key components of cross-functional *collaboration* and *interaction.* According to [8], this definition is "*one of the clearest definitions of cross-functional integration*". Given then our understanding of the core concept of integration, we carried out a review of the extant literature in order to uncover the key enablers of greater value chain integration, providing an answer to RQ1. The following seven enablers for achieving integration in value chains were formally identified during the literature search, and provide the basis for the rest of the investigation:

Table 1. Enablers of value chain integration

Enablers of Value Chain Integration	**Identified in:**
Culture (social mechanisms and the creation of lateral relations)	[10, 11]
Management support (vertical integration)	[2, 3, 6, 11-16]
Consensus	[3]
Formalization (standardization)	[17, 18]
Information systems	[19, 20]
Facility and layout	[9, 21]
Measurements and rewards	[22, 23]

3 Research design

The research approach adopted for this study is a multiple case study design that builds on the identification of enablers for value chain integration that were identified in the previous section. Partly to serve as illustrative cases and partly to demonstrate practical usage of the integration theory, the case studies were conducted in different industries and different types of companies. The cases also serve to provide empirical insights into enablers and disablers of better integration in internal value chains. The main reason for choosing a case-study approach, according to [24], is its distinct advantage in situations wherein “how”, "what" and “why” type questions are posed in order to understand a complex phenomenon. When selecting cases for studying, there

are several criteria to consider, i.e. what data are accessible, type of context and if the data is suitable for testing for the chosen approach. Within this study, the dominant criteria for selecting the case organizations has been the convenience sample [25]. We chose to study the phenomena within different industries in order to have the possibility to illustrate the topic from different perspectives and to build a foundation for the research to be generalizable for different industries. To increase the robustness of the research [26], data triangulation was ensured by using multiple sources when collecting the data, such as documents and direct observations in the field [27].

3.1 Case study overview

The case companies in this study are two mass producers (MPI & MPII), a craft producer (CP), a hospital (H) and a service provider (SP), each of which are presented below. The units of analysis in these different organizations are the value-adding elements of their internal value chains. As stated in [3], "the only way to truly assess the level of integration is by collecting data from respondents responsible for different value creating processes." Consequently, this research focuses on ensuring that at least two employees were interviewed within each process step of the value-adding elements of the value chain. Interviewees ranged from operators and team leaders to more senior managers, as well as trade union representatives. A summary of the case studies can be found in the following table:

Table 2. Case study overview

	MPI	**MPII**	**H**	**CP**	**SP**
Main Product / area of study	Auto components	Aluminium billets	Thrombo-lysis ward	Leisure boats	Insurance & banking
No of employees	37	513	265	20	1200
No of interviews	11	16	15	12	8

4 Discussion: Towards a Theoretical Framework for Value Chain Integration

Based on the theory from the literature study and the observations made during the case study research, we have been able to construct a model that provides insight into the relationships of each of the enablers for value chain integration. The model is illustrated in Figure 1:

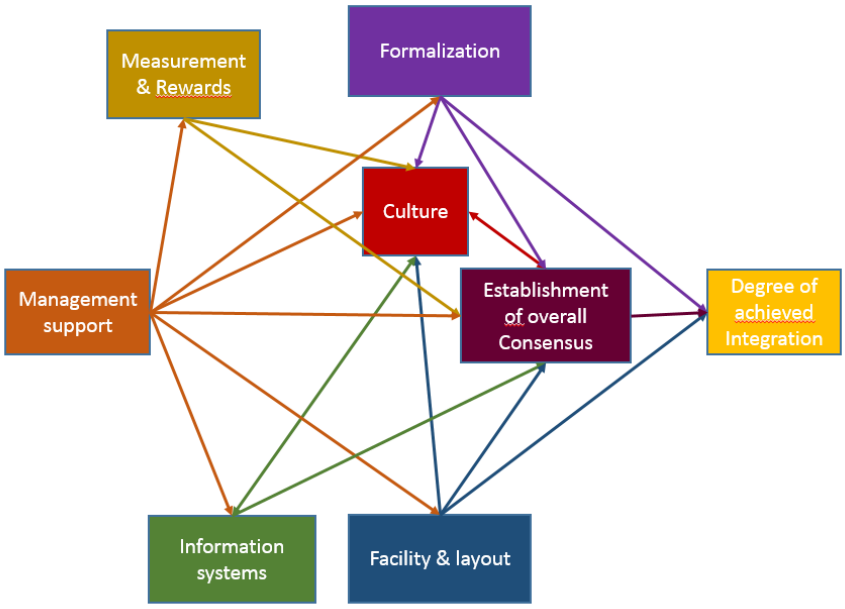

Fig. 1. Theoretical Framework for Value Chain Integration

This model can be used as the basis for a value chain integration maturity assessment tool, to help improve the integration of value chains in and across organizations. To exemplify how this could be applied to improve the integration of a value chain, we provide a theoretical example using data from MPII. The mechanisms were rated according to the extent to which the researchers found evidence for each mechanism during the case study, following the scale defined. (It should be noted that this rating should normally be performed by the company representatives themselves, who would rate the mechanisms according to their own experiences with them). After the rating procedure, the average rating per category is calculated. Table 3 presents an overview of the distribution and scoring of several examples within the given categories *Consensus, Culture*, and *Facility & Layout*:

