

Management of synergistic knowledge alliances

A model and application framework based on VSM

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Abstract

Purpose: In this thesis the viable system model (VSM) is used as a framework to develop a model for the management of a business alliance that contains the necessary and sufficient conditions for maintaining synergy of its constituent organisations and for adapting to a changing environment so that it can remain a long-term viable alliance. In addition, a model is developed that makes explicit the inherent link between the VSM and the core elements of knowledge management theory. Based then on the alliance management model and the link established between the VSM and knowledge management, an application framework is developed to guide practitioners in defining necessary alliance management functions and relationships, the knowledge required by that management to fulfill those functions, and the processes that need to be in place to manage that knowledge.

Design/strategy: The research has been divided into four phases: theoretical *construction*, *refinement* with practitioners, real-world *application*, and *evaluation* of test case and toolset. The researcher has worked closely with practitioners actively involved in the formation of a new international alliance to develop a VSM model and application framework for the alliance management. Formally, the research strategy has been defined as an *action research* and the research philosophy as one of *pragmatism*.

Findings/limitations: The developed application framework, has been successfully used to identify absent and incomplete roles, actions, and interactions within the management of the specific alliance test case. This has helped to demonstrate how the application framework and VSM model can be used to diagnose and, most importantly, to articulate and visualise management deficiencies to facilitate clear and unambiguous discussions. The timing of this cross-sectional research did not allow the application framework to be utilised from the outset of the alliance formation as an organisational planning tool and also not to its full extent to support the development of knowledge processes for the alliance management. However, the step-by-step approach used in developing the toolset and then explaining its application will allow the reader to judge its credibility and generalisability for other practical applications.

Practical implications: The developed toolset consists of a VSM for an alliance management, *job descriptions* for that management (responsibilities, interfaces, and core competencies), a visual model illustrating the link between the VSM and knowledge management, and an application framework to guide the filling of the alliance management job descriptions in phases of *recruitment*, *onboarding*, and *development* (of interfaces and activities processes).

Overall, one could say that the conditions prescribed by the VSM are rather obvious and yet, as seen by the specific alliance test case, many of these conditions have been completely overlooked by a management that was more than capable, willing, and empowered to enact those conditions. This gives a good indication that the toolset which has been compiled in a

visual and tabular systematic fashion may well be useful to practitioners for the organisational planning of an alliance management.

The visual representation of a management role in the VSM as a set of *knowledge episodes* put forward by this research is significant. It forces the express recognition that knowledge management is an integral part of every interaction that takes place and every action performed that, according to the VSM, are necessary and altogether are sufficient for viability. It means that knowledge management cannot be considered as some abstract topic or unnecessary overhead or afterthought – it is entirely necessary, practical and forms a natural course of events during design of action/interaction processes. In other words, if an organisation is viable then, by definition, it does knowledge management whether or not it is formally recognised as such. The VSM, by defining necessary and sufficient actions and interactions for its roles, therefore provides a focus for *relevant knowledge* and serves as a tool for structured knowledge management.

Originality/value: This research addresses a general academic call for hands-on insights of VSM applications by sharing real-world insights, artifacts and reflections generated by a practical and relevant organisational management application. It also addresses the potential, recognised by academics, for VSM as a framework for knowledge management by developing an intuitive model linking those theories and then using that model as part of a framework to guide its application.

The introduction to aspects of knowledge management theory relevant to the model developed as well as the meticulousness and comprehensive explanation of the VSM provides a solid theoretical foundation for practitioners. The developed toolset is based on existing theories from multiple fields of research that have been logically linked and extended in an original and novel manner with a strong focus on practical application. This researcher's hope is that this will stimulate interest for future research and practical application from academics and practitioners alike.

Keywords: Viable system model, knowledge management, alliance management, synergy.

Kurzreferat

Zweck: In dieser Arbeit wird das lebensfähige Systemmodell (VSM) als Rahmen verwendet, um ein Modell für das Management einer Geschäftsgemeinschaft zu entwickeln, das die notwendigen und ausreichenden Bedingungen für die Aufrechterhaltung der Synergie ihrer Mitgliedsorganisationen und die Anpassung an eine sich verändernde Umgebung enthält, damit sie eine langfristig lebensfähige Allianz bleiben kann. Darüber hinaus wird ein Modell entwickelt, das den inhärenten Zusammenhang zwischen dem VSM und den Kernelementen der Wissensmanagement-Theorie explizit macht. Basierend auf diesem Allianz-Management-Modell und dem etablierten Zusammenhang zwischen dem VSM und dem Wissensmanagement wird dann ein Anwendungsrahmen entwickelt, der Praktikern dabei hilft, die notwendigen Allianz-Management-Funktionen und -Beziehungen zu definieren, das von diesem Management benötigte Wissen zu erfüllen und die Prozesse zu verwalten, die notwendig sind, um dieses Wissen zu managen.

Design/Strategie: Die Forschung wurde in vier Phasen unterteilt: theoretische Konstruktion, Verfeinerung mit Praktikern, Anwendung in der realen Welt und Bewertung des Testfalls und des Werkzeugsatzes. Der Forscher hat eng mit Praktikern zusammengearbeitet, die aktiv an der Bildung einer neuen internationalen Allianz beteiligt sind, um ein VSM-Modell und einen Anwendungsrahmen für das Allianz-Management zu entwickeln. Formal wurde die Forschungsstrategie als Aktionsforschung und die Forschungsphilosophie als Pragmatismus definiert.

Ergebnisse/Einschränkungen: Das entwickelte Anwendungsframework wurde erfolgreich eingesetzt, um fehlende und unvollständige Rollen, Aktionen und Interaktionen im Management des spezifischen Alliantestfalls zu identifizieren. Dies hat gezeigt, wie das Anwendungsframework und das VSM-Modell verwendet werden können, um Managementdefizite zu diagnostizieren und insbesondere um diese klar und eindeutig zu diskutieren und zu visualisieren. Die zeitliche Begrenzung dieser querschnittlichen Forschung ließ jedoch nicht zu, dass das Anwendungsframework von Anfang an als Organisationsplanungswerkzeug für die Allianzbildung genutzt wurde und auch nicht in vollem Umfang zur Unterstützung der Entwicklung von Wissensprozessen für das Allianzmanagement. Die schrittweise Herangehensweise bei der Entwicklung des Toolsets und der Erklärung seiner Anwendung wird es dem Leser jedoch ermöglichen, seine Glaubwürdigkeit und Übertragbarkeit auf andere praktische Anwendungen zu beurteilen.

Praktische Auswirkungen: Das entwickelte Werkzeugset besteht aus einem VSM für das Allianzmanagement, Stellenbeschreibungen für dieses Management (Verantwortlichkeiten, Schnittstellen und Kernkompetenzen), einem visuellen Modell, das die Verbindung zwischen dem VSM und dem Wissensmanagement veranschaulicht, sowie einem Anwendungsrahmen, um die Besetzung der Allianzmanagement-Stellenbeschreibungen in den Phasen der

Rekrutierung, Einarbeitung und Entwicklung (von Schnittstellen und Aktivitätsprozessen) zu leiten. Insgesamt könnte man sagen, dass die vom VSM vorgeschriebenen Bedingungen recht offensichtlich sind und dennoch wurden, wie beim spezifischen Allianztestfall zu sehen ist, viele dieser Bedingungen von einem Management vollständig übersehen, obwohl es mehr als fähig, bereit und bevollmächtigt war, diese Bedingungen umzusetzen. Dies gibt einen guten Hinweis darauf, dass das Werkzeugset, das in visueller und tabellarischer systematischer Weise zusammengestellt wurde, für die organisatorische Planung eines Allianzmanagements für Praktiker durchaus nützlich sein kann.

Die visuelle Darstellung einer Managementrolle im VSM als eine Reihe von Wissensepisoden, die von dieser Forschung vorgestellt werden, ist bedeutend. Es zwingt zur ausdrücklichen Anerkennung, dass das Wissensmanagement ein integraler Bestandteil jeder Interaktion, die stattfindet, ist. Weiterhin ist jede Handlung, die nach dem VSM ausgeführt wird notwendig und insgesamt ausreichend für die Lebensfähigkeit. Das bedeutet, dass das Wissensmanagement nicht als abstraktes Thema oder unnötiger Overhead oder Nachgedanke betrachtet werden kann - es ist vollständig notwendig, praktisch und bildet einen natürlichen Verlauf der Ereignisse während der Gestaltung von Aktions-/Interaktionsprozessen. Mit anderen Worten, wenn eine Organisation lebensfähig ist, führt sie per Definition Wissensmanagement durch, unabhängig davon, ob es formal als solches anerkannt wird oder nicht. Das VSM definiert notwendige und ausreichende Handlungen und Interaktionen für seine Rollen und bietet daher einen Fokus für relevantes Wissen und dient als Werkzeug für strukturiertes Wissensmanagement.

Originalität/Wert: Diese Forschung beantwortet den allgemeinen akademischen Ruf nach praktischen Einblicken in VSM-Anwendungen, indem sie realitätsnahe Einsichten, Artefakte und Reflexionen teilt, die durch eine praktische und relevante organisatorische Managementanwendung generiert wurden. Sie behandelt auch das Potenzial, das von Akademikern anerkannt wird, dass VSM als Rahmen für Wissensmanagement dienen kann, indem ein intuitives Modell entwickelt wird, das diese Theorien verknüpft und dann dieses Modell als Teil eines Frameworks zur Anleitung seiner Anwendung verwendet.

Die Einführung in Aspekte der relevanten Wissensmanagement-Theorie für das entwickelte Modell sowie die Sorgfalt und umfassende Erklärung des VSM bieten eine solide theoretische Grundlage für Praktiker. Das entwickelte Toolset basiert auf bestehenden Theorien aus mehreren Forschungsfeldern, die logisch miteinander verknüpft und auf originelle und neuartige Weise mit einem starken Fokus auf praktische Anwendung erweitert wurden. Die Hoffnung des Forschers ist, dass dies das Interesse an zukünftiger Forschung und praktischer Anwendung bei Akademikern und Praktikern gleichermaßen wecken wird.

Schlüsselwörter: Viable System Model, Wissensmanagement, Allianzmanagement, Synergie.

Table of Contents

List of Figures	i
List of Tables	iii
List of Abbreviations	iv
1 Introduction	1
1.1 Topic motivation	1
1.2 Research question	5
1.3 Document structure	6
2 Research methodology	8
2.1 Philosophical assumptions	8
2.2 Research design	9
2.3 Research stakeholders	11
2.4 Formal research methodology	13
3 Theoretical foundation	16
3.1 Knowledge management	16
3.1.1 Concept of knowledge	16
3.1.2 Knowledge processes	22
3.1.3 Relevant knowledge	25
3.2 The viable system model	27
3.2.1 Unfolding complexity	28
3.2.2 Collective cohesion	33
3.2.3 Adaption mechanism	39
3.2.4 VSM overall model	45
3.3 Existing KM applications of VSM	50
3.3.1 Adopted principles	51
3.3.2 Research gap	54

4	Empirical results	57
4.1	General model and framework	57
4.1.1	Business alliance VSM	58
4.1.2	VSM-KM model	60
4.1.3	Alliance VSM S5 job description	61
4.1.4	Alliance VSM S4 job description	64
4.1.5	Alliance VSM S3 job description	67
4.1.6	Alliance VSM S2 job description	71
4.1.7	Application framework	72
4.2	Specific application	78
4.2.1	VSM of specific alliance	78
4.2.2	Status of specific alliance	80
4.2.3	Application framework - Phase 1	84
4.2.4	Application framework - Phase 2	88
4.2.5	Application framework - Phase 3a	91
4.2.6	Application framework - Phase 3b	94
4.2.7	Assessment of specific alliance	96
4.2.8	Assessment of framework	101
5	Conclusions	102
5.1	Research summary	102
5.2	Implications & further research	108
	References	110
	Appendices	114
	Appendix A - Beer's viable system model	114
	Appendix B – Business model template	115
	Appendix C – Specific alliance statements of intent	116
	Appendix D – Specific alliance RASI matrix	118
	Appendix E – Specific alliance collaboration tool	120
	Statement of Affirmation	121

List of Figures

Figure 1: Research focus – VSM as a tool to support the design of synergistic knowledge alliances... 4	4
Figure 2: Illustrates the influence of a researcher's philosophical assumptions on a research..... 9	9
Figure 3: Summary outline of the plan formulated for the execution of the research..... 10	10
Figure 4: Demonstrates the continuous iterative feedback process between the research stages. 11	11
Figure 5: Saunder's research onion framework..... 14	14
Figure 6: A non-exhaustive web of knowledge attributes. 17	17
Figure 7: The knowledge ladder. 18	18
Figure 8: Illustrates knowledge management facilitating a knowledge episode..... 21	21
Figure 9: Probst's building blocks of knowledge management..... 23	23
Figure 10: Phases of knowledge conversion and the knowledge spiral 24	24
Figure 11: Illustration of Amy Edmondson's psychological safety and accountability..... 26	26
Figure 12: Appropriate attenuator/amplifier design allows balancing of complexity between systems. 29	29
Figure 13: Complexity management and individual learning. 30	30
Figure 14: Decentralisation of management functions through recursive layers of autonomous units.32	32
Figure 15: Intermediate VSM build-up illustrating command and coordination channels..... 34	34
Figure 16: Intermediate VSM build-up illustrating global coordination and operational linkages. 35	35
Figure 17: Illustrates a control dilemma example. 37	37
Figure 18: Intermediate VSM build-up illustrating senior management audit function. 38	38
Figure 19: Intermediate VSM build-up illustrating the intelligence and policy functions. 41	41
Figure 20: Tangram: depending on the purpose set out, a given set of shapes can form different relations to create different identities. 43	43
Figure 21: The overall VSM illustrated to two levels of recursion. 47	47
Figure 22: Generalised MSC - goals and orientators at different logical levels of management..... 48	48
Figure 23: Culture at the heart of McKinsey 7-S framework..... 53	53
Figure 24: Example of a dependency diagram 55	55
Figure 25: Approximate representation of overall literature review and identified research gap..... 56	56

Figure 26: Research focus – VSM as a tool to support the design of synergistic knowledge alliances.	57
Figure 27: VSM of business alliance consisting of two independent, complementary organisations... 59	
Figure 28: Represents a VSM system as a knowledge processor linking the four core elements of KM.	60
Figure 29: Knowledge processes considered during the definition of VSM system responsibilities. ... 61	
Figure 30: Typical content of S4 strategic and S3 operational plans provided to S5 for budget release.	62
Figure 31: Typical concerns of S5 for S4-S3 imbalance/misalignment.	62
Figure 32: Input knowledge required by S4 during the development of innovative business models. . 65	
Figure 33: S3 distribution of alliance operational objectives and generation of alliance operational plan.	68
Figure 34: Alliance management model application framework flowchart.....	77
Figure 35: Assumed VSM of specific business alliance before analysis.	79
Figure 36: Specific alliance - mindmap of possible focus points for innovation.....	82
Figure 37: VSM of specific business alliance after analysis – currently not a viable system!	98
Figure 38: Beer’s viable system model.....	114
Figure 39: Illustrates the content of a typical business model template.	115
Figure 40: Specific alliance formation committee RASI matrix – illustrates stakeholders.	118
Figure 41: Specific alliance formation committee RASI matrix – illustrates starting activities.....	119
Figure 42: Collaboration tool, <i>Confluence</i> , used to document specific alliance MVP development... 120	

List of Tables

Table 1: Summary outline of the structure and content of the research thesis.	7
Table 2: Overview of the businesses that have formed the alliance considered in this research.	12
Table 3: Demonstrates the strategic benefits of the alliance.	12
Table 4: Knowledge required by knowledge management to fulfill its function.	21
Table 5: Knowledge processes adopted by this research.	23
Table 6: An example table format to visualise centralisation/decentralisation of support functions.	49
Table 7: Overview of relations between VSM relevant knowledge, functions and processes.	54
Table 8: Alliance management S5 interfaces and interactions define responsibility.	64
Table 9: Alliance management S5 role and competencies.	64
Table 10: Alliance management S4 interfaces and interactions define responsibility.	66
Table 11: Alliance management S4 role and competencies.	67
Table 12: Alliance management S3 interfaces and interactions define responsibility.	70
Table 13: Alliance management S3 role and competencies.	71
Table 14: Alliance management S2 interfaces and interactions define responsibility.	72
Table 15: Alliance management S2 role and competencies.	72
Table 16: Alliance management model application framework table.	76
Table 17: Alliance formation committee members.	80
Table 18: Agenda of initial alliance planning workshops.	80
Table 19: Alliance formation committee interaction rules.	83
Table 20: Check if S5-S2 roles are filled with capable, willing and empowered stakeholders.	86
Table 21: Check if management interactions are understood and accepted by responsible roles.	91
Table 22: Check if processes and instruments are defined for alliance management interactions.	94
Table 23: Check if processes and instruments are defined for alliance management actions.	96
Table 24: Specific alliance statement of purpose and values.	116
Table 25: Specific alliance outline of foreseen relationship.	117
Table 26: Specific alliance vision statement.	117
Table 27: Specific alliance mission statement.	117

List of Abbreviations

AU	Austria
BI	Business Intelligence
CEO	Chief Executive Officer
CPU	Computer Processing Unit
CSO	Chief Strategy Officer
CTO	Chief Technology Officer
DACH	Germany, Austria and Switzerland
DE	Germany
ECA	European Court of Auditors
EMEA	Europe, Middle East, and Africa
Environ.	Environment
FAE	Field Application Engineer
GM	General Manager
HR	Human Resource (management)
HQ	Headquarters
ICE	Industrial Computer Enabler
ICT	Information and Communication Technology
IP	Intellectual Property
IT	Information Technology
KM	Knowledge Management
KMS	Knowledge Management System
KPI	Key Performance Indicator
Manuf.	Manufacturing
MIS	Management Information System
MNC	Multinational Corporation
MSC	Model of Systemic Control
MSME	Micro, Small & Medium Enterprises
MVP	Minimum Viable Product

OECD	Organisation for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
OP	Operations (of an organisation)
Org.	Organisation
Org. AU	Organisation based in Austria
Org. DE	Organisation based in Germany
PDSA	Plan Do Study Act
PLM	Product Lifecycle Management
PMO	Project Management Office
QLS	Quality and Lifecycle Services
R&D	Research & Development
RASI	Responsible, Accountable, Supportive, Informed
ROI	Return of Investment
S1-S5	System 1 to System 5 of the VSM
SCM	Supply Chain Management
SME	Small to Medium-sized Enterprise
STM	Self-Transformation Methodology
SWOT	Strengths, Weaknesses, Opportunities and Threats analysis
Viplan	Viability planning
VRIN	Valuable, Rare, Imperfectly imitable, Non-substitutable
VSM	Viable System Model
VUCA	Volatile, Uncertain, Complex, Ambiguous
WEF	World Economic Forum
WTO	World Trade Organisation

1 Introduction

The following section of this introductory chapter describes the context, motivation and focus of this research. This is subsequently followed by the definition of the research question which leads to the set of objectives to be fulfilled by the research. The final section of this chapter provides the high-level structure and logical unfolding of the overall research thesis.

1.1 Topic motivation

We live in an ever-increasing knowledge-based economy competing in a global marketplace. That is to say, the high-value segments of global value chains are based on knowledge-intensive activities¹. Knowledge-intensive activities therefore allow the creation of high-wage employment for knowledge workers¹ which brings about wider economic and social benefits. The production of goods and services that are based primarily on knowledge-intensive activities require investment in knowledge-based capital¹ (or intellectual capital). The World Bank stipulates critical requisites for a country to be able to fully participate in the knowledge economy (including for example, education and training, information infrastructure, regulatory and economic incentives, innovation nodes and networks)² and the OECD calls on governments to develop policies that promote investment in knowledge-based capital¹.

The global knowledge-based economy drives the continuous demand for knowledge production leading to rapid advances in science and technology further fueling knowledge generation but also causing rapid knowledge obsolescence (Powell & Snellman, 2004). This has given rise to the need for a deliberate and systematic approach to knowledge management in organisations that focuses on the agile mobilisation of its intellectual capital in order to add value to its processes and products/services and keep pace with market demands (Dalkir, 2013).

The exploitation of key knowledge to help an organisation to achieve its strategic goals is not new. But ironically, this is part of the difficulty in formalising the discipline of knowledge management in our knowledge-based economy. Knowledge has always been managed instinctively as a natural course of events through informal networks within an organisation and so the necessary change in mindset to see knowledge as a key strategic resource to be formally managed requires organisational change (Birkinshaw, 2001).

¹ OECD - Knowledge is growth - 2013:
www.oecd.org/innovation/knowledge-is-growth.htm

² The World Bank - The four pillars of the knowledge economy:
<http://go.worldbank.org/5WOSIRFA70>

A challenge with managing organisational knowledge as a resource is that it involves the management of intangible assets which are not easy to value and worse still are often not even fully recognised as assets. The reason for this is that key knowledge is mostly embodied in knowledge workers in the form of tacit knowledge. That is to say, knowledge workers not only possess explicit, codifiable information but also possess, for example, subtle context differentiators, practical experience, tuned skills, working relationships and a feeling for how to do things right. It may well be the case that an activity has become so intuitive or even instinctive to a knowledge worker that even they themselves no longer recognise it as significant knowledge (Nonaka & Takeuchi, 1995). As the famous business management pundit, Peter Drucker, once wrote: “You can’t manage what you can’t measure”. And yet, this is an important part of what knowledge management must try to achieve because it is this tacit knowledge of knowledge workers that is considered to be the most valuable resource in gaining competitive advantage, since it cannot be quickly transferred and so is difficult for competitors to quickly reproduce (North & Kumta, 2018).

Given then that knowledge workers are a critical component of knowledge-based productivity and competitiveness, an additional challenge for organisations competing in knowledge-intensive sectors, is the general shortage of workers to fill job positions requiring knowledge-rich skills. In ManpowerGroup 2022 survey, on average 75% of the more than 40,000 employers across 40 countries reported difficulty to find the right blend of technical and soft skills³. This is a growing trend, with the WEF citing the rapid pace of technological development making it harder for workers skill sets to keep pace with the needs of employers and asserting that reskilling the current workforce is a critical imperative⁴.

Additionally, the rapidly evolving developments in science and technology (both fuelling and fuelled by the knowledge-based economy), the uncertainty surrounding global political, economic, financial, and environmental events, the fragility and inter-dependence of our societies to disruptions caused by global events, as well as the difficulty to interpret causal relationships of these complex events and predict new trends and markets, are constantly re-defining the context of the environment in which organisations must survive and thrive. This leaves many observers to describe the volatility, uncertainty, complexity and ambiguity of the present state of the business world to be a “VUCA” environment (Tulder et al., 2020).

³ ManpowerGroup 2022 – Global talent shortage
<https://go.manpowergroup.com/talent-shortage>

⁴ WEF 2021 – Reskilling workforce in the fourth industrial revolution
www.weforum.org/agenda/2021/06/reskilling-the-workforce-lifelong-learning/

The WTO *World Trade Report 2020* reported that SMEs (including micro enterprises) represent around 95% of all companies globally, and 60% of total global employment – numbers that indicate their economic importance throughout the world⁵. SMEs often have the advantage over large MNCs of being capable to be more agile in response to a changing business environment since they are less burdened with organisational complexity and legacy. It is this ability and necessity to adapt to new situations that is often a source of creativity, innovation and entrepreneurship that is highly associated with SMEs⁶. On the other hand, in the storm of a truly VUCA environment, SMEs may have the disadvantage, compared to large MNCs, of fewer resources (financial, human, physical, intellectual, relational) and diversity of resources necessary to bridge the gap between innovative commercial potential and realised market product⁷.

The formation of alliances between two or more organisations to exploit complementary resources and capabilities to their mutual benefit is a common business strategy (Nielsen, 2002) and may be especially important for SMEs. However, it is worth noting that exploitation of complementary resources alone does not necessarily lead to the generation new knowledge resources within the alliance (Nielsen, 2002). It is entirely possible (or even intentional) for example, that purely explicit knowledge is shared, alliance interaction rules are established and that little further management intervention is required (Nielsen, 2002). This, however, is not conducive to the creation of new tacit knowledge among knowledge workers within the alliance. The creation of new knowledge in the alliance that was not previously known to any of the individual organisations no longer amounts to the simple sum of existing knowledge parts - it is synergy which according to Nielsen (2002) should be the ultimate goal of an alliance since leads to innovation and competitive advantage.

Synergistic alliances or strategic knowledge alliances (North & Kumta, 2018) that are capable of developing new knowledge-based resources have been described as complex, dynamic networks that cooperate through the interconnection of multiple knowledge nodes (Valkokari, 2015). Espejo & Reyes (2011) described organisations as human communication systems and the importance of designing effective communication structures. However, organisations are complex-adaptive systems (Cilliers & Spurrett, 1999) and identifying the necessary

⁵ WTO 2022 – MSME participation in developed economy
www.wto.org/english/tratop_e/msmes_e/ersd_research_note1_msmes_in_developed_economies.pdf

⁶ PwC 2018 – European SMEs driving force for growth and innovation
www.pwc.nl/nl/assets/documents/pwc-europe-monitor-innovation-sme.pdf

⁷ ECA 2019 – EU support of SME innovation
www.eca.europa.eu/lists/ecadocuments/ap19_06/ap_sme_en.pdf

interconnecting nodes and stimulating effective cross-boundary relationships that generate tangible, but also intangible assets is a complex management and leadership challenge (Valkokari, 2015).

The Viable System Model (VSM) is one of the most powerful tools for understanding the necessary preconditions for an organisation (as a complex-adaptive system) to remain viable when operating within a changing environment (Espinosa, 2022). “The VSM is above all about connectivity, about structuring the system to facilitate the healthy growth of effective relationships” which “...permit the parts of an organization to operate together” as a synergistic whole (Espejo, 1990, p. 4-5). Despite this impressive claim however, the VSM is not widely used among the general management population because it is not intuitively reconciled with traditional organisational structures (Espejo & Gill, 2011; Lowe et al., 2020).

This research is therefore interested to focus on the investigation of how the VSM can be utilised, in the application of a real and newly formed synergistic knowledge alliance, to define necessary and sufficient alliance management functions and relationships, the knowledge required by that management to fulfill those functions and maintain relationships, and the processes that need to be in place to manage that knowledge. Given the context of our knowledge-based economy and the growing necessity for a very conscious, purposeful, and structured approach to knowledge management, the research seeks to clearly establish a link between VSM and the core elements and language of knowledge management.

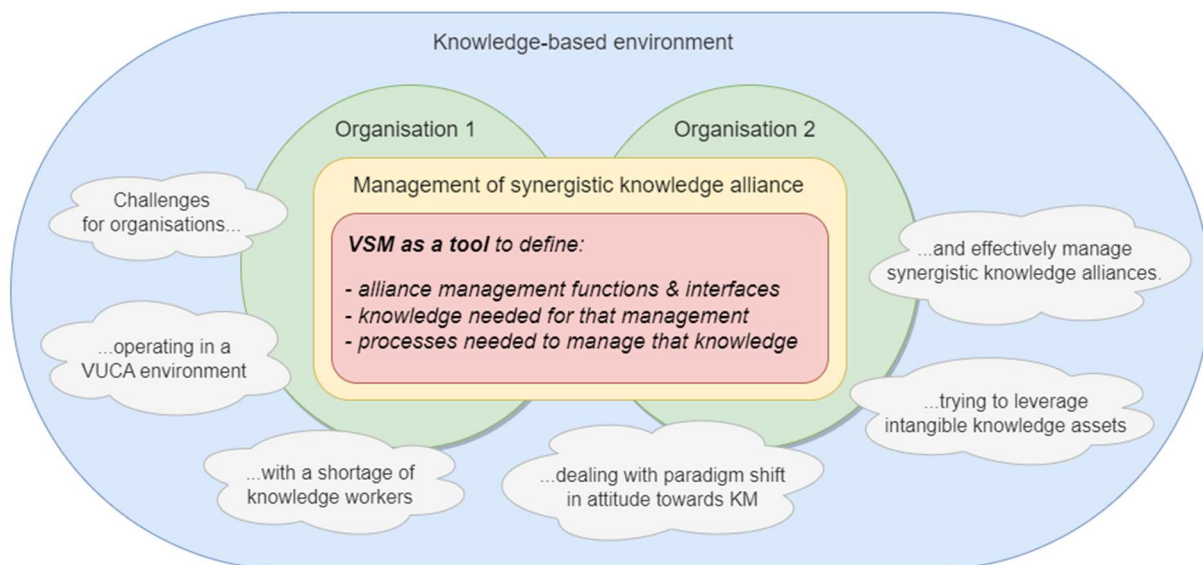


Figure 1: Research focus – VSM as a tool to support the design of synergistic knowledge alliances.
Source: Self-created.

1.2 Research question

Given the advantages achievable by organisations that succeed in forming real synergistic alliances and the clear need for efficient and effective management of knowledge within the alliance; and furthermore, given the allure of VSM as a tool for identifying the necessary and sufficient functions and relationships in an organisation to remain viable in the face of a changing environment, this research is interested to investigate the following question:

How can the VSM be utilised, in the context of a synergistic knowledge alliance, to define necessary alliance management functions and relationships, the knowledge required by that management to fulfill those functions, and the processes that need to be in place to manage that knowledge?

The following research objectives are defined as the means of answering the above question and their completion will be cross-checked at the end of the research in order to demonstrate whether this goal has been achieved:

- **Objective 1:** Construct a VSM of a business alliance and link the VSM with the core elements of KM theory in an intuitive manner.
- **Objective 2:** Construct an application framework to support the design of the alliance management functions and interfaces, the knowledge required by management to fulfill those functions, and the processes that need to be in place to manage that knowledge.
- **Objective 3:** Refine the theoretical model and application framework together with practitioners that are actively involved in the organisation of a newly formed international alliance with the target of improving its general practability for business applications.
- **Objective 4:** Apply the refined model and application framework to that same specific alliance in order to observe and record its usage. "The ultimate test of ideas is their usefulness in practice" (Probst, 1998, p. 18).
- **Objective 5:** Review and compile a reflective assessment of the usage of the model and framework in the practical application together with alliance stakeholders.

1.3 Document structure

1. Introduction

1.1. Topic motivation

- Describes the context, motivation and focus of the research.

1.2. Research question

- Specifies the tangible objectives and ultimate goal of the research.

1.3. Document structure

- Provides an overview of the main purpose of each section of the thesis.

2. Research methodology

2.1. Philosophical assumptions

- Describes the researcher's philosophical assumptions adopted during this research.

2.2. Research design

- Outlines the purpose, activities and stakeholder roles for each stage of the research.

2.3. Research stakeholders

- Specifies the specific alliance considered in this research.
- Announces the researcher's relationship with the alliance.

2.4. Formal research methodology

- Formally describes the research methodology employed.

3. Theoretical foundation

3.1. Knowledge management

- Introduces concepts and definitions of knowledge management used in the research.

3.2. The viable system model

- Introduces concepts and definitions of the VSM used in the research.

3.3. Existing KM applications of VSM

- Identifies existing KM applications of VSM.
- Explains why an existing framework linking KM warrants further research (research gap).
- Specifies what aspects of the framework are employed and extended in this research.

4. Empirical results

4.1. General model and framework

- Presents a VSM model of a business alliance linking the core elements of KM theory.
- Presents an application framework to support the design of alliance management.

4.2. Specific application

- Applies the developed model and application framework to a specific business alliance.
- Provides an overall assessment and recommendations for the specific alliance.
- Provides an assessment of the model and framework during the specific alliance application.

5. Conclusions

5.1. Research summary

- Summarises the journey through the complete thesis highlighting key findings and takeaways.

5.2. Implications & further research

- Reviews the benefits that the research brings to academics and practitioners.
- Recognises aspects of the research that have not been fully addressed and would benefit from further research.

Table 1: Summary outline of the structure and content of the research thesis.

2 Research methodology

In this chapter, a brief description of the philosophical assumptions taken towards the research is provided. This is followed by an outline of the design of the research carried out as well as a description of the stakeholders involved. Finally, the chapter concludes by formally addressing aspects of the research methodology not explicitly mentioned during the description of the research design.

2.1 Philosophical assumptions

At the heart of any research is a researcher and possibly the most important element of a research is the researcher's philosophical assumptions in terms of ontology, epistemology, axiology, and rhetoric. After all, it is the researcher's view of the world that leads to the research question and objectives, which shapes the research methodology and determines how results are interpreted and presented. Having said all that, the reader is likely not overly interested in the researcher's "view of the world" and will judge the topic relevance and research reliability, validity and generalisability based on the evidence provided and their own view of the world. However, in the interest of completeness, the researcher's philosophical assumptions are briefly described here below.

- **Ontological assumption** (*nature of reality*): The researcher appreciates that social interactions are complex and different realities exist depending on the perspective/position/involvement of the observer in the situation. However, the researcher's overriding view is that social interactions generally share commonalities, and a single reality exists independent of the observer - although it is often imperfectly comprehended and captured.
- **Epistemological assumptions** (*nature of knowledge*): In the researcher's view, knowledge must have a clear and practical purpose in the "real world" (usefulness). It must be clear, structured, unambiguous, and objective (objectivity). There may be some exception cases where the rules of provided knowledge break down, but the exception triggers should be known (so as to allow generalisability). Knowledge should be made simple and intuitive so that it is accessible for everyone (useability). And finally, knowledge is a set of tools needed to get jobs done - one must know when a particular tool is applicable (context matters).
- **Axiological assumptions** (*values and ethics*): The researcher believes that it is acceptable and even beneficial to express personal values and beliefs during the research, as long as it is part of a group dialogue and a group effort to reach a consensus of the best possible objective outcome. The researcher is aware that values and beliefs could unintentionally manipulate/bias a subjective topic but does not view this research as being subjective.

- **Rhetorical assumptions (communication):** Since the research is considered to be objective and researcher values do not influence the process of arriving at a scientifically “correct” result, a passive language is generally adopted by “the researcher”.

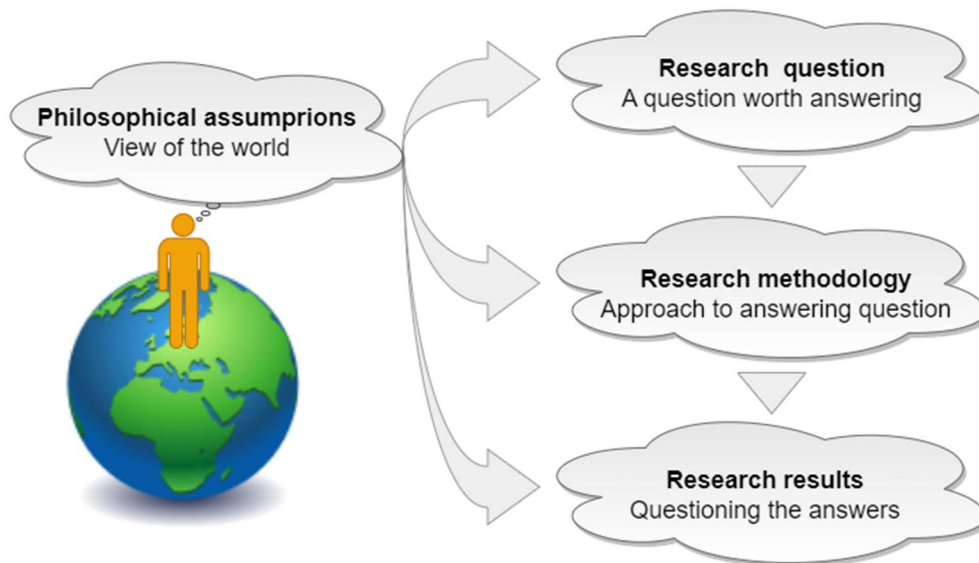


Figure 2: Illustrates the influence of a researcher's philosophical assumptions on a research.

Source: Self-created

2.2 Research design

The research is divided into four stages of development, namely tool construction, refinement, application, and evaluation as illustrated in Figure 3. A description of these four research stages is provided here below.

- **Tool construction stage:** This stage is designed to satisfy research objectives 1 and 2. Based on a thorough desk research of relevant literature (see Chapter 3 - Theoretical foundation), a VSM model of a business alliance is constructed and clear links to the core elements of knowledge management theory are established. Furthermore, during this stage, an application framework is constructed to support the design of alliance management functions and interfaces, the knowledge required by management to fulfill those functions, and the processes that need to be in place to manage that knowledge.
- **Tool refinement stage:** This stage is designed to satisfy research objective 3. During this stage, the theoretical model and application framework constructed in previous stage is optimised for practical application together with decision makers, organisation architects and alliance strategists that are involved in the development of a business alliance specifically selected for this research. During a series of workshops, the researcher actively collaborates with practitioners with the goal of arriving at a group consensus of

what is considered to be a useful and practical model and application framework. The eventual output of the model construction and subsequent refinement stages are presented in Section 4.1 - General model and framework.

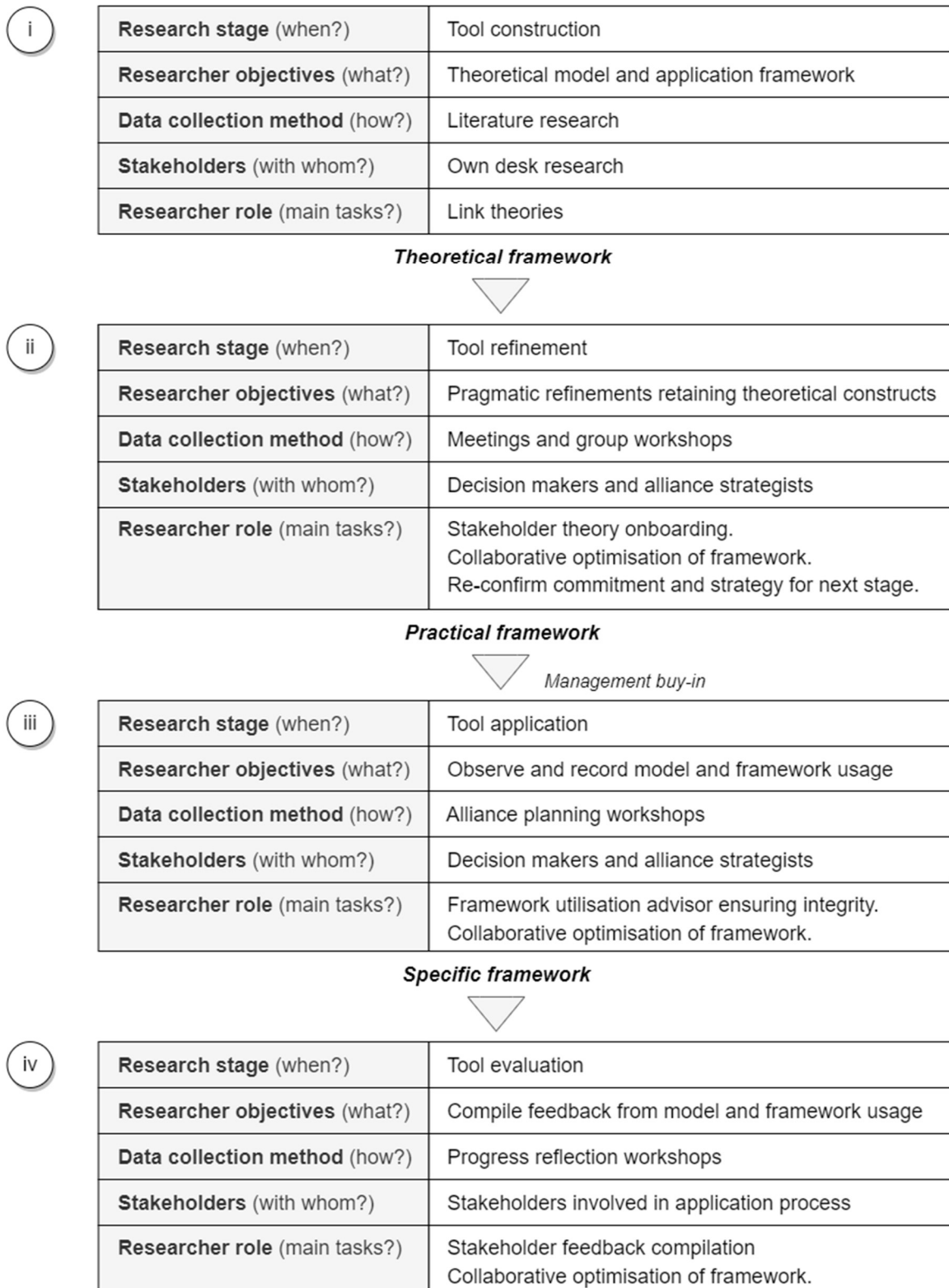


Figure 3: Summary outline of the plan formulated for the execution of the research.