Table 3: Maturity Model for Value Chain Integration

	Low				High	
	Definitely not		Somewhat		Definitely	
Use of mechanisms within each category	**1**	**2**	**3**	**4**	**5**	**Average**
Consensus integration						
The overall strategy is transferred down to individual measures				x		4
The employees are involved in the process of deriving KPI's (to avoid mistrust)			x			3
The overall strategy is well known					x	5
The employees support the overall strategy				x		4
There is a correlation between management focus and employee focus				x		4
All the managers agree upon the business strategy			x			3
Count per score value	0	0	2	3	1	**3,83**
Culture, social mechanisms and creation of lateral relations						
The personell are available at the value chain				x		4
The employees have confidence in systems				x		4
Degree of acknowledgement of colleagues				x		4
Degree of focus on customer among the employees				x		4
Degree of openness among the employees				x		4
Degree on focus on the entire value chain				x		4
The employees have focus on the interrelation of the process steps				x		4
There exists an informal culture				x		4
The employees have an information sharing mentality				x		4
The use of job rotation is consistent when possible throughout the value chain				x		4
The employees have knowledge of other departments				x		4
The employees have team work experience					x	5
The transfer of managers is used to increase the integration					x	5
There is a use of cross functional teams				x		4
The employees are used to standardized work				x		4
Count per score value	0	0	0	13	2	**4,13**
Facility and layout						
The employees are co-located			x			3
The plant layout is small and transparent				x		4
The layout contains no partitions				x		4
Count per score value	0	0	1	2	0	**3,67**

The result is a maturity level on the scale 1-5, where 1 indicates a very poor level of value chain integration and 5 indicates very good level of value chain integration. Figure 2 provides an overview of results for case company MPII, that can be used by the firm to identify and prioritize areas for improving value chain integration at the firm:

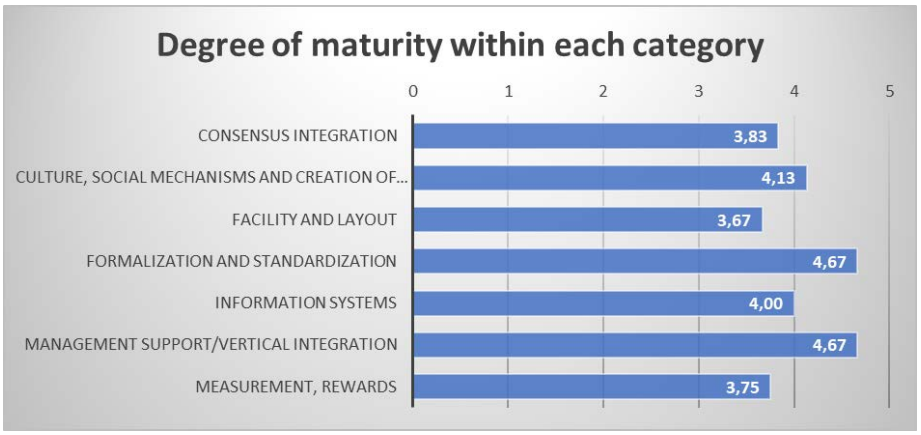

Fig. 2. Results of Maturity Model

5 Conclusion and further research

The results of this research support the view of [28] in that integration is a multidimensional concept. This may explain why, when studying an individual category, it is

often seen that it can directly or indirectly influence one or more other categories. It can also be observed that some enablers may be placed under several categories and that an enabler could in fact become a disabler, or vice versa, depending on the circumstances. Despite several years of research on the topic of integration, there remains a need for further research to achieve a greater understanding of this concept [8, 29]. Many different terms and definitions are used within this field, and some authors do not use any definition at all. Given that such inconsistency exists within this area of study, this research was intended to address the need for greater clarification and to provide a holistic overview of integration measures in the value chain. Furthermore, this article contributes to providing an enhanced understanding of which enablers can influence the levels of integration between two or more process steps. As an initial step toward gaining a more generic understanding of the topic, five case companies were studied. Moreover, a value chain integration maturity assessment model was constructed. This can be used to support practitioners when attempting to improve the value chain integration through identifying actions to strengthen such integration.

We realize that it is difficult to make concrete generalizations from a small sample of case data. Future work should therefore develop and distribute a survey instrument to gain a greater sample size, thus contributing to more generalizable theory.