Source: Self-created

- **Tool application stage:** This stage is designed to satisfy research objective 4. During this stage, the refined theoretical framework is utilised by practitioners as a tool to support the organisational planning of the alliance. The researcher, not being a decision-maker, organisation architect or alliance strategist from either organisation of the alliance, does not contribute to organisational planning. But rather, the researcher acts as a facilitator of the framework usage, guiding adherence to or as necessary further refinement of the constructed theoretical model and framework.
- **Tool evaluation stage:** This stage is designed to satisfy research objective 5. During the course of the application stage, the researcher observes barriers encountered towards the usage of the theoretical model and framework and actively engages and collaborates with stakeholders to enable solutions by group reflection and consensus and iteratively improve the model and framework. This means that stakeholders experiences, improvement suggestions and overall impressions of the model and framework are evaluated on a continuous basis during the framework application. The eventual output of the model/framework application and continuous evaluation are presented together in Section 4.2 - Specific application.

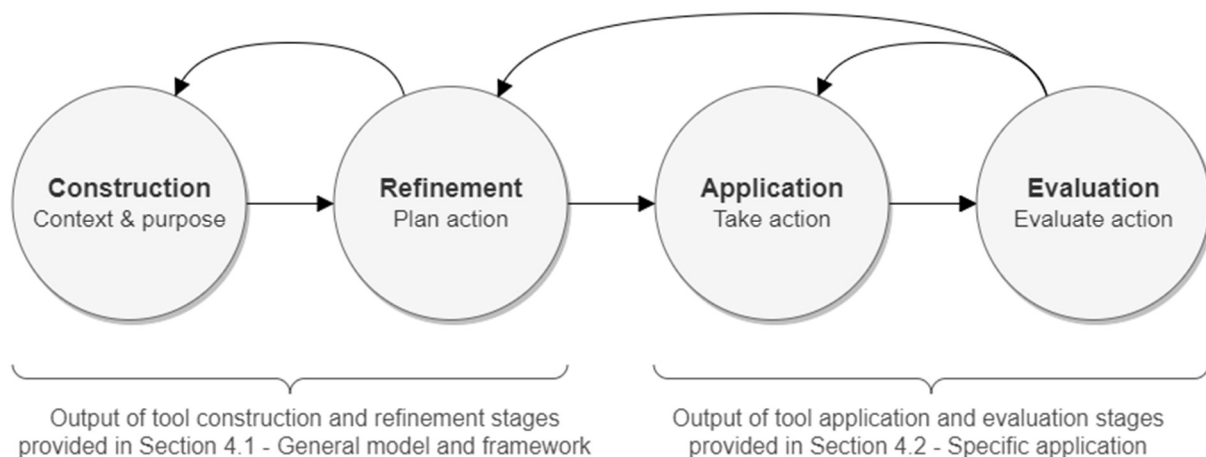


Figure 4: Demonstrates the continuous iterative feedback process between the research stages.

Source: Self-created based on the “Action Research spiral” (Saunders et al., 2015, p. 191)

2.3 Research stakeholders

A brief overview of the business organisations that have formed the alliance considered in this research is provided in Table 2. For discussion purposes, the first organisation shall hereafter be referred to as the *module vendor* (or *Org. DE*) and the second organisation shall be referred to as the *system developer* (or *Org. AU*). The businesses have a long-standing customer-supplier relationship with the system developer purchasing modules from the module vendor.

	Org. DE: Module vendor	Org. AU: System developer
Primary activity	Manufacturer and vendor of range of standard computer (CPU) modules. Influential global stakeholder for definition of module standardisations.	Custom development and production of electronic products for OEMs (hardware / software / mechanical systems & sub-systems).
Market sector	Similar to Org. AU and various others	Medtech, industry, cybersecurity
Market regions	Worldwide sales	Mainly DACH region
Revenue	2021: ~€130M	2021: ~€40M
#Employees	2021: ~300	2021: ~120
Site locations	German HQ and 9 locations divided between Poland, Czech, USA, China, Taiwan, Japan, and Australia.	Austrian HQ and 2 additional locations in Germany

Table 2: Overview of the businesses that have formed the alliance considered in this research.

Table 3 illustrates the obvious benefit of an alliance from the perspective of potential customers. Both businesses recognise that achieving a seamless one-stop-shop solution for customers as well as together generating new innovative offerings into the future will involve a level of alignment and integration not needed for the existing customer-supplier relationship. Therefore, less obvious is the strategy for implementing necessary alliance management functions and relationships, the knowledge required by that management to fulfill those functions, and the processes that need to be in place to manage that knowledge so as to ensure a synergistic and long-term viable alliance in the face of changing external factors. This research uses this specific alliance to assess the practical application of a theoretical model/framework as a tool to assist with this organisational challenge.

	Competitors	Module provider	System developer	Alliance
Own CPU modules	✓	✓	✗	✓
CPU module expertise	✓	✓	✗	✓
Baseboard design	✓	✗	✓	✓
System integration	✓	✗	✓	✓
System production	✓	✗	✓	✓

Table 3: Demonstrates the strategic benefits of the alliance.

The business alliance in question, publicly announced in early 2022, triggered the researcher's interest in the challenges surrounding the implementation of such an alliance and is one of the motivational factors for this research. That is to say, how to go from a 'looks-good-on-paper' alliance to a truly synergistic functional network of effective relationships with a shared sense of purpose that is capable of developing and applying new knowledge?

It is important to state at this point that the system developer organisation is, in fact, the researcher's place of employment. It is perhaps also relevant to mention that the researcher is a member of the operational staff and is not an organisation decision maker, organisation architect or an alliance strategist.

Note that at the time of the start of this research, almost 1 year after the announced alliance, the formation of a strategy for actual implementation of a working alliance is still at a very early stage. It is fair to say that early momentum has somewhat suffered as a result of necessary re-prioritisation of available planning resources to troubleshoot the fallout of the continued recovery from the global supply chain crisis. Nonetheless, management remain optimistic regarding the alliance and its potential for creating competitiveness. This research therefore coincides with the still early strategic analysis and planning phase of the alliance formation.

2.4 Formal research methodology

So far, a research question has been posed, research objectives have been set, insights to the researcher's philosophical assumptions have been shared and the research execution plan has been outlined, the results of which should demonstrate that the objectives have been reached and the question answered. In order to now ensure that all aspects of a sound research methodology have indeed been considered, this section applies the highly-cited "research onion framework" (Saunders et al., 2015) as a means of cross-check and labelling.

- **Philosophy:** Based on the researcher's philosophical assumptions shared in section 2.1, one could describe the researcher philosophy as positivism or possibly post-positivism since there is an acknowledgement that social interactions are complex and often imperfectly comprehended and captured. However, given the type of research question and the lack of a large data population to validate a theory, the researcher has adopted the philosophy of **pragmatism**. The research design clearly demonstrates that different types of knowledge and methods are considered appropriate, whichever gives the most value, validity and reliability, in order arrive at a solution. Provided that data is relevant and reliable and methods are credible and well-founded then the research quality is considered dependable (Saunders et al., 2015).

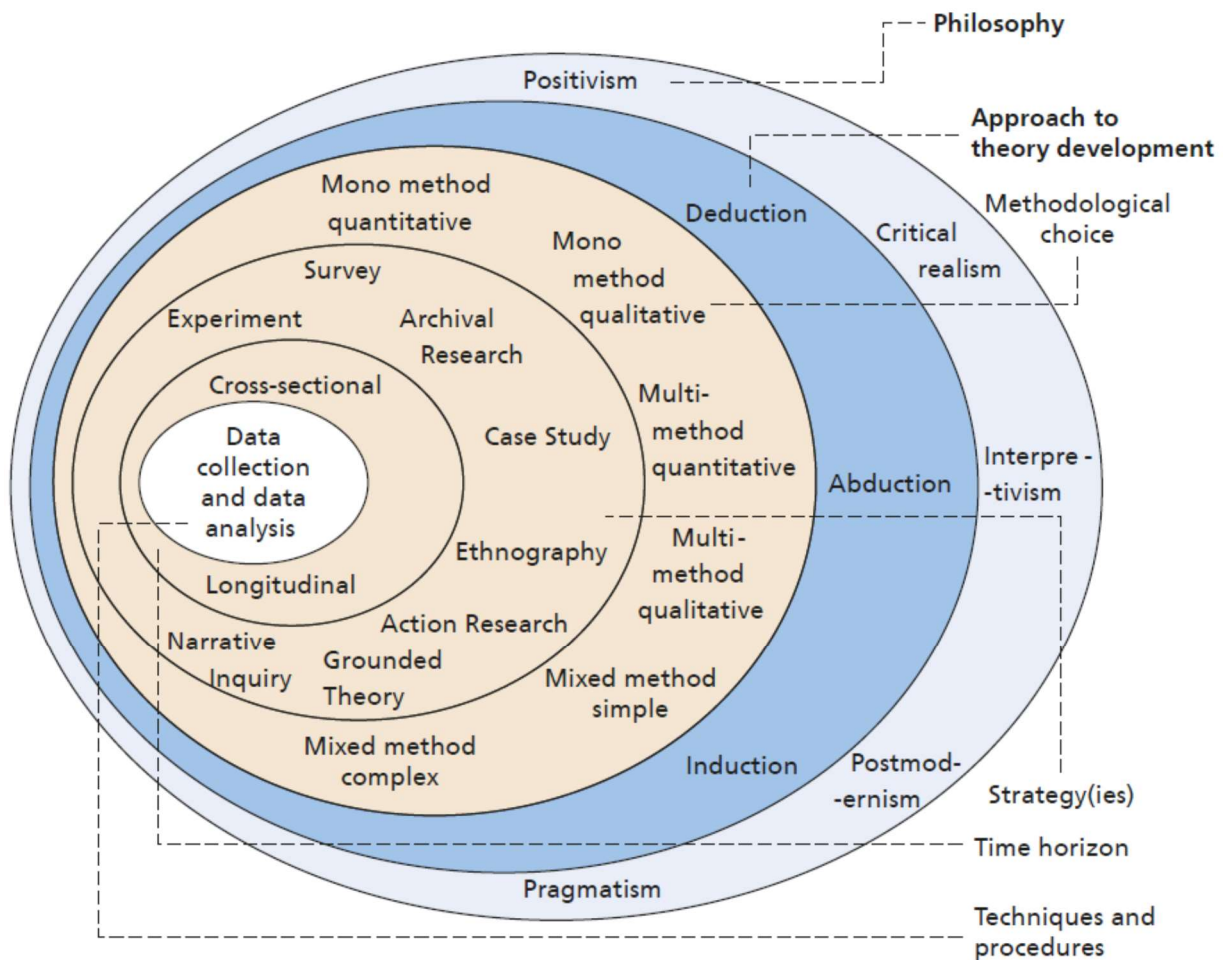


Figure 5: Saunders' research onion framework

Source: (Saunders et al., 2015, p. 124)

- Approach:** The research seeks out practical perspectives in order to refine a theoretical model/framework and, after its application attempts to evaluate the proposition that the framework is useful during alliance formation. It could be argued that this is a somewhat **abductive** approach to the research because there is a constant back and forth movement from theory to data to theory (see Figure 4) which is a property of abduction (Saunders et al., 2015). However, the researcher is not keen to necessarily assign a single label to the approach, “as pragmatists are more interested in practical outcomes than abstract distinctions” (Saunders et al., 2015).
- Methodological choice:** The research does not seek to test a hypothesis especially since a suitable quantity of data relevant to the subject topic is certainly not available and therefore cannot be described as typical quantitative research. Also, the research does not seek to make sense of “subjective and socially constructed meanings” (Saunders et al., 2015) and therefore cannot be described as a typical qualitative research. There are elements of a qualitative (albeit objective) as well as quantitative (albeit low quantity non-

numeric data) in the research and one might label it as **mixed method simple**. “Both quantitative and qualitative research are valued by pragmatists and the exact choice will be contingent on the particular nature of the research” (Saunders et al., 2015)

- **Research strategy:** The strategy contains all the hallmarks of an **action research**, namely, research, focused on addressing real-life practical problems, participation of the researcher as well as members of the social unit, group decision making regarding actions to be taken, an iterative process of inquiry-action cycles, with the goal to bring about improvement of organisational practices and implications beyond the research project (Saunders et al., 2015). Saunders et al. (2015) said of an action research, and it is certainly the hope of this researcher, that:

Implications from the process may be used to inform other contexts. Academics will use the results from undertaking Action Research to develop theory that can be applied more widely. Consultants will transfer knowledge gained to inform their work in other contexts (p. 192).

- **Time horizon:** An action research which brings about organisational change and improvement tends to be longitudinal in nature. Since the research is short-term and essentially **cross-sectional**, the full extent and long-term implications of the action research are not possible within the scope of the research.
- **Data sample:** The details of the **specific alliance** considered in the action research is provided in Section 2.3.
- **Data collection & analysis:** The research design outlines that data for model/framework refinement and evaluation is collected from stakeholders of the specific alliance during **meetings** and group **workshops**. Meetings are conducted in an agile, solutions-oriented, objective manner with the goal of arriving at a stakeholder-consensus of what is considered to be the next best iterative step towards improving the framework and formation of the alliance.

3 Theoretical foundation

This chapter provides a brief and general overview of both organisational knowledge management and the viable system model (organisational/management cybernetics). Both topics are extremely vast, and so the scope is necessarily limited and mainly targeted towards the concepts and terminology utilised later in this research. Importantly, the chapter concludes by specifying the principles, drawn from literature review, that are adopted by the research (see Section 3.3 - Existing KM applications of VSM).

3.1 Knowledge management

The goal of knowledge management (KM), as Probst (1998) simply put it, “is a practical one: to improve organisational capabilities through better use of the organisation’s individual and collective knowledge” (p. 17) or as North & Kumta (2018) similarly put it two decades later, “is to generate knowledge from information and convert this knowledge into a sustainable competitive advantage that can be measured as success in the business” (p. 10). The exact recipe for the implementation of KM required to achieve this seemingly simple goal is however less than simple. The famous lamentation of former Hewlett Packard CEO, Lew Platt, encapsulates both the motivation for and the struggle with achieving an effective KM “if HP knew what it knew, it would be three times as profitable”.

The challenge for KM is that firstly, the management of knowledge encompass all aspects of a business organisation which is itself is a complex-adaptive system and secondly, and most fundamentally, there is no general consensus on how exactly to define knowledge. The latter often becomes a philosophical debate regarding an intangible object which is boring and obscure to practitioners (Spender & Scherer, 2007). It is far beyond the scope of this research to attempt to perform a taxonomy of the vast volumes of literature on KM and to provide a comprehensive discussion of a subject matter still apparently in a state of flux. However, the following sections use a pertinent selection of modern and/or well-cited literature in order to introduce the terminology and concepts on which this research is based.

3.1.1 Concept of knowledge

Before discussing the different types of KM activities that take place in an organisation in the next section, it is important to recognise the different attributes of knowledge that influence how those activities are conducted and therefore how formal knowledge processes are designed. Holsapple & Joshi (2004) described that knowledge represents itself in many *formats* including mental, behavioral, symbolic, digital, visual, audio, and other sensory patterns and that regardless of the format, knowledge has a variety of *attributes* including but not limited to the following: mode (tacit vs. explicit), type (descriptive vs. procedural vs.

reasoning), orientation (domain vs. relational vs. self), applicability (local vs. global), accessibility (public vs. private), immediacy (latent vs. currently actionable) and perishability (shelf life).

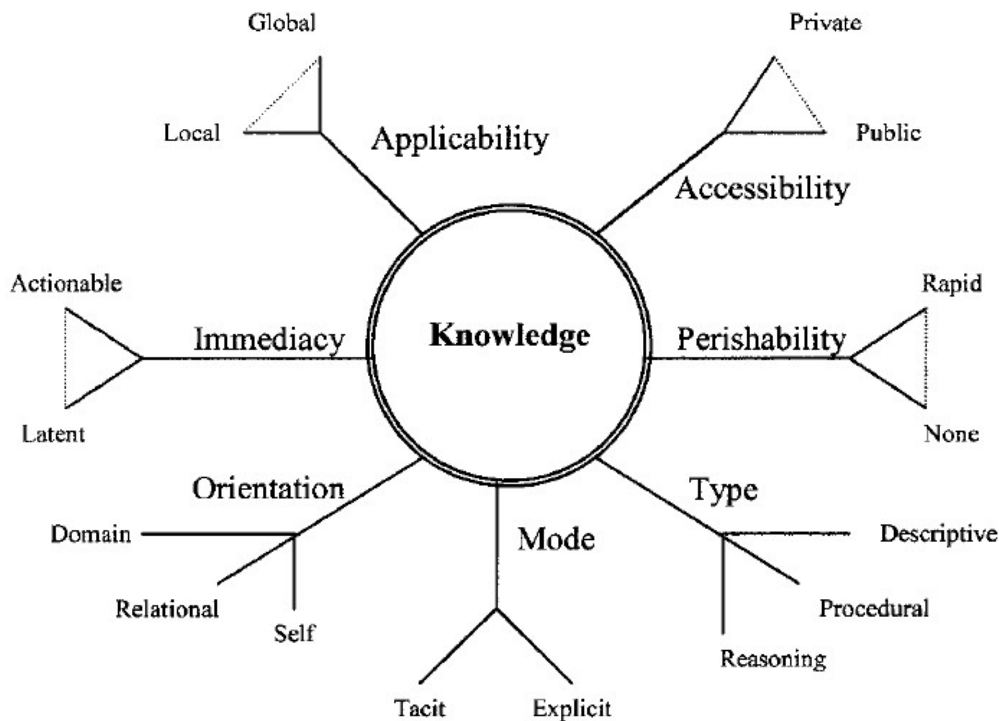


Figure 6: A non-exhaustive web of knowledge attributes.

Source: (Holsapple & Joshi, 2004, p. 598)

According to the resource based view of an organisation, knowledge can be treated as a *resource* of the organisation with the potential of being a source of sustained competitive advantage should it satisfy the four *VRIN* criteria of being: (a) Valuable for exploiting opportunities and/or neutralising threats, (b) Rare among current and potential competition, (c) Imperfectly imitable by competitors and (d) Non-substitutable, meaning that there are not alternative resources that are neither rare nor imperfectly imitable (Barney, 1991).

Holsapple & Joshi (2004) described the processing of a knowledge resource instance as a knowledge *episode* and the individual/collective with the skills to perform the processing as the knowledge *processor*. Depending on the attributes of a knowledge resource, including its *VRIN* value, the knowledge episode may be categorised based on the nature of the intent, such as strategic planning, decision making, designing, researching, negotiating, problem solving, and brainstorming (Holsapple & Joshi, 2004). No matter the intent, the processing of knowledge, that has been deemed relevant to the organisation, brings about learnings that enriches the level of knowledge within the organisation in some way (Holsapple & Joshi, 2004). The knowledge ladder (North & Kumta, 2018) shown in Figure 7 is a useful tool for

visualising the evolution of knowledge level (i.e., its increase in value as a VRIN resource) within an organisation leading to eventual competitiveness. The knowledge ladder also provides a useful visual to aid discussions related to many other aspects of KM such as, for example, knowledge modes, IT limitations in KM and KM omnipresence (each of which are briefly discussed in the following bullet points).

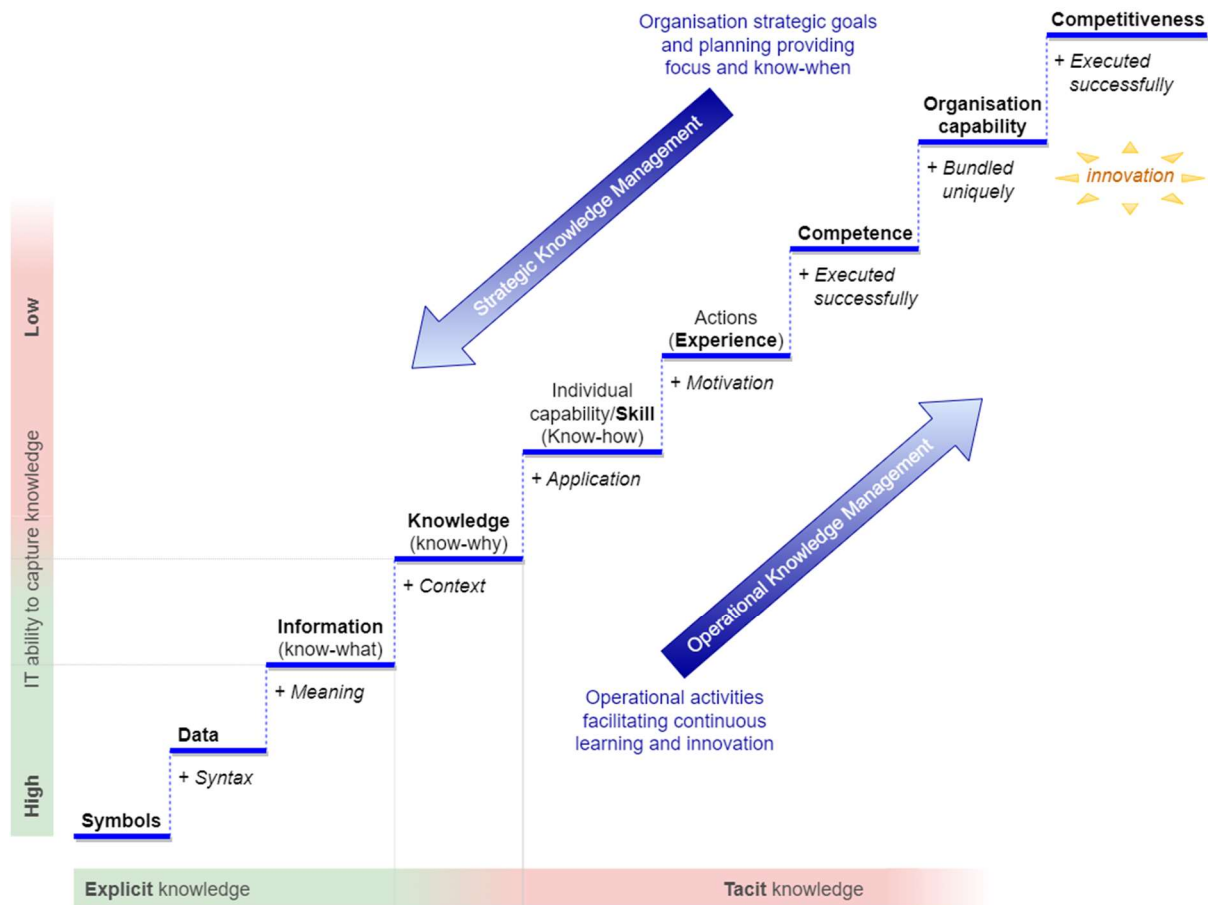


Figure 7: The knowledge ladder.

Source: Additions and modifications of original (North & Kumta, 2018, p. 35)

- Knowledge modes:** The knowledge ladder indicates that symbols, data and information are *explicit* knowledge meaning that the knowledge is codifiable in the form of text, audio, video, images or algorithms which are portable artifacts that are easily captured and transferred (Milton & Lambe, 2020; North & Kumta, 2018). Knowledge of the context in which explicit knowledge is applicable often requires a deeper understanding of the subject matter and its subtleties and is referred to as *implicit* knowledge. As application context become more subtle and subjective, and more based on experience and intuition of individuals, then the knowledge is said to become increasingly *tacit*. Since tacit knowledge is *embodied* in individuals, it is often difficult to articulate and codify and consequently it is

difficult to capture and transfer to others (Milton & Lambe, 2020; North & Kumta, 2018). Note that the terms implicit, tacit and embodied knowledge are generally interchangeably used within literature to mean the same thing and so going forward this document shall simply use the terms explicit knowledge and tacit knowledge.

In the interest of completeness, it is worth to mention that some literature also uses the term *embedded* knowledge to refer to knowledge that is embedded into an organisation's products/services and processes (North & Kumta, 2018; Dalkir, 2013; Davenport & Prusak, 1998). Embedded knowledge may, for example, originate from individual knowledge that over time has become an unspoken shared collective norm such that it is automatically assumed must be part of any new product/service or process. Embedded knowledge is therefore often not explicit knowledge and has much to do with the history and culture of the organisation (Davenport & Prusak, 1998). In practice "it is difficult to locate the dividing line between knowledge that is fully embedded in a process and the tacit, human knowledge that keeps the process going" (Davenport & Prusak, 1998, p.187). In summary then, the use of the terms explicit knowledge and tacit knowledge typically suffice to describe the modes of knowledge, recognising that there is a continuum of tacitness in between these two extremes.

The fact that tacit knowledge is complexity that has been internalised and fine-tuned by an individual over a long period of time means that it is almost impossible to quickly separate that knowledge from the individual person or to reproduce that knowledge in the form of a document, database or other tangible artifact (Davenport & Prusak, 1998; Nonaka & Takeuchi, 1995). This means that while tacit knowledge is seen as the most potentially valuable VRIN resource to an organisation (North & Kumta, 2018; Nonaka & Takeuchi, 1995), it also poses a risk should individuals possessing such knowledge depart the organisation and thus making knowledge retention an important aspect of any KM strategy (Dalkir, 2013). "Much of an organization's valuable knowledge walks out the door at the end of the day" (Dalkir, 2013, p.2). Not surprisingly then, the more tacit the knowledge the more costly its administration in an organisation (Spender & Scherer, 2007).

- ***IT limitations in KM:*** There is no doubt that IT/ICT plays an important role in KM. However, some business leaders have a false sense of security that technology alone will be enough to harvest the value of knowledge management.⁸ This has of course, in part, been fed by clever marketing of enterprises selling Knowledge Management Systems (KMS), Management Information Systems (MIS) and Business Intelligence (BI) systems. For example, IBM in promoting its AI-powered search tool describes "Knowledge management

⁸ <https://www2.deloitte.com/us/en/insights/focus/technology-and-the-future-of-work/organizational-knowledge-management.html>

(KM) is the process of identifying, organizing, storing and disseminating information within an organization.” and that “a knowledge management system (KMS) harnesses the collective knowledge of the organization, leading to better operational efficiencies.”⁹ From the knowledge ladder and based on the previous discussion of tacit knowledge, it should now be clear that KM involves much more than just information and that any IT system cannot possibly hope to identify, organise, store and disseminate the collective knowledge of an organisation. As Richardson et al. (2006) put it, “the preponderance of knowledge management theory stems from strategy and organizational theory research, but in practice KM tends to rely on information technology and the theories do not relate to design and use of information technology” (p. 1322).

- ***KM omnipresence***: A short consideration of the steps of the knowledge ladder quickly leads to the realisation that KM is an integral part of all functions and all levels of an organisation including, for example, strategic decision making, innovation management, competence management, human resources, business process management, operational activities, and ICT. This means that the role of KM could be fulfilled in an organisation by a dedicated formal KM team or informally dispersed across the organisation under different roles and titles. Furthermore, regardless of the chosen organisational structure, since KM demands the involvement of all organisation functions, it is possible to define borders of responsibility and communication interfaces in any number ways. It is therefore important that KM roles, responsibilities and interfaces are clearly defined, well communicated, and continuously re-evaluated in order to avoid general inefficiencies and personnel dissatisfaction leading to ineffective or potentially dysfunctional KM. It is, in fact, this concern (particularly with the additional complexities posed by the formation of an intended synergistic knowledge alliance) and the conviction that a tool to support the definition of roles, responsibilities and interfaces is needed that are the main impetuses for this research. The research is necessarily narrowed to focus on the organisation management level but as we shall later see can be recursively scaled to all levels of an organisation.

Finally, Figure 8 combines concepts introduced earlier in this section to illustrate the facilitating role of KM in processing knowledge episodes in a typical closed-loop management pattern (Deming’s cycle of Plan, Do, Study, Act). Achterbergh & Vriens (2002) defined the knowledge that is needed for KM to function in an organisation to be that which is needed “for the assessment of signals and for the performance of actions” (p. 226). They further broke down *assessment of signals* into knowledge needed to allow the *perception, interpretation* and *evaluation* of signals and *performance of actions* into knowledge needed to allow the

⁹ <https://www.ibm.com/cloud/learn/knowledge-management>

articulation, selection, and implementation (see Table 4). This definition of knowledge is a key concept adopted by this research and will be re-visited in Section 3.3.

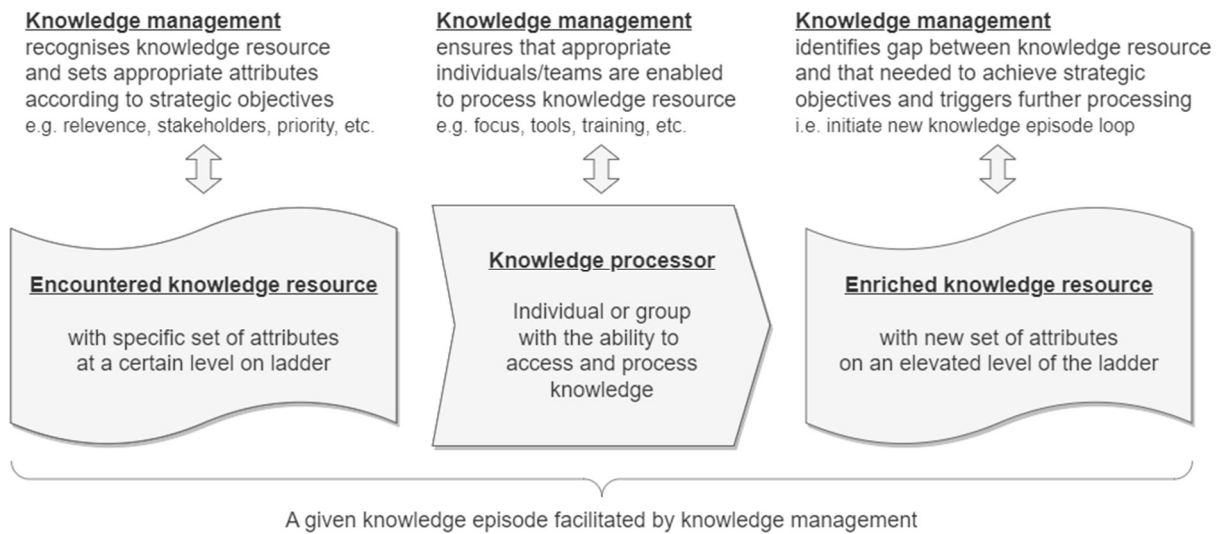


Figure 8: Illustrates knowledge management facilitating a knowledge episode.

Source: Self-created.

Knowledge is needed to allow the <i>assessment of signals</i> , that is...	
knowledge for <i>perception</i>	...is needed to allow detection and identification of a new knowledge resource.
knowledge for <i>interpretation</i>	...is needed to allow meaning to be assigned to the knowledge resource.
knowledge for <i>evaluation</i>	...is needed to allow a determination of whether knowledge is applicable and warrants action.
Knowledge is needed to allow the <i>performance of actions</i> , that is...	
knowledge for <i>articulation</i>	...is needed to allow postulation of different possible courses of action.
knowledge for <i>selection</i>	...is needed to allow evaluation of trade-offs and selection of optimum action.
knowledge for <i>implementation</i>	...is needed to allow the planning and execution of selected action.

Table 4: Knowledge required by knowledge management to fulfill its function.

Source: Based on “functional definition of knowledge” (Achterbergh & Vriens, 2002, p. 226)

3.1.2 Knowledge processes

King (2009) defined KM as “the planning, organizing, motivating, and controlling of people, processes and systems in the organization to ensure that its knowledge-related assets are improved and effectively employed.” (p. 4). In order for KM to fulfill such a role of managing operational knowledge within an organisation that leads to strategic benefits for the organisation, then it too needs knowledge and processes for managing that knowledge. This naturally starts to raise questions such as, for example, what are sources for the knowledge needed for KM? how can the required knowledge be extracted from these sources? who else in the organisation requires this knowledge to allow its successful application? how can the knowledge be translated and applied in practice? how can newly generated knowledge be protected and retained in the organisation? and the consideration of such questions provides input for the design of processes needed for KM.

There is no general agreement in literature regarding the quantity or definition of knowledge processes and various labels, differing descriptions and combinations have been used such as, for example, knowledge *identification, creation, generation, development, and acquisition*, knowledge *sharing and distribution*, knowledge *transfer, application, use, and utilisation*, and knowledge *codification, storage, preservation, and retention* (Probst, 1998; Davenport & Prusak, 1998; Marquardt, 2002; Achterbergh & Vriens, 2002; King, 2009; Shehadeh & Mansour, 2019).

Achterbergh & Vriens (2002) deemed four core knowledge processes (*generation, sharing, application and retention*) to be central to the variety of relevant processes and sufficient for capturing the essence of all KM activities. Probst (1998) defined six knowledge processes or “building blocks” (identification, acquisition, development, distribution, use and preservation) as well as stipulating a feedback to measure goal achievement (see Figure 9). This research uses the four processes from Achterbergh & Vriens (2002) but also includes the identification process from Probst (1998). It makes sense to include identification as a separate process because it forces a focused discussion regarding how a new knowledge episode is detected, how it is measured and where knowledge to support the knowledge episode can be found. According to Probst (1998), “many knowledge problems occur because organizations neglect one or more of the knowledge management building blocks and interrupt the knowledge cycle” (p. 19). Heeding the advice from this accomplished academic and practitioner, the research therefore also includes Probst (1998) separate acquisition and development processes under the single more general definition of Achterbergh & Vriens (2002) generation process. Table 5 summarises the knowledge processes that are adopted by this research and will be revisited later in Section 3.3.

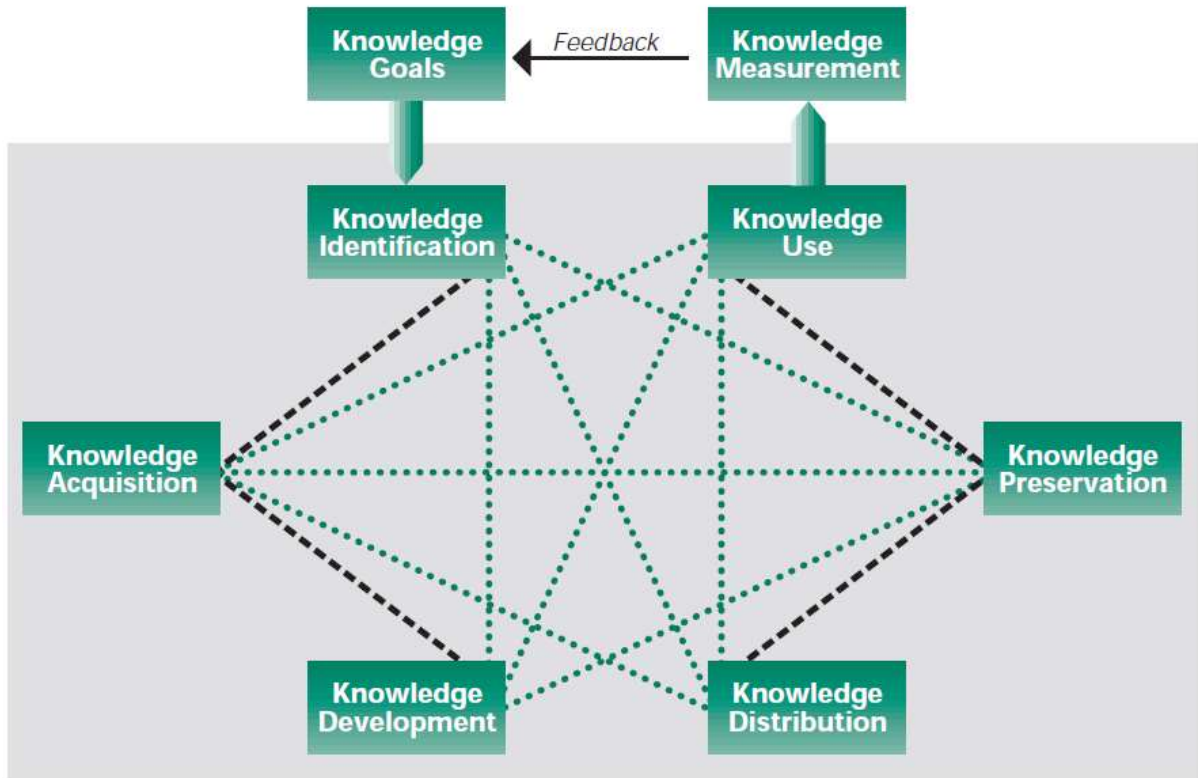


Figure 9: Probst's building blocks of knowledge management.

Source: (Probst, 1998, p. 19)

Probst (1998)	Achterbergh & Vriens (2002)	This research	Researcher's assigned meaning. Process considers for example...
Identification	-	Identification	how new knowledge is detected and how knowledge sources are identified.
Acquisition	Generation	Generation	how knowledge is gained/transferred from knowledge source, be it external or internal.
Development			
Use	Application	Application	how the gained knowledge is utilised for the application performed.
Preservation	Retention	Retention	how to ensure that gained knowledge is never lost by the organisation's memory.
Distribution	Sharing	Sharing	how to ensure relevant knowledge is shared with the right stakeholders at the right time.

Table 5: Knowledge processes adopted by this research.

Source: Self-created.

As mentioned in the previous section, in order to design an effective knowledge process (identification, generation, application, retention or sharing) for a particular category of knowledge episodes, then the attributes of the knowledge resource to be processed should be consciously and carefully considered as design input. As also mentioned previously, the knowledge mode (explicit vs. tacit) is of particular relevance due to potential benefits but also challenges and risks associated with tacit knowledge.

According to the seminal work of Nonaka & Takeuchi (1995) on knowledge creation theory, it is the continuous and dynamic interaction between tacit and explicit knowledge that leads to knowledge creation and innovation. Nonaka & Takeuchi (1995) developed the highly cited SECI model to explain the types of processes that need to take place in order to transition from tacit knowledge of one individual to explicit knowledge, which can more easily be leveraged by the organisation as a whole, and returning again to internalised tacit knowledge of another individual. KM “strategies should therefore revolve around the tactical processes which focus on capturing and converting individual knowledge for achieving organisational goals” (North & Kumta, 2018, p. 162). Figure 10 shows the knowledge conversion phases of the SECI model to be Socialisation, Externalisation, Combination, and Internalisation which are briefly outlined in the following bullet points.

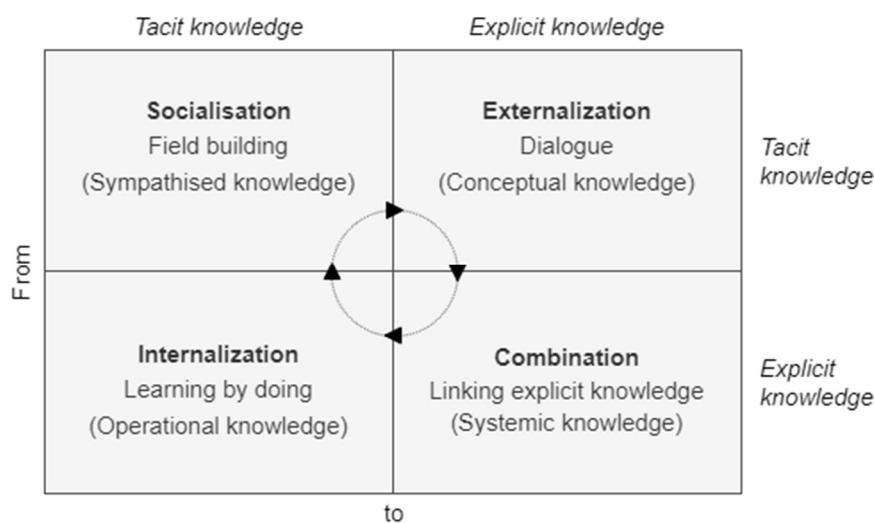


Figure 10: Phases of knowledge conversion and the knowledge spiral

Source: Self-created based on (Nonaka & Takeuchi, 1995, p. 71-72)

- Socialisation is required to transfer tacit knowledge of one individual to another. A mentor-apprentice system is an example of socialisation which allows for novice practice and experienced correctional guidance.