Acknowledgements

The authors acknowledge the support from the Research Council of Norway through the research program *SFI Manufacturing.*

References

1. Gamme, I.A.Ø., *Assessing Integration in Value Chains-Assessing enablers and disablers of integration in different sectors*. 2018, Thesis for the degree of Philosophiae Doctor, Norwegian University of Science and Technology: Trondheim.
2. Basnet, C. and J. Wisner, *Nurturing internal supply chain integration.* Operations and Supply Chain Management, 2012. **5**(1): p. 27-41.
3. Pagell, M., *Understanding the factors that enable and inhibit the integration of operations, purchasing and logistics.* Journal of operations management, 2004. **22**(5): p. 459-487.
4. Ballé, M., et al., *The Lean Sensei. Go. See. Challenge*. 2019, Boston, MA: Lean Enterprise Institute, Inc.
5. Stank, T.P., S.B. Keller, and P.J. Daugherty, *Supply chain collaboration and logistical service performance.* Journal of Business logistics, 2001. **22**(1): p. 29-48.
6. Morash, E.A. and S.R. Clinton, *Supply chain integration: customer value through collaborative closeness versus operational excellence.* Journal of Marketing Theory and Practice, 1998. **6**(4): p. 104-120.
7. Stock, G.N., N.P. Greis, and J.D. Kasarda, *Logistics, strategy and structure.* International Journal of Operations & Production Management, 1998.

8. Frankel, R. and D.A. Mollenkopf, *Cross-functional integration revisited: Exploring the conceptual elephant.* Journal of Business Logistics, 2015. **36**(1): p. 18-24.
9. Pagell, M. and J.A. LePine, *Multiple case studies of team effectiveness in manufacturing organizations.* Journal of Operations Management, 2002. **20**(5): p. 619-639.
10. Griffin, A. and J.R. Hauser, *Integrating R&D and marketing: A review and analysis of the literature.* Journal of Product Innovation Management: An International Publication of the Product Development & Management Association, 1996. **13**(3): p. 191-215.
11. Braunscheidel, M.J., N.C. Suresh, and A.D. Boisnier, *Investigating the impact of organizational culture on supply chain integration.* Human Resource Management, 2010. **49**(5): p. 883-911.
12. Lawrence, P.R. and J.W. Lorsch, *Organization and environment.* 1967.
13. Chen, I.J. and A. Paulraj, *Towards a theory of supply chain management: the constructs and measurements.* Journal of operations management, 2004. **22**(2): p. 119-150.
14. Barki, H. and A. Pinsonneault, *A model of organizational integration, implementation effort, and performance.* Organization science, 2005. **16**(2): p. 165-179.
15. Drupsteen, J., T. van der Vaart, and D.P. Van Donk, *Operational antecedents of integrated patient planning in hospitals.* International Journal of Operations & Production Management, 2016.
16. Le Meunier-FitzHugh, K., G.R. Massey, and N.F. Piercy, *The impact of aligned rewards and senior manager attitudes on conflict and collaboration between sales and marketing.* Industrial Marketing Management, 2011. **40**(7): p. 1161-1171.
17. Bowersox, D.J., D.J. Closs, and T.P. Stank, *21st century logistics: making supply chain integration a reality*. 1999.
18. Malone, T.W. and K. Crowston, *The interdisciplinary study of coordination.* ACM Computing Surveys (CSUR), 1994. **26**(1): p. 87-119.
19. Gattiker, T.F., *Enterprise resource planning (ERP) systems and the manufacturing–marketing interface: an information-processing theory view.* International Journal of Production Research, 2007. **45**(13): p. 2895-2917.
20. Galbraith, J.R., *Competing with flexible lateral organizations*. 1994: Addison-Wesley Reading, MA.
21. Pinto, M.B., J.K. Pinto, and J.E. Prescott, *Antecedents and consequences of project team cross-functional cooperation.* Management science, 1993. **39**(10): p. 1281-1297.
22. Coombs Jr, G. and L.R. Gomez-Mejia, *Cross-functional pay strategies in high-technology firms.* Compensation & Benefits Review, 1991. **23**(5): p. 40-48.
23. Galbraith, J.R., *Designing organizations: an executive guide to strategy*. Structure, 2002.
24. Karlsson, C., *Researching operations management*. 2009, New York: Routledge.
25. Marshall, M.N., *Sampling for qualitative research.* Family practice, 1996. **13**(6): p. 522-526.

26. Patton, M.Q., *Qualitative evaluation and research methods*. 1990: SAGE Publications, inc.
27. Yin, R.K., *Case study research: design and methods*. 4th ed. 2009, Thousand Oaks, California: Sage Publications.
28. Turkulainen, V. and M. Ketokivi, *Cross-functional integration and performance: what are the real benefits?* International Journal of Operations & Production Management, 2012.
29. Autry, C.W., W.J. Rose, and J.E. Bell, *Reconsidering the supply chain integration–Performance relationship: In search of theoretical consistency and clarity*. Journal of Business Logistics, 2014. **35(**3): p. 275-276.