- Externalisation is required to transfer tacit knowledge to a conceptual form of explicit knowledge. This can be encouraged by “meaningful dialogue or collective reflection, in which using appropriate metaphor or analogy helps team members to articulate hidden tacit knowledge that is otherwise hard to communicate” (Nonaka & Takeuchi, 1995, p. 71).
- Combination is required to transfer from a conceptual form of explicit knowledge to explicit knowledge. This is triggered by combining the as yet conceptual form of explicit knowledge together with existing knowledge from other areas of the organisation to develop new products, services, or systems. This helps to crystalise and codify the knowledge explicitly.
- Internalisation is required to transfer from explicit to tacit knowledge. As explicit knowledge is applied by an individual, context, experience and skills are gained and internalised into tacit knowledge.

3.1.3 Relevant knowledge

John Naisbitt, author of *Megatrends* published in 1982, famously coined the phrase “drowning in information but starved for knowledge”. With the exponential advances and accessibility of technology including the Internet, this prediction could not have been more true. For KM in an organisation to avoid drowning and to be able to function efficiently, it needs to focus on *relevant* knowledge. That is to say, KM should ensure in a systematic manner that the right knowledge is in the right place and the right time in order to facilitate the organisation achieving its strategic goals which it believes will provide competitive advantage.

Therefore, an organisation’s senior management play a critical role in formulating a KM strategy by providing clear purpose, scope and values for the organisation as well as its specific short-term tactical/operational and long-term strategic goals. This is a mutually dependent and bi-directional working relationship, with KM also providing information about available and potential knowledge resources allowing management to set realistic goals that are based on the organisations’s capabilities. Of course, this must be a continuous iterative process since organisational goals and knowledge resources change and require adaption due to the VUCA nature of the business environment. As Spender & Scherer (2007) put it:

Under the conditions of uncertainty which always exist in the managerial world there is no description of the context that allows one to reason logically to the recipe for best performance. While one can say, retrospectively, ‘of course’, one can never say, ‘it could only be this way’ (p. 25).

Management leadership style and organisational culture hugely influence employee attitudes towards KM and their willingness and ability to self-determine if encountered knowledge resources are relevant for the organisation and how they should be processed for the benefit

of the organisation. Organisational culture is the attitudes about the norms, beliefs and values that are unspoken assumptions shared by the employees of the organisation (Schein, 1992). Formed over time through its management leadership style, organisational culture influences employee engagement and psychological safety which in turn influence learning, creativity, knowledge sharing, commitment and accountability (Edmondson, 2019). So, knowledge, and therefore knowledge management, are inseparable from organisational culture and leadership. It is therefore legitimate to view culture as a dimension to be considered during KM implementation/deployment (culture-in-the-model) or to view KM as a dimension that contributes to culture (culture-of-the-model) (Andreeva & Ikhilchik, 2011).

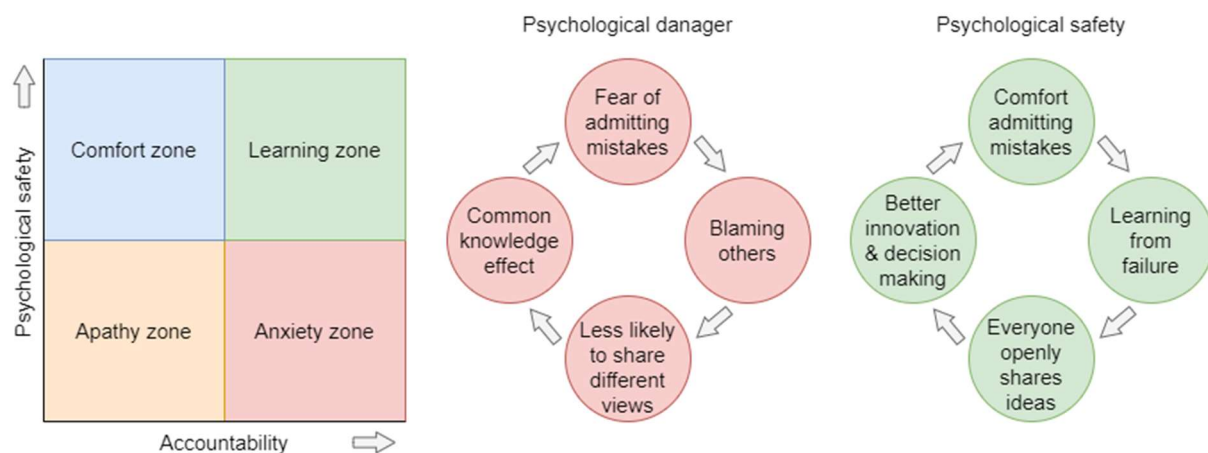


Figure 11: Illustration of Amy Edmondson's psychological safety and accountability

Source: Based on (Edmondson, 2019)

Knoco Global Survey of Knowledge Management (2021) cited cultural issues and lack of support from leadership as the top two KM barriers in an organisation. It is important that leadership should effectively communicate KM as a source of growth and profit, not as a superfluous ballast or as a pure "nice to have" (Probst et al., 2012). Edmondson (2019) recommended leadership behaviours that help to promote a culture of psychological safety including providing work context (purpose), inviting participation, practicing intense listening and humility, expressing recognition and appreciation, destigmatising failure but also sanctioning clear violations. Senge (1990) discussed the need for organisations to evolve to a culture of a "learning organisation":

In an increasingly dynamic, interdependent, and unpredictable world, it is simply no longer possible for anyone to "figure it all out at the top". The old model, "the top thinks and the locals act", must now give way to integrating thinking and acting at all levels. (p. 7)

Senge (1990) described the three leadership roles of leader as designer, leader as teacher and leader as steward (as well as the disciplines/skills needed to fulfill those roles) that are

needed to cultivate an organisational culture of curiosity, learning and sharing that is aligned with the organisation's goals. He defined one of the disciplines that leaders should master is *systems thinking* which as it happens is a concept discussed in the following Section 3.2 - The viable system model. He believed that treating the organisation as a complex-dynamic system composed of smaller systems helps leaders to move away from linear explanations and symptomatic fixes leading to an endless spiral of increasing intervention. Instead, systems thinking helps organisations as a whole (and so leaders) towards recognising and understanding underlying causes, interrelationships, and processes.

3.2 The viable system model

The viable system model (VSM) was developed by Stafford Beer over a period of decades starting in the late 1950s based on the study of cybernetics control theory applied to business organisations. Cybernetics (Wiener, 1948) is the broad area of science concerned with “the study of systems of any nature which are capable of receiving, storing, and processing information so as to use it for control.”¹⁰ In other words, systems that are structured so as to be able to recognise a change in their environment and are able to learn and adapt their behaviour to compensate for the change and so restore equilibrium. Beer's VSM defines the functional structure and interfaces that are required in an organisation so that it can maintain its independent existence (its viability) in the face of the changing environment in which it operates (Beer, 1979).

Organisations are forced to operate in an increasingly VUCA environment (Bennett & Lemoine, 2014). The decentralisation of management functions, autonomy of operational functions and defined communication interfaces of relevant knowledge described by the VSM are key to ensuring an organisation's capacity for rapid adaptation needed to survive and thrive in a VUCA environment. Conceptually, however, VSM is not immediately intuitive and requires a concerted effort to grasp and considerably more to master in practice (Malik, 2002) and is little known among the general management population (Espejo & Gill, 2011). “The VSM has been the subject of criticism and in particular the cognitive accessibility of the VSM has been recognised to be an issue for many who have tried to apply it in everyday or practice” (Lowe et al., 2020, p. 1014). The following sections therefore attempt to provide a clear and concise explanation of the main concepts and principles employed by the VSM, allowing also the introduction of terminology and concepts utilised later in the research.

¹⁰ Credited to famous mathematician Andrey N. Kolmogorov as cited by the American Society of Cybernetics <https://asc-cybernetics.org/definitions/>

Beer is seen as the father of management cybernetics and the inventor of VSM and so, despite its age, modern literature typically still references his original work, "Brain of the Firm" (1972), "The Heart of Enterprise" (1979) and "Diagnosing the System for Organisations" (1985). In general, this research has taken the approach of using Beer's original and seminal work as the primary reference in preference to using modern literature, which in turn references Beer anyway but with its own interpretations (i.e. 'get it straight from the horse's mouth'). However, when further explanation is required modern and/or highly cited literature is employed. Typically cited in this research are two prominent and highly cited authors in the field of VSM with a long trail of publications over a period of many years, namely Raul Espejo, who worked together with Beer during a well-known VSM application in Chile (1971-1972), and Angela Espinosa, a staunch supporter of VSM since her PhD (1988-1994). Additionally, Lassi (2019) has been used to cross-check the correctness and accuracy of explanations in this research.

3.2.1 Unfolding complexity

Systems thinking (or systemic thinking) views a system as a set of interconnected components, that share a collective purpose, and that together develop emergent properties that distinguishes it from other systems (Espinosa, 2022). The number of all possible behavioural distinctions (or states) of a system is referred to as the system's variety and the number of states that are relevant to a particular observer is referred to as the system's complexity (Beer, 1979; Espejo & Reyes, 2011). It is important to note that just because a system complexity is of relevance to an observer, does not mean that the observer has the individual complexity to adequately respond to those relevant perturbations (Espejo & Reyes, 2011). Ashby's law of requisite variety states that when the variety or complexity of the environment exceeds the capacity of a system (natural or artificial), the environment will dominate and ultimately destroy that system (R. W. Ashby, 1957) or as Beer (1979) summarised: "Only variety absorbs variety" (p. 89). If an individual has not developed sufficient complexity (e.g. experience, resources, etc.) to respond to system complexity then it is said that the individual does not exhibit 'requisite variety' and cannot control the situation complexity (Beer, 1985; Espejo & Reyes, 2011).

Clearly, an organisation cannot possibly match the variety of the environment in which it coexists and similarly, management cannot match the variety of an operational unit of any significant size. And yet somehow, established organisations are capable of remaining viable, and management is more or less capable of maintaining control of operations (Espejo & Reyes, 2011). This balancing of complexity which is necessary to satisfy Ashby's law of requisite variety is referred to as complexity management or variety engineering (Beer, 1979). According to Beer (1979), management can be seen as the task of manipulating complexity by designing attenuators and amplifiers to balance complexity. Attenuators refer to any

mechanism employed to reduce high variety to a level of complexity relevant to the observer and amplifiers refer to any mechanism employed to increase low variety of the observer to match the relevant complexity achieved by the attenuator so that the desired performance of the observer can be achieved (Beer, 1979; Espejo & Reyes, 2011).

Figure 12 illustrates that, even though the variety of the environment exceeds that of the organisation and the variety of the organisations's operations exceeds that of the organisation's management, the development of suitable attenuators and amplifiers by the organisation allows complexity balancing and so Ashby's law of requisite variety to be satisfied. That is to say, the complexity of the environment from the viewpoint of the organisation can be absorbed by the complexity of the organisation, and the complexity of the operations of the organisation from the viewpoint of management can be absorbed by the complexity of the management. It should be clear that just because an organisation does not recognise environment complexity does not mean that it does not exist. "The lethal variety attenuator is sheer ignorance" (Beer, 1985, p. 25). The complexity developed by an organisation should be well founded and based on a complexity analysis of the environment niche in which it must coexist.

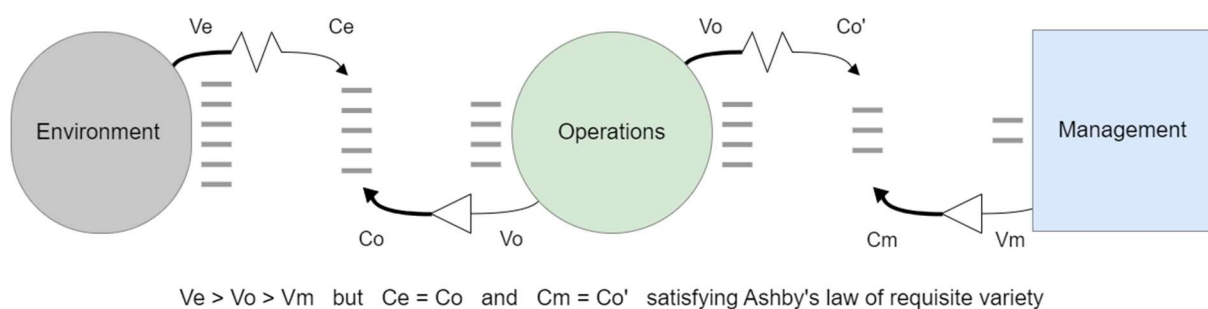


Figure 12: Appropriate attenuator/amplifier design allows balancing of complexity between systems.
Source: Self-created based on readings from Beer (1979).

Market research would be an example of an environment attenuator because it reduces variety by providing information for a niche of the environment relevant to the organisation. This attenuation of environment variety does not necessarily mean that the organisation itself has the requisite variety to deal with the residual variety and so the organisation would need to develop amplification to achieve desired performance and be viable in its niche. Outsourcing (e.g., development, production, distribution, advertising) would be an example of an organisation amplifier because it increases variety by increasing the capabilities and capacity of the organisation. Examples of attenuators and amplifiers between internal organisation systems are provided in subsequent sections.

Since the environment is not static and since organisation variety evolves over time, attenuators and amplifiers should be constantly adjusted to maintain complexity balance (Beer, 1985). A test of effective management is to maintain complexity balance at a minimum cost to the organisation (Espejo & Reyes, 2011). For example, an increase of knowledge resources (see Section 3.1.1) increases organisation variety and so a previously installed amplifier may no longer be necessary (cost reduction), or an attenuator could be re-evaluated to consider expansion of the environment niche (revenue increase). Similarly, a loss of knowledge resources decreases organisation variety and so an additional amplifier may become necessary (cost increase), or an attenuator could be re-evaluated to consider reduction of the niche to be served (revenue decrease).

Espejo & Reyes (2011) described the circular learning process of an individual or organisation in terms of complexity management. As illustrated in Figure 13, the individual encounters a task with certain performance criteria (Observe) and interprets this input relative to his/her own level of individual complexity (Assign). Initially, due to the complexity imbalance, the individual unknowingly filters out relevant information needed to perform the task and meet the performance criteria. The individual selects what he/she considers to be the best course of action (Design) and performs the task (Implement). Due to the complexity mismatch, the individual will inevitably initially fail to reach the specified performance criteria. However, as a natural learning process, having experienced and reflected on the results of their actions, the next time that the individual is presented with a similar such task, the complexity imbalance is less, and so improved performance can be expected.

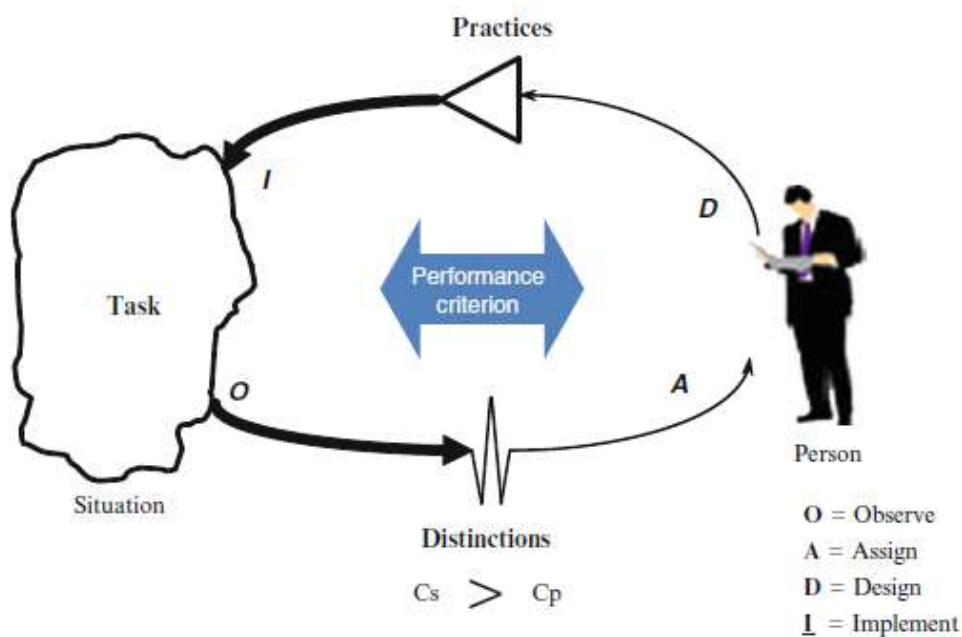


Figure 13: Complexity management and individual learning.

Source: (Espejo & Reyes, 2011, p. 64)

At this juncture, it is worth to highlight the point that complexity management/variety engineering upon which the VSM is based is very much related to continuous organisational learning and knowledge management (KM) or indeed are one and the same. The previous section (Section 3.1 – Knowledge management) discussed, for example, relevant knowledge, processes to support identification, generation, application, retention and sharing of knowledge, encountering new knowledge and the evolution of knowledge necessary to bring competitiveness, and the alignment with strategic goals to identify knowledge gaps. It is now easily recognisable that KM with the purpose of filling knowledge gaps and bring competitiveness is in fact complexity management with the same purpose of reducing complexity imbalances to allow survival. This explicit recognition of the relationship between the two abstract worlds of KM and the VSM is a crucial aspect of this research. It justifies the creation of a framework within this research that is built on the structure of the VSM that explicitly links the expected core elements of KM and utilises the language of KM so that knowledge is managed in a very conscious, purposeful, and structured manner.

So far, complexity balancing through the design of appropriate attenuators and amplifiers has been discussed at an organisation level. However, the VSM allows the distribution of complexity throughout the whole organisation in a process known as complexity unfolding (Espejo & Reyes, 2011) which is introduced in the remainder of this section.

In classical hierarchical organisations enterprise-wide tasks are broken down into smaller sub-tasks with increasingly narrow definition as it descends the hierarchy. This means that senior management must deal with high levels of complexity and are typically overloaded, while lower levels of the hierarchy (who possess the same biological variety handling capability compared to their fellow human beings in senior management) deal with relatively low levels of complexity and have limited responsibility and scope for creative contribution (Espejo & Reyes, 2011). However, as can be deduced from Figure 12, the more complexity that is absorbed by operations, the less complexity remaining to be absorbed by management for a similar level of performance. For this purpose, to allow efficient treatment of environment complexity to be made at an operational level by those best equipped to deal with the complexity, operations should be permitted enough autonomy and be capable of self-organisation and self-regulation unfolding (Espejo & Reyes, 2011; Espinosa, 2022).

In the VSM, operations is divided into one or more *primary activities*, each one fulfilling an aspect of the organisation's stated purpose and themselves permitted and capable of self-organisation and self-regulation (Espejo & Reyes, 2011). Each primary activity is, in turn, further divided into a number of autonomous units, each one fulfilling an aspect of the stated purpose of the given primary activity. This dividing and further subdividing of primary activities (autonomous units) may continue any number of iterations with the limitation that any VSM unit must necessarily be a 'producer' of the organisation with exposure to market forces (Beer,

1985). This means that, in theory, such a unit could be plucked out of the organisation and be capable of being a viable system in its own right.

The VSM organisation structure of recursive layers of autonomous units, illustrated in Figure 14, allows complexity to be more evenly distributed throughout the organisation leaving management to cope with far less variety than in a hierarchical structure. In other words, complexity unfolding means that the recursive layers absorb variety leaving management with only a residual variety (Espejo & Reyes, 2011). Distributing responsibility and accountability throughout the organisation, in a recursive system of devolved power, recognises the contribution of each individual towards the organisation's viability. This promotes employee sense of purpose, worth and identity which encourages work engagement and likely then performance and creativity (Espejo & Reyes, 2011). This means that overall, the VSM equips an organisation to utilise far greater diversity for effective problem solving and decision making and increases its capacity for knowledge generation and innovation (Espejo & Reyes, 2011).

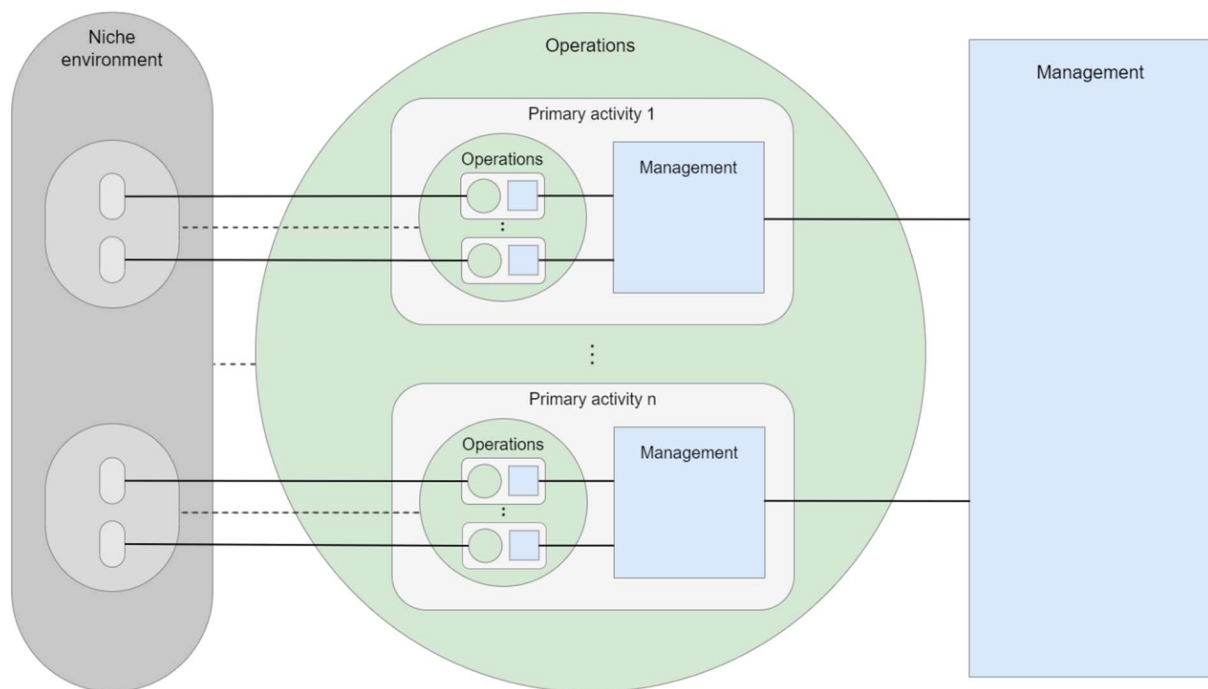


Figure 14: Decentralisation of management functions through recursive layers of autonomous units.

Source: Self-created based on (Beer, 1985, p. 136).

Note that in Figure 14, each solid line connecting system components represents appropriate attenuators and amplifiers while dashed lines indicate an effective connection that is actually realized by multiple connections at a lower level of recursion. Beer (1985) also empathised the need for transducers (encoders/decoders) at either end of any interconnect within the VSM

so that messages that cross system boundaries are expressed in a mode that is understood in the same way by the inter-connected systems.

3.2.2 Collective cohesion

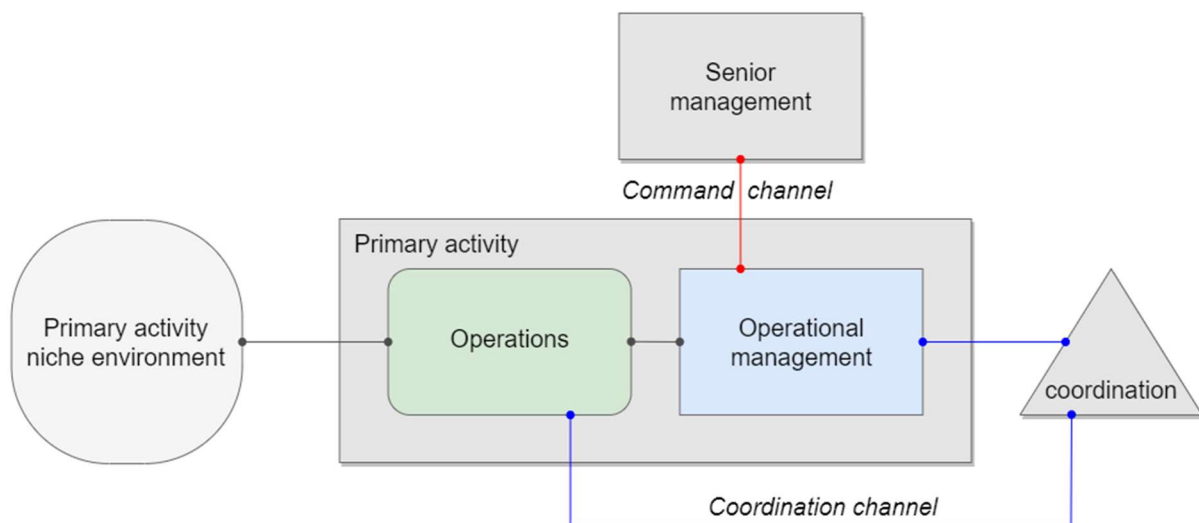
The previous section explained how complexity can be unfolded within an organisation by using the VSM's recursive structure of autonomous units (units that are permitted self-organisation and self-regulation) allowing effective and efficient problem solving and decision making by appropriate unit(s) at a local level. In this section, the cohesion mechanisms of the VSM, that ensure that those autonomous units (that each seek individual viability) together achieve an overall synergistic whole, are now explained. In order to do so, the VSM is gradually constructed to allow a clear explanation of the functions and interactions necessary to achieve global cohesion of the organisation.

According to the VSM, there are three interaction types that must take place between the senior management of the organisation and the operational management of each of its primary activities namely, *legal and corporate requirements*, *resource bargain* and *accountability* (Beer, 1985) which are now briefly outlined in the following bullet points:

- Legal and corporate requirements (shortened in this text to *rules & interventions*): Within the organisational environment, the autonomy of a primary activity must be constrained to the point that it abides by certain 'rules of the game' set out by senior management. Constraints, while limiting to some degree, also helpfully act as variety attenuators, providing relevant context and scope (e.g., objectives, restrictions, compulsory norms) so that all primary activities behave in a consistent and coherent manner (Espinosa, 2022).
- Resource bargain: Each primary activity, in producing its aspect of the organisation's stated purpose, requires organisation resources that must be negotiated with and released by senior management in an agreed contract. This gives a primary activity the mandate to proceed with its activities under the agreed conditions (Beer, 1985).
- Accountability: Having reached an agreed contract, operational management is accountable for its operations delivering the agreed results with the agreed level of quality within the agreed timeframe. Operational management must enable senior management to verify performance by reporting to senior management at regular agreed intervals (Beer, 1985). Operational management must necessarily attenuate variety to a level of complexity that is relevant for, and is capable of being processed by, senior management. Complexity mismatch leads to inefficient and/or ineffective reporting resulting essentially in a lack of accountability of the primary activity (Espinosa, 2022).

Note that since each primary activity is itself a viable system and due to the recursive structure of the VSM, these types of interaction must also take place between the management of each primary activity and their respective operations and indeed similarly at every lower level of recursion. For simplification of discussions going forward, a channel where rules & interventions, resource bargain and accountability type interactions take place is referred to as a *command* channel as shown in Figure 15.

Operational management is accountable for the establishment and later elaboration of a plan to be executed by its operations (including the detailed planning of its resource allocation) as well as the subsequent coordination of that plan in order to fulfill the agreed contract with senior management. According to the VSM however, the responsibility (as opposed to accountability) for such is seen as a regulatory/supporting function which enables, but is outside of, the primary activity which produces purpose (Beer, 1985). This *coordination* function, represented by the triangle in Figure 15, is essentially an outsourcing by operational management that provides the necessary amplification, attenuation and transducers (complexity management) to enable planning, coordination and monitoring between operational management and operations (Beer, 1985).



Command channel = Rules & interventions, Resource bargain, Accountability

Figure 15: Intermediate VSM build-up illustrating command and coordination channels.

Source: Self-created based on (Beer, 1985, p. 39).

The recursive structure of the VSM means that a coordination function must be present to support management at every level of recursion, including senior management. As illustrated in Figure 16, the global coordination function supporting senior management interacts with all local coordination functions of the organisation's primary activities. As mentioned, this then

enables a holistic planning, coordination and monitoring between senior management and its operations (all of its primary activities). The coordination function is responsible to avoid or at least minimise collisions of resources shared by primary activities. This in turn prevents each primary activity from continuously trying to adjust around the resource utilisation of every other primary activity for which they are largely ignorant and is described by Beer (1985) as *anti-oscillatory*.

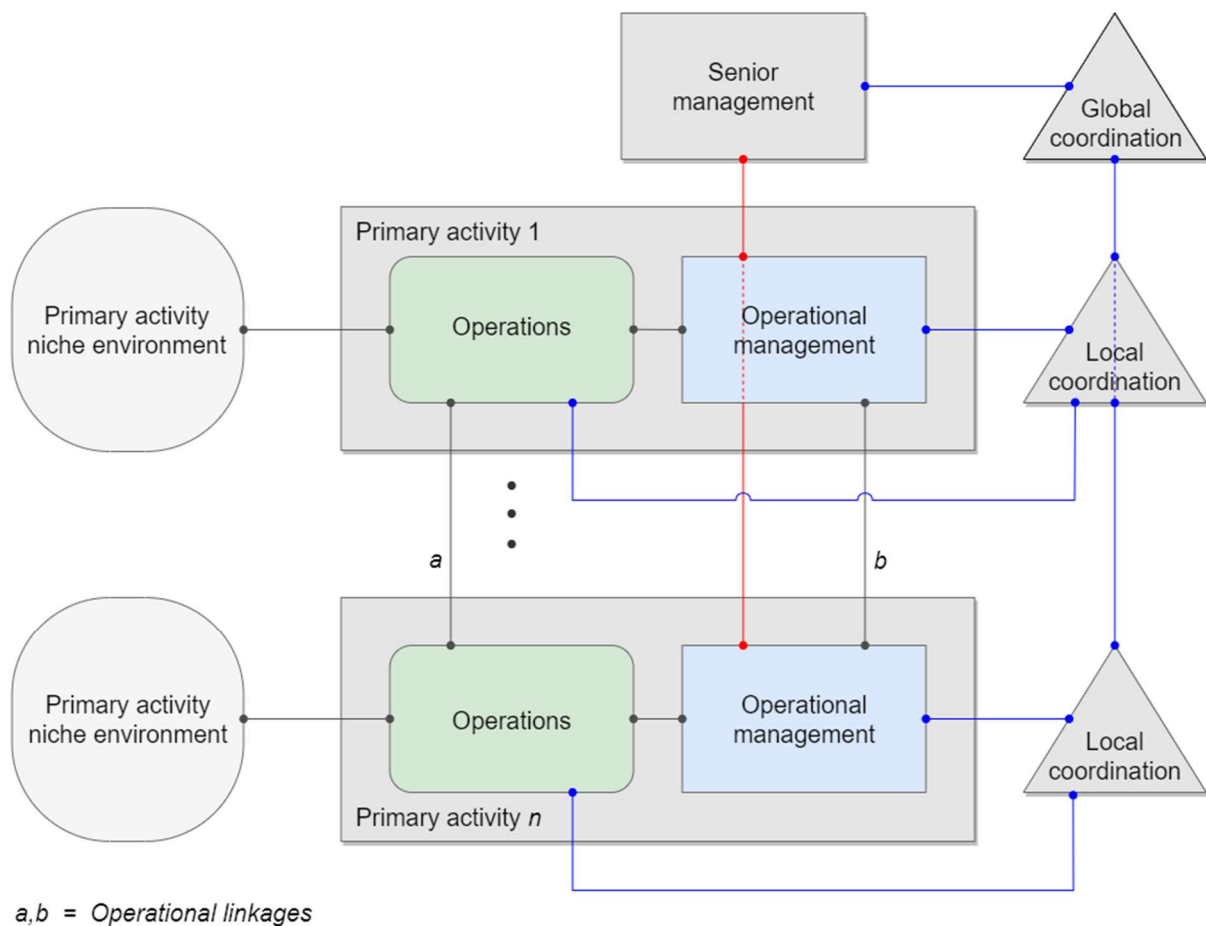


Figure 16: Intermediate VSM build-up illustrating global coordination and operational linkages.

Source: Self-created based on (Beer, 1985, p. 136).

Beer (1985) provided the simple example of a school whose purpose is to educate with each teacher having the primary activity of producing that purpose (to teach). The school provides classrooms as a shared resource and the school administration (a regulatory/coordination function that supports but does not produce purpose) plans a class timetable allocating teachers to classrooms and flexibly coordinates adjustments as needs arise. Without a planned timetable, teachers would spend their time negotiating classrooms and oscillating from one conflict to the next instead of performing their primary activity. The timetable is accepted as authoritative by all teachers, but it does not seize authority – meaning that it does

not prevent teachers from coming to an arrangement with other teachers (operational linkages) or of taking the opportunity and initiative to avail of a free classroom. Therefore, while the timetable provides constraints, it is not autocratic and does not restrict autonomy or creativity. The simple timetable is therefore an important function towards facilitating harmony, cohesion, and synergy in the school as a whole. To conclude this example, it is important to mention that the school administration (coordination function) reflects managerial policies and decisions but does not make them. It is the school management (senior management) that is ultimately accountable for a non-functional timetable or lack of classrooms leading to poor teaching performance and poor student grades (dissatisfied customers in the niche environment). And finally, to note that teachers do not report performance accountability to the school administration but rather directly to the school management (the command channel).

Ultimately, the responsibility of the coordination function is to provide holistic solutions that prevent inefficient uncoordinated back-and-forth oscillations between primary activities in its lower level of recursion. It should be noted that this is not limited to the coordination of existing organisation resources but also includes the coordinated development of new resources that are beneficial to more than one primary activity. For example, consider one primary activity putting in place an environment, tool or even a simple form only to discover halfway through that another primary activity is in the middle of a similar process causing both to necessarily reassess their initial solutions (resulting in oscillations creating inefficiencies, ineffectiveness, and a lack of synergy). Beer (1985) warns that when senior management learn of such oscillations then there is a tendency to intervene on the command channel by setting a new directive or policy for all primary activities to abide by but that this is not always appropriate because the dictate risks future loss of flexibility and initiative in the primary activities. Whether cohesion is imposed by senior management via the command channel or achieved by coordinated mutual agreement via the coordination channel it does create certain constraints for the primary activities. In other words, there is a tradeoff between autonomy, which is required for flexibility and distributed creativity, and cohesion which is required for synergy. The challenge is to get the balance right because “an effective enterprise produces simultaneously global cohesion and local autonomy” (Espejo & Reyes, 2011, p. 92).

In Figure 16 it can be seen that *operational linkages* exist between primary activities. Operational linkage may consist of many permanent relationships (strong connections) which is likely if, for example, the output of one primary activity feeds the input of another primary activity or if primary activities serve environment niches with overlap of customers, suppliers, partners, or competitors. Operational linkage could also be few intermittent relationships (weak connections) if, for example, primary activities serve very different environment niches with little or no overlap and have few practical needs for collaboration other than the fact that they may share resources and may (or may not) be supported by common regulatory/

supporting functions (e.g., sales, procurement, quality, logistics, personnel). In any case, operational linkages (personal relationships) provide a channel for sharing distributed knowledge and it is vital that senior management recognise that this offers the best opportunity for knowledge generation and innovation. Given a purpose (more about this in the next section), exercises to encourage creative collaboration can be planned along the coordination channels and resources released for the task on the command channels.

Senior management, having formed a plan with the support of the coordination channel, obtained commitment and released resources in agreed contracts with operational management via the command channel, elaborated the plan again with the support of the coordination channel is accountable for its successful execution of the plan. Senior management can monitor progress of the plan via the coordination channel. However, remember that, while the global coordination function has an overview of the primary activities (thanks to the local coordination functions) and provides a cohesion and supporting role, it does not and should not have authority over the primary activities. The global coordination function can therefore not be accountable for the performance of the primary activities.

Senior management who does have authority over the operational management, can monitor performance of primary activities via the command channel and may intervene if felt necessary. While interventions, such as requesting investigations or more detailed and regular reporting, may indeed be necessary and helpful, senior management should be conscious that interventions may have the effect of introducing constraints on autonomy. Espejo & Reyes (2011) cautioned senior management of inadvertently creating a *control dilemma* by taking measures in an effort to stay in control but as a result reducing the organisation's complexity handling capacity which is the exact opposite of that intended.

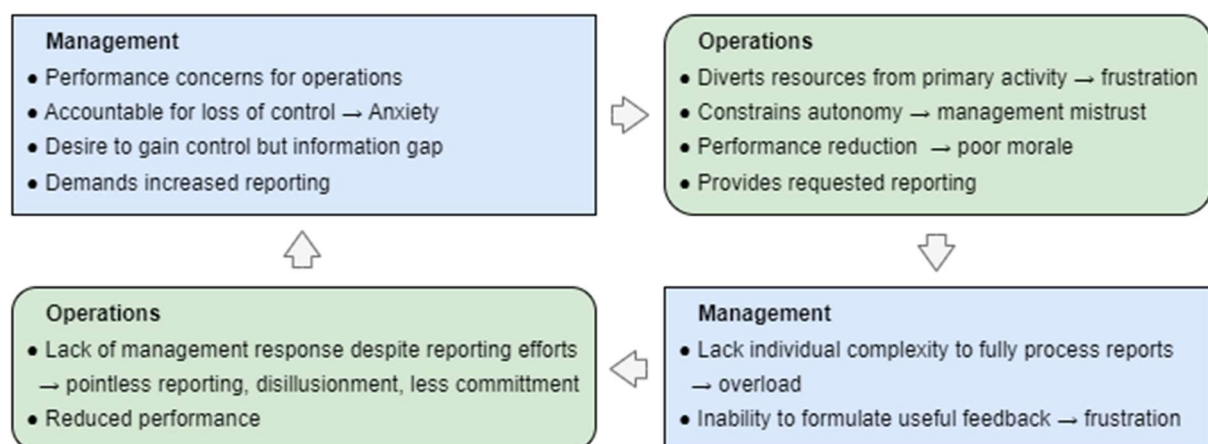


Figure 17: Illustrates a control dilemma example.

Source: Self-created.

The VSM includes a function to help senior management increase their individual complexity so that they can better understand the language, context and subtleties of operational reporting and can determine if reporting is overly attenuated thus filtering out information relevant to gauge performance. This in turn helps senior management to make more informed decisions regarding interventions on the command channel and helps to avoid control dilemmas. This function is referred to as the *audit* function (Beer, 1985) and is represented in Figure 18 by an inverted triangle. According to Beer (1985), senior management generate enormous variety by conducting sporadic audits themselves directly with operations. “Giving meaning to the shared information requires its contextualisation and this implies crossing sporadically the boundaries of the autonomous units and learning firsthand the context from which they produce the information” (Espejo & Reyes, 2011, p. 102). So, unlike the coordination function, the audit function must be performed by senior management and is only drawn separately in the VSM to make clear that it is a direct link with operations and apart from the command channel link with operational management.

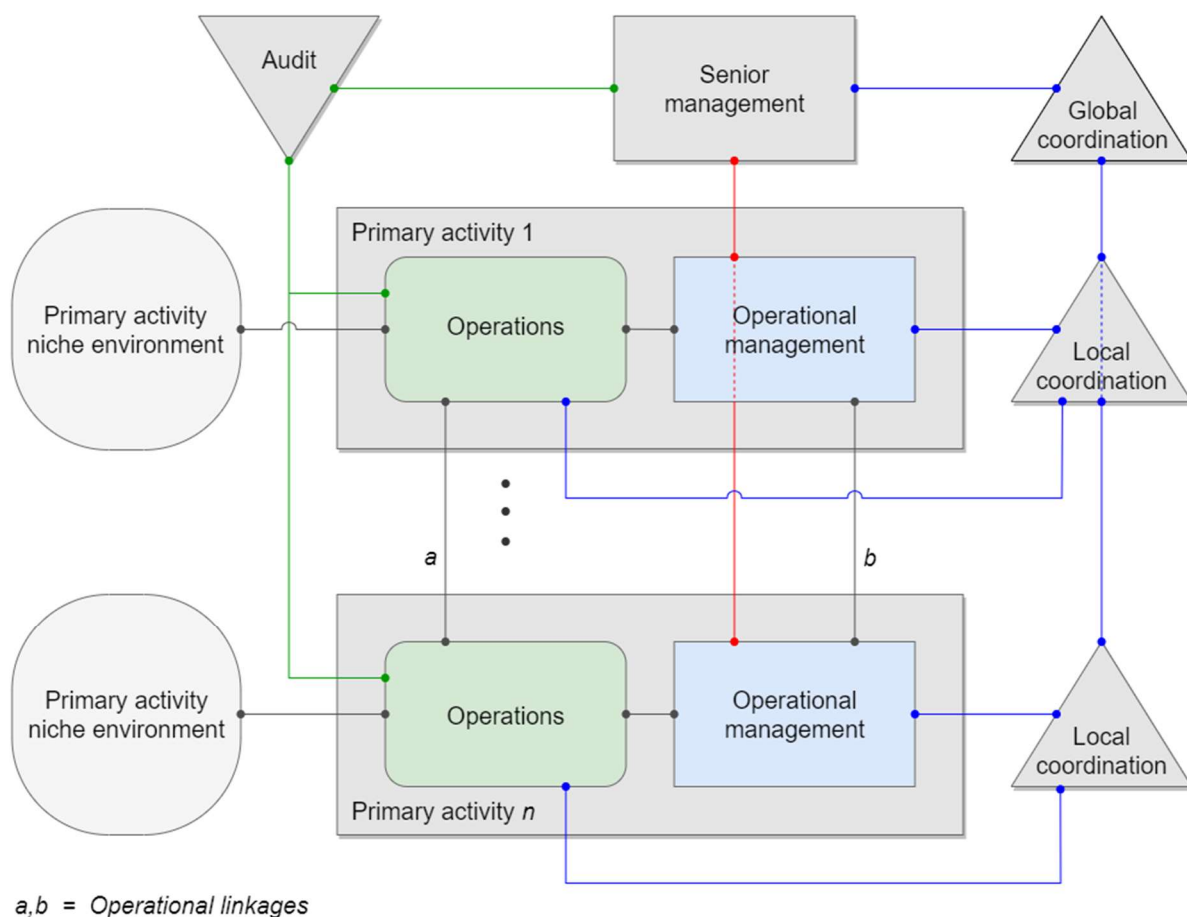


Figure 18: Intermediate VSM build-up illustrating senior management audit function.

Source: Self-created based on (Beer, 1985, p. 136).

The purpose of the audit function must be clearly understood and agreed with operational management (Beer, 1985). It is important that operational management recognise the audit function to represent senior management showing an interest and their willingness to learn and understand at first-hand regulation. Otherwise, there is a risk of undermining the authority and trust vested in operational management resulting in defensive behaviour (Espejo & Reyes, 2011). Audits are necessarily informal, open, unscheduled, and infrequent must not require preparation by operations (Beer, 1985; Espejo & Reyes, 2011). According to Beer (1985), this would be missing the point because senior management are trying to fill/discover the gaps that regular reports may not be providing. Finally, as previously discussed, the VSM's ability to manage complexity is based on recursive structure of autonomous units with each unit attenuating complexity for units at a higher level of recursion and amplifying complexity to units at a lower level of recursion. Therefore, in general, the audit function must only happen with operations at a level that is immediately below the audit function's recursive level. Monitoring activities at levels below this bypasses levels of management and undermines the organisation's complexity management structure (Espejo & Reyes, 2011).

3.2.3 Adaption mechanism

The previous section explained how senior management achieve cohesion of primary activities through its controlling command channels and its anti-oscillatory coordination channels with operational management as well as through its learning/verification audit channels directly with the operations (allowing better controlling of operational management). By now, it should be clear that all such mechanisms exist at every level of recursion of the VSM, and this ensures the cohesion of the organisation as a whole. However, the cohesion of the VSM's recursive structure of autonomous units is still not sufficient to ensure the viability of the organisation. In order for a system to be viable it also must be able to recognise changes in the environment in which it coexists and be able to learn and adapt its behaviour to respond to those changes. In this section, the adaption mechanism of the VSM, that ensures environment changes are recognised and that the organisation takes appropriately actions to adapt to those changes is now explained.

In the previous section, it was discussed that senior management is accountable for the planning and subsequent controlling of its primary activities (supported by a coordination function to elaborate plans and prevent oscillations) to maintain cohesion and to achieve its operational objectives. This equates to operative management and is mainly concerned with the efficient operation of the organisation's internal, day-to-day activities: its 'inside-and-now' (Beer, 1979). Going forward this function of operative management shall be referred to as the *cohesion* function (Espejo, 1990).

In order to formulate effective operational objectives, operative management first require strategic objectives that consider the organisation's long-term orientation in its external environment allowing it to continue to produce its purpose into the future. For this reason, the management *metasystem* of the VSM, in addition to the cohesion function managed by operative management, must also include an *intelligence* function managed by *strategic* management and a *policy* function managed by *normative* management (Beer, 1979; Espejo & Gill, 2011; Schwaninger, 2000). This management metasystem is illustrated in Figure 19 and its functions and interactions are discussed in the remainder of this section. Note that the coordination and monitor functions discussed in the previous section as well as interaction channels with primary activity *n* have been omitted from Figure 19 in order to reduce visual clutter.

Intelligence function creation of organisation and environment models: Strategic management is concerned with an organisations 'outside-and-then' (Beer, 1979) being accountable for the creation and maintenance of an organisation's business model¹¹ and strategic objectives. In order to do this, the intelligence function must compile and maintain an up-to-date model of the organisation's primary activities including their individual niche environments as well as an up-to-date model of the organisation's overall niche environment including known risks and uncertainties (Beer, 1979). Strategic management can then use these models to assess the impact of current, probable, and possible changes in the environment on the organisation's long-term viability and allowing the design of effective measures and adjustments of the strategic objectives and business model. Environment changes could represent either new challenges or opportunities for the organisation but in either case may necessitate the adaption of strategic objectives leading to the necessary adaption of operational objectives assigned to primary activities.

The reliability of results from an impact assessment can only be as good as the reliability of the models compiled for the environment and the organisation (Schwaninger, 2001). For example, it is difficult for management to plan appropriate action to address an increase in market demand if information about the size of the demand or organisation's actuality, capability and potentiality is not available. As the Conant-Ashby theorem states: "every good regulator of a system must be a model of that system" (Ashby & Conant, 1981, p. 205). This means that the intelligence function requires a high level of variety (expertise, experience, ingenuity and bandwidth) in order to match the complexity needed to compile, interpret, evaluate, and leverage changes in the models of the organisation and environment. Therefore, the intelligence function is typically composed of resources (internal or outsourced) such as, e.g. market research, technology research, innovation development and corporate planning.

¹¹ Appendix B demonstrates the content of a typical business model template.

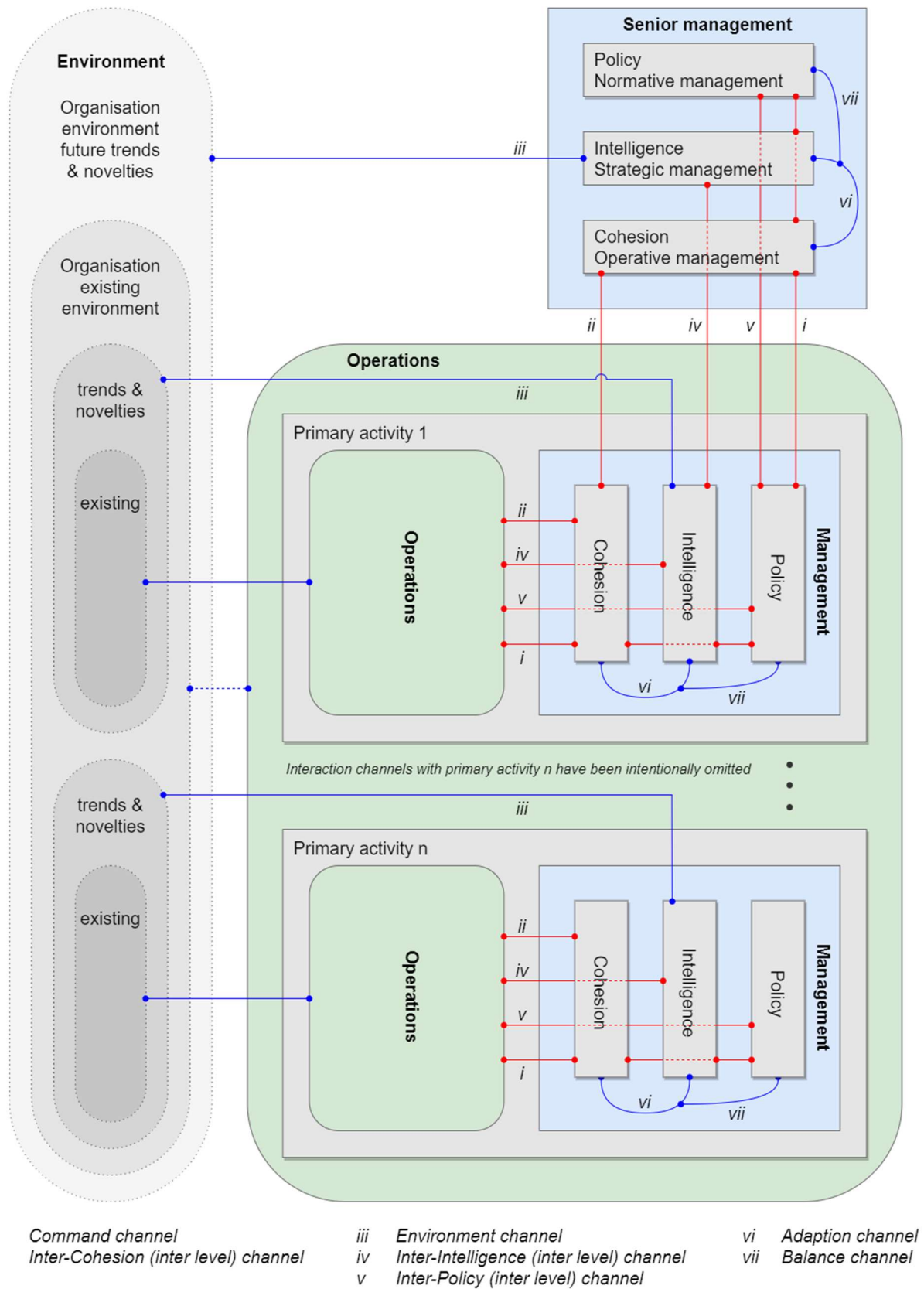


Figure 19: Intermediate VSM build-up illustrating the intelligence and policy functions.

Source: Self-created based on (Beer, 1985, p. 136).

Intelligence function interaction with the environment: As illustrated in Figure 19, the intelligence function of the senior management metasystem engages with the organisation's perceived niche environment through the *environment* channel. The recursive structure of the VSM means that the intelligence function and its corresponding niche environment channel are also present in the management metasystem of the primary activities and indeed at every lower level of recursion. As also illustrated by the *inter-intelligence* (inter-level) channel of Figure 19, each intelligence function has access to the niche environment model from the perspective of each of the intelligence functions at the next lower level of recursion. This means that the intelligence function of the senior management metasystem has an overview of the niche environments from each of its primary activities and can consider them as a whole from the perspective of the overall organisation. Once again, this helps to demonstrate how the VSM's recursive structure of autonomous units helps to distribute complexity (problem solving, learning and innovation) throughout the organisation.

Beer (1985) cautioned that monitoring environment trends and assuming that the future will be an extrapolation of the past is not enough and that the intelligence function must actively seek novelty (in the external environment or generated within the organisation) that could be innovated to be relevant for the organisation/environment. The intelligence function requires ingenuity to explore different possible avenues to the organisation's future viability (Espinosa, 2022). This includes the innovative consideration of any aspect of the organisation's business model such as, new products or services, target groups, branding, distribution channels, strategic alliances, suppliers and resources, revenue streams, investments in science, technology, IT infrastructure, costs and funding, and so on (Espinosa, 2022). This activity of looking to the outside environment and considering innovative strategies for adaption that will ensure future viability takes place at all levels of recursion.

Interaction of intelligence and cohesion functions: Clearly, any strategic plans formulated by the strategic management of the intelligence function, that would impact in any way the primary activities under the care of the operative management of the cohesion function, must be aligned with the operative management. Both functions with their perspectives of 'inside-and-now' and 'outside-and-later' need to be highly interconnected (Espejo, 1990) (represented by the *adaption* channel *vi* in Figure 19). The intelligence function provides the cohesion function with strategic objectives, adapted to consider future opportunities and threats on the operations of the organisation (Beer, 1979). The cohesion function provides the intelligence function with the model of its primary activities (their actuality and capability), formulates practical operational objectives needed to satisfy strategic objectives and estimates operational adaptations required to achieve those objectives (Beer, 1979). Strategic management and operative management must together reach a consensus on the best course of action to be taken and are authorised to then enact change in their respective domains.

However, what happens if strategic management and operative management cannot reach a consensus on the direction to be taken? Or what happens if neither strategic management nor operative management have sufficient resources available within the limit of their operational budgets to execute an agreed necessary change? The answers to such questions are provided by the final function of the VSM, the policy function which is discussed in the remainder of this section.

The importance of purpose: As mentioned previously, in systems thinking terms, a system is a set of interconnected components, that share a collective purpose, and together develop emergent properties that distinguishes it from other systems (Espinosa, 2022). An organisation then, as Espejo & Reyes (2011) described, emerges when members of a collective individually assign meaning to their purpose that is in line with all other members of that collective and that the necessary relationships formed in order to achieve that shared purpose establish the identity of the organisation. Espejo & Reyes (2011) explained, using the analogy of the old Chinese game Tangram (see Figure 20), that the same collective of individuals will necessarily form different relationships depending on the purpose that they share and can give rise to organisations with very different identities/cultures. The importance of an organisation having a shared, clear purpose, while seemingly obvious, cannot be overstated enough. If purpose is not shared with and shared by individuals throughout an organisation then the everyday actions and types of relationships deemed to be relevant by individuals may be out of phase with the organisation's espoused purpose and identity (Espejo & Reyes, 2011).

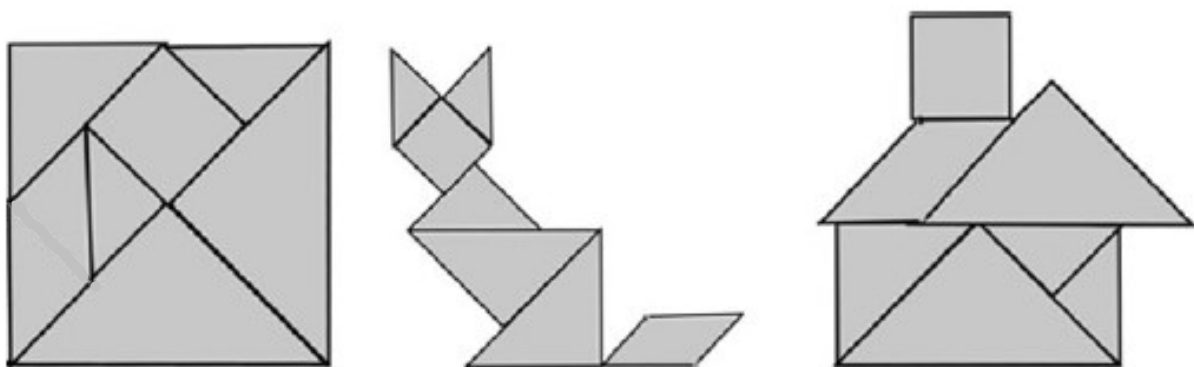


Figure 20: Tangram: depending on the purpose set out, a given set of shapes can form different relations to create different identities.

Source: (Espejo & Reyes, 2011, p. 77).

Beer (1985) cautioned that agreement of objectives to be accomplished by an organisation does not constitute the purpose of the organisation saying that “the agreement about objectives is a spin-off from the convergence on purpose” (p. 100). Espejo & Reyes (2011)

used the following charming story to illustrate the difference between knowing the objective and knowing the greater purpose of a task:

A traveler approached some people erecting a structure and asked one by one: "What is it you're doing?" One replied with irritation: "Oh, look, from morning till night we carry these damned stones . . ." Another rose from his knees, straightened his shoulders and said proudly: "You see, it's a temple we're building!" (Gorbachev, 1987 as cited in Espejo & Reyes, 2011, p. 50).

Policy function provides purpose and ethos: Normative management is accountable for the formation and communication of the organisation's purpose and its core values and ideals by which it wants to live this purpose. In systems terms, purpose is said to provide *closure* to the network of component relationship. The network of relations specifies in full the distinction of the system that is being made and it is self-referential, meaning that in order to describe itself, it must refer to itself – there are no additional components which is not already included inside its borders Espejo & Reyes (2011). Normative management provides the organisation's purpose and ethos to strategic and operative management. This interaction is represented by the command channel (intervention & rules) illustrated in Figure 19. This then narrows down (attenuates) variety available to the intelligence and cohesion functions (Beer, 1979) and acts to steer their interactions and decisions along the lines of the organisation's purpose and core values (Espejo, 1990). This allows strategic and operative management to get on with the business of running the organisation and minimises the response requirements of the policy function (Espejo, 1990).

Policy function providing balance: The intelligence and cohesion functions offer alternative, but complementary, perspectives of organisational adaptation (Espejo, 1990). It is important that both functions are highly interconnected and well balanced so that they absorb one another's variety leaving little variety to be absorbed by the policy function. If the intelligence and cohesion functions are not highly interconnected, then the policy function would receive information independently from both sides and would itself need to make the necessary checks and balances to decide the best course of action (Espejo, 1990). Normative management cannot absorb this high level of variety (at least not consistently over the long term) leading to poor decision making and underutilised intelligence and cohesion functions (Espejo, 1990). Furthermore, it is also important that the variety of the intelligence and cohesion functions are balanced (Beer, 1979). If the intelligence function produces adaptation proposals at a higher rate than the cohesion function resources can process them, then this reduces the organisation's responsiveness in dealing with external opportunities or threats (Espejo, 1990). If on the other hand, the intelligence function lacks resources to identify impending external events, then this reduces the organisation's opportunity to prepare for the event (Espejo, 1990). In order to gauge that the intelligence and cohesion functions are highly interconnected and balanced, normative management must monitor their relationship and decision-making process to determine if a corrective intervention may be required (Espejo,

1990). This monitoring function and interventive action are represented in Figure 19 by the balance channel and the command channel (intervention & rules) respectively.

Policy function decision making: Even when the intelligence and cohesion functions are highly interconnected and well balanced, there can still be occasions when strategic and operative management do not reach a consensus and/or need additional steering from normative management. Since issues will have been debated and subjected to detailed checks and balances from the intelligence and cohesion functions before they reach the policy function then it is possible that normative management have or can achieve requisite variety to moderate further debate and come to a decision (Espejo, 1990).

The recursive structure of the VSM means that a policy function is present in the management metasystem of the primary activities and at every lower level of recursion. As illustrated by the *inter-policy* (inter-level) channel of Figure 19, each policy function has access to the policy function at the next lower level of recursion. This means that the policy function of the senior management metasystem has the option to trigger debate and opinion forming that takes into consideration the perspectives from each of its primary activities and so on down through the recursive structure as necessary leading to holistic and well-informed decision making.

Policy function resource negotiation: Strategic management and operative management require resources in order to implement the intelligence function and cohesion function (in addition to its operations). Resource budget negotiation, release and subsequent reporting is conducted through the command channel (resource bargain and accountability interactions) illustrated in Figure 19. These interaction types were already discussed in the previous section.

3.2.4 VSM overall model

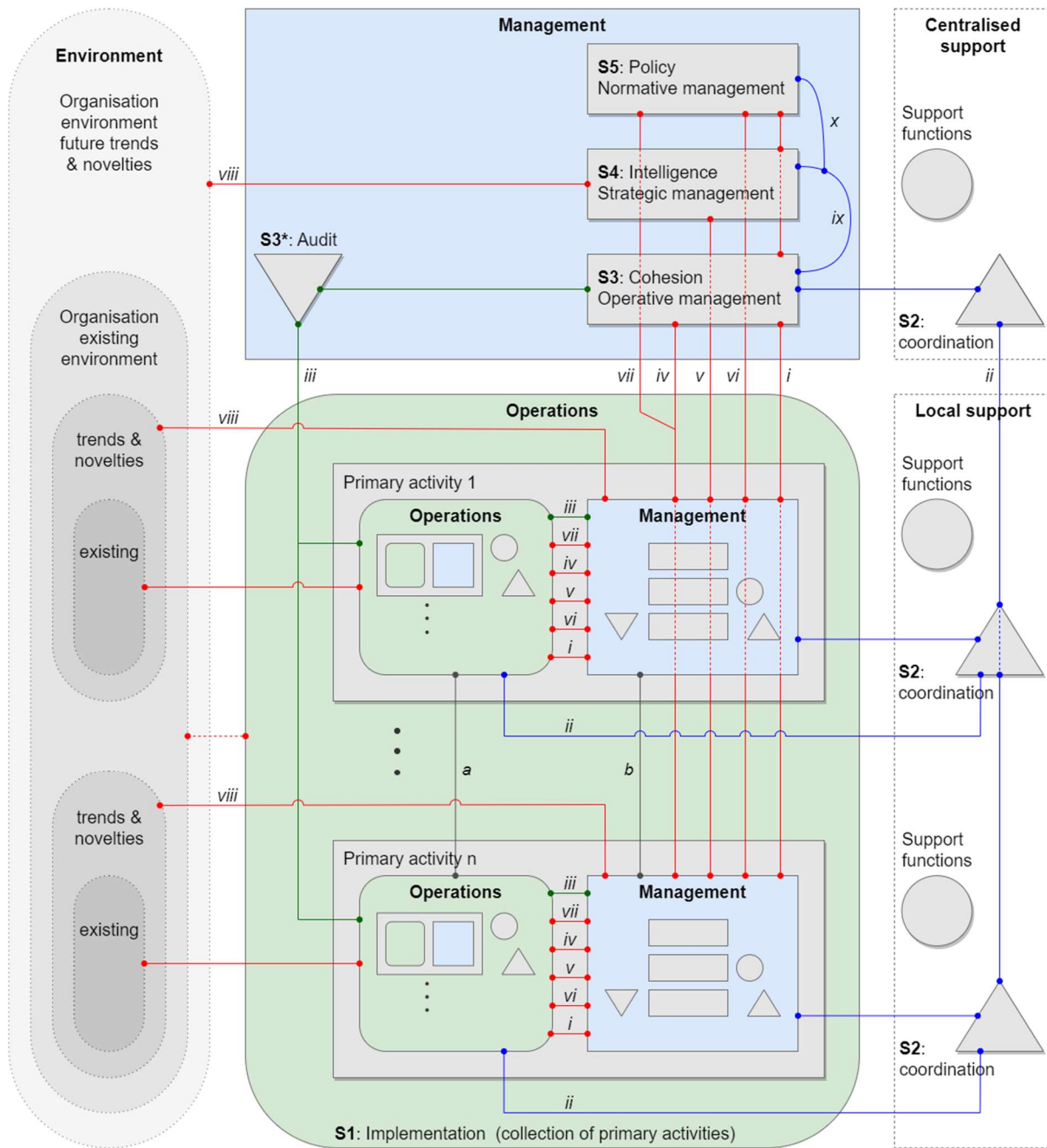
The previous sections described the VSM of an organisation to be a recursive structure of autonomous units, each with their own management metasystem and operations, that are permitted the freedom to act on their own initiative in order to respond to external perturbations in its own niche environment and restore equilibrium, but only within the framework of action determined by the purpose of the organisation (Beer, 1985). Beer (1979) defined these properties of the VSM (complexity distribution, cohesion and adaption) as being the necessary and sufficient conditions that an organisation must exhibit to ensure that it will remain viable in its environment. In this section, these properties are finally brought together to present the complete VSM, tie up some loose ends and summarise key takeaways and conventions to be utilised later in the research.

Figure 21 illustrates the complete VSM of two recursion levels (Beer's (1985) VSM containing three recursion levels is provided in Appendix A). Note that Beer (1979) referred to the functions of policy, intelligence, cohesion, audit and coordination described heretofore as *system 5*, *system 4*, *system 3*, *system 3** (star) and *system 2* respectively. Beer (1979) also referred to the total collection of primary activities at any given level of recursion which produces the overall purpose at that level of recursion to be *system 1*. A number of authors have referred to system 1 as the *implementation* function (Espejo, 1990; Espejo & Gill, 2011; Espejo & Reyes, 2011). While the descriptive labels of functions vary slightly from author to author, the use of the labels system 1 to system 5 is consistent throughout literature. This convention is therefore adopted in this research with labels sometimes being shortened to systems *S1* to *S5* as reflected in Figure 21.

The general Model of Systemic Control (MSC) developed by Markus Schwaninger (2001) as one tool of the St. Gallen Management Concept toolset is based on organisational cybernetics. As shown in Figure 22, the MSC describes the three logical levels of management to be operative, strategic, and normative (Schwaninger, 2000). According to Schwaninger (2000), the MSC and VSM are intrinsically related through a conceptual commonality of operative, strategic, and normative management of the MSC with the system 3, system 4 and system 5 functions of the VSM. Operative, strategic, and normative management have already been introduced in the previous section and are reflected in Figure 21.

Figure 21 provides the descriptive labels, adopted in this research, of all interaction channels of the VSM. Note that in Figure 21 a dot represents an interaction interface, and every interaction channel is assumed to contain appropriate attenuators, amplifiers, and transducers to achieve complexity balancing and language alignment.

Figure 21 contains an interaction channel labelled *vii* that is called an *algedonic signal* (Beer, 1979) that has not yet been introduced. Algedonic signals are generated by any of the operative management of system 1 directly to system 5, bypassing system 3. They are rapid escalation signals that alert system 5 of situations that are getting out of control and could have a major impact on the performance of any given primary activity and so require immediate attention (Beer, 1979). An algedonic signal can be seen to be equivalent to the body's reflex mechanism which triggers immediate action in the face of danger. The types of algedonic signals may be predefined or even automated as threshold values of certain KPIs but should not be limited and must permit exceptions (Espinosa, 2022).



- | | | |
|--|---|-------------------------------|
| <i>i</i> Command channel | <i>v</i> Inter-Intelligence (inter level) channel | <i>ix</i> Adaption channel |
| <i>ii</i> Coordination channel | <i>vi</i> Inter-Policy (inter level) channel | <i>x</i> Balance channel |
| <i>iii</i> Audit channel | <i>vii</i> Allegedonic signal | <i>a</i> Operational linkages |
| <i>iv</i> Inter-Cohesion (inter level) channel | <i>viii</i> Environment channel | <i>b</i> Operational linkages |

Figure 21: The overall VSM illustrated to two levels of recursion.

Source: Self-created based on (Beer, 1985, p. 136).

Figure 21 illustrates once again the recursive structure of the VSM, with an organisation consisting of a management metasystem and an operations metasystem that contains one or more primary activities that each contain their own management metasystem and operations metasystem that contains one or more primary activities and so on. Such unfolding can

continue any number of iterations. In theory this could be until a primary activity team has reached a size where a single person is capable of managing the complete management metasystem of the primary activity – but always with the limitation that any primary activity must necessarily be a producer of purpose with exposure to market forces (Beer, 1985; Leonard, 1999). According to the VSM, this means that the organisation and every primary activity at any level of recursion within the organisation are all viable systems capable of independent existence.

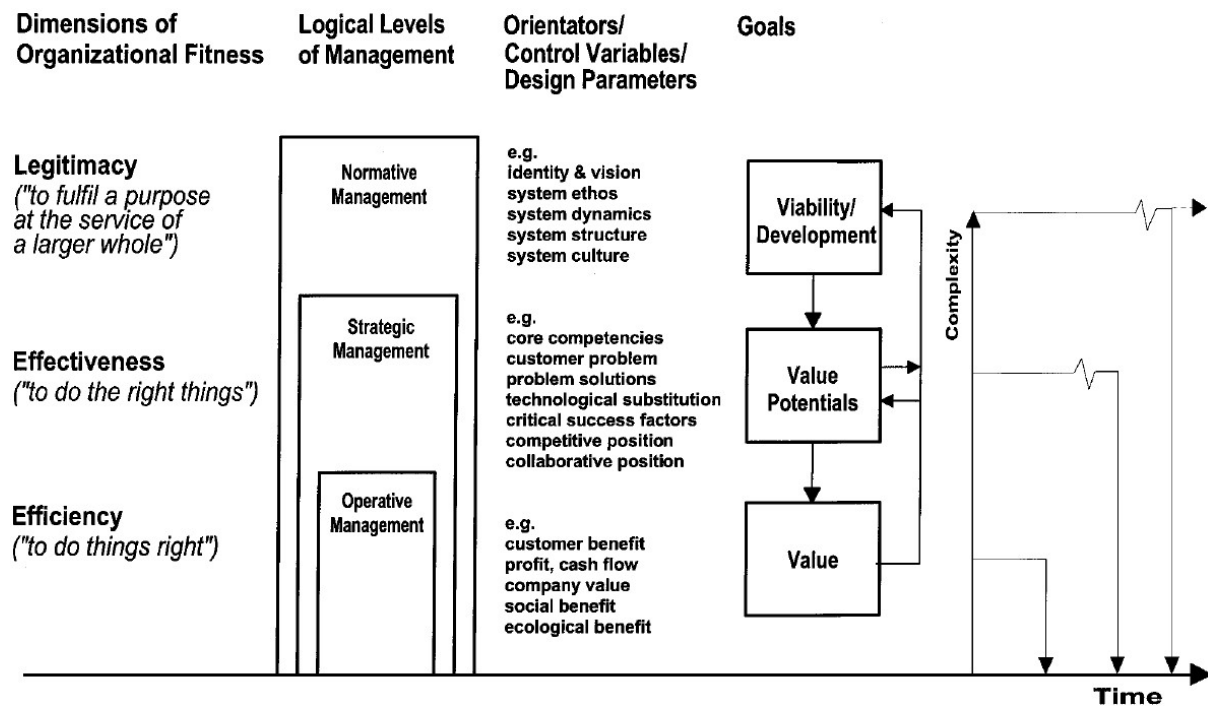


Figure 22: Generalised MSC - goals and orientators at different logical levels of management.

Source: (Schwaninger, 2000, p. 216).

The VSM defines the functions and interactions that are necessary, and that all together are sufficient, to ensure viability of an organisation. Beer (1985) cautioned against the temptation, during the process of diagnosing the viability of an organisation, of attempting to neatly map a classical hierarchical organisation chart into the VSM. This may lead to confusion since it is perfectly permissible, for example, that more than one person, team or department realise any given function of the VSM or conversely that more than one function can be realised by one person, team or department (Beer, 1985; Achterbergh & Vriens, 2002).

Furthermore, Beer (1985) cautioned that not every department of an organisational chart is necessarily primary activity. "Most of the incorrect inferences (and therefore the inopportune diagnoses and recommendations) made in applying the VSM derive from nominating activities that are not in themselves viable systems as if they were" (Beer, 1985, p. 8). "It is wholly

unsafe simply to list major departments (however essential, however powerful) as constituting the next lower level of recursion” of primary activities (Beer, 1985, p. 10). For example, “an invoicing department has no meaning unless the product is there to be invoiced; and it would surely be perverse to contend that it is a viable system whose environment is the whole corporation” (Beer, 1985, p. 8). The organisation and its primary activities could not operate without, for example, an invoicing department, but the invoicing department alone is not a viable system and cannot be considered as a primary activity producing purpose.

The job of functions such as invoicing, personnel, finance, marketing, information services, etc. is to facilitate the organisation and its primary activities and so they are considered to be regulatory or *support functions* (Beer, 1985; Espejo & Reyes, 2011). In an organisation certain support functions (e.g. finance and R&D) may be centralised and shared among primary activities while others (e.g. quality assurance and HR) may need to be devolved to each primary unit (Espejo & Reyes, 2011). Centralised support functions are helpful to provide consistency and cohesion among primary activities. But centralisation of support functions (just like centralised management) also introduce certain constraints on the autonomy of primary activities. When making decisions about the centralisation/decentralisation of support functions it is therefore important to ensure that primary activities do not lose their capacity for self-organisation and self-regulation (Espejo & Reyes, 2011).

In Figure 21 centralised and decentralised support functions are represented by a circle shape at the organisation level and at each of the primary activities respectively. While this is not a convention used in literature, it has been included here because it provides a mental container for those functions that support the organisation and its primary activities. The convention also serves as a visual reminder of the need to address the question of centralisation/decentralisation which is central to the type of emergent organisation (Espejo & Reyes, 2011). An example of table format used to show centralisation/decentralisation of support functions is provided in the following Table 6.

Function \ Recursion	Legal	Capital Exp	Finance	Credit Control	Personnel	Training	Quoting	Sales	Marketing	Administration	Buying	Prod'n Mgt	Prod'n Scheduling	Quality Assurance	Quality System	Process Dev'p't	Equipment Dev'p't	Maintenance	Factory Logistics	Goods In/Out/ Store
Company					●	●						●	●	●		●		●	●	
Primary activity 1						●						●		●				●		
Primary activity 2						●						●		●				●		
Primary activity 3						●		●				●								

Table 6: An example table format to visualise centralisation/decentralisation of support functions.
Source: (Espejo & Reyes, 2011, p.173).

3.3 Existing KM applications of VSM

In Section 3.1 KM was discussed in terms of the concept of knowledge, knowledge processes and relevant knowledge. As discussed, knowledge is ingrained in all aspects of an organisation with the most valuable knowledge being intangible and successful KM having much to do with managing the relationships and the culture within the organisation. Section 3.2 explained how the VSM simultaneously distributes the overall complexity needed to produce the organisation's purpose throughout the organisation and also provides the cohesion needed to ensure synergy of that distributed complexity so that the organisation's purpose is then fulfilled.

Distribution of complexity includes, amongst other things, distribution of problem solving, decision making, creativity, and so generally speaking, amounts to the distribution and management of the knowledge required to perform such tasks. Given then this already implicit link between the VSM and the core elements of KM theory, this research is therefore interested to formalise and make the link clearly explicit.

The VSM provides a tool to diagnose and design the structure, functions, and relationships necessary and sufficient to ensure the viability of an organisation in the face of a changing environment. And so, a framework based on the VSM that explicitly links the core elements and language of KM theory would allow KM to be very consciously and purposefully considered as part of the design of a viable organisation and not as a loosely integrated addendum made in afterthought. This section identifies existing relevant academic research that explicitly links KM to the VSM, clearly states the concepts and principles to be adopted from that research and indicates gaps that this research seeks to advance to some degree.

Leonard (1999) proposed the VSM as a powerful descriptive and diagnostic tool that allows knowledge to be viewed from the perspective of the individual, the relationship network and the organisation. Similarly, Leonard (2000) described the VSM as providing an excellent structure for addressing the organization as a whole in order to realise KM's full potential. Indeed, Rubenstein-Montano et al. (2001) primary research finding was the recommendation that any KM framework should be developed in-line with systems thinking because this allows for a cohesive definition and evaluation of the given knowledge management framework - an opinion shared by Sharma (2021), Yang & Yen (2007) and Yolles (2000). While the aforementioned research is encouraging in that it recognised the value of developing a KM framework based on the VSM, it stops short of demonstrating theory in practical applications. And according to Hildbrand & Bodhanya (2015), even though there have been many successful practical applications of VSM reported, hardly any of this literature provides practitioners with an insight as to how a VSM diagnosis was actually accomplished within the given application.

Despite the fact that VSM is little known among the general management population (Espejo & Gill, 2011), there have been hundreds of applications of VSM worldwide (Espinosa, 2022; Vahidi et al., 2019; Cardoso Castro, 2019; Espejo & Reyes, 2011). Nevertheless, a literature research of VSM relating to KM conducted by this researcher revealed few relevant results and zero results when also considered in a context to an alliance formation. Vahidi et al. (2019) analysed the top one thousand Google Scholar ranked publications in the field of VSM listing the top one hundred most cited in other scholarly literature. They found that 3% of publications related to the area of KM citing Leonard (1999 and 2000), which has already been referenced above, as well as the research paper “Managing Viable Knowledge” from Achterbergh & Vriens (2002).

In fact, it is this research from Achterbergh & Vriens (2002) that forms the basis for the theoretical framework linking VSM with KM that is developed in this research. Espinosa (2022) and Lowe et al. (2020) who are prominent contributors in the field of VSM, cited Achterbergh & Vriens (2002) as their single reference while reviewing VSM methodologies related to KM, which gives confidence that Achterbergh & Vriens’ (2002) research is a credible point of departure for this research. In the following section, the concepts and principles that are adopted from Achterbergh & Vriens (2002) as well as additions based on a wider literature review are clearly stated. A brief assessment of the outcome of the research from Achterbergh & Vriens (2002) is provided at the end of this section in order to highlight gaps that this research seeks to fill.

Finally, in the interest of completeness, it is important to recognise that there are a number of published approaches that attempt to guide the practical application steps of the VSM for diagnosis and design. Espinosa (2022) provided some examples including, for example, Viability planning or *Viplan* (Espejo & Reyes, 2011) and Self-Transformation Methodology or *STM* (Espinosa, 2022). It is not appropriate or beneficial at this point to elaborate the details of such generic approaches. However, any aspects of the *Viplan* or *STM* employed during the specific application of this research (see Section 4.2) will be explicitly acknowledged as appropriate.

3.3.1 Adopted principles

As discussed in Section 3.1.1, Achterbergh & Vriens (2002) defined knowledge as being that needed for the assessment of signals and for the performance of actions. This *functional definition of knowledge*, as they refer to it, lends itself well to domain of the VSM, which can be viewed as a system of actions interlinked by signals (Achterbergh & Vriens, 2002). Since the VSM of an organisation then models the actions and signals that are required for the organisation to remain viable, the knowledge that is needed to assess those signals and

perform those actions can be seen as the knowledge that is relevant for the organisation (Achterbergh & Vriens, 2002). This same logic is employed in this research. That is:

- **Principle 1:** Relevant knowledge is identified by that which is needed in order for the five VSM systems (S1-S5) to perform their functions and interactions. This provides a focus for the knowledge needed by an organisation to remain viable.
- **Principle 2:** The concept of knowledge has a functional definition. It is that which is needed for the assessment of signals (perception, interpretation, evaluation) and for the performance of actions (articulation, selection, implementation). This definition is helpful because it forces the express consideration of the knowledge needed for each logical stage of a knowledge episode.

As discussed in Section 3.1.2, Achterbergh & Vriens (2002) deemed four knowledge process types to be sufficient (generation, sharing, application and retention) when considering how the knowledge needed for the assessment of signals and performance of actions should be treated. The same process types are employed in this research with the addition of an identification process type described by Probst (1998) (see Section 3.1.2) That is:

- **Principle 3:** Five knowledge process types (identification, generation, application, retention and sharing) are considered sufficient to identify the variety of processes that are performed in relation to the knowledge needed for the assessment of signals and performance of actions.

Furthermore, as discussed in Section 3.1.1, knowledge attributes such as, for example, knowledge mode (explicit/tacit), involved stakeholders, confidentiality level, etc. influence how knowledge processes are performed. This is therefore another relevant aspect that is employed in this research. That is:

- **Principle 4:** The attributes of the knowledge that are needed for the assessment of signals and performance of actions must be ascertained and expressly stated to ensure complete and effective process design.

Achterbergh & Vriens (2002) considered KM to consist of *four core elements*, the first three of which have already been mentioned in principles 1 to 3, namely: relevant knowledge, a concept of knowledge and knowledge processes. The fourth core element is considered to be *instruments that support knowledge processes*. Achterbergh & Vriens (2002) cited literature suggesting that instruments can be categorised under: organisational structure, human resources management and ICT which aligns well with the VSM definition of support functions discussed in Section 3.2.4. Achterbergh & Vriens (2002) also cited literature suggesting that promoting a climate of knowledge creation and sharing should also be considered as an

instrument and indeed Section 3.1.3 recognised that effective knowledge management is inseparable from organisational culture and leadership. Effectively then, this means that all organisational dimensions should be considered when determining if all instruments are in place to support knowledge processes. In this regard, McKinsey 7-S framework (Waterman et al., 1980) provides a useful and comprehensive tool (see Figure 23).

- **Principle 5:** KM consists of four core elements: relevant knowledge, a concept of knowledge, knowledge processes, and instruments that support knowledge processes. This definition is helpful because it forces the express consideration that all core elements of KM are integrated into the theoretical framework presented in this research.
- **Principle 6:** Required instruments that support knowledge processes must be considered with a holistic view of organisational dimensions. It is useful to consider instruments required in terms of organisational structure, human resources management and ICT tools but it is also important to question if a leadership style is in place that encourages the culture of a learning organisation. McKinsey 7-S framework is a useful tool when questioning if all organisational dimensions have been considered as instruments to support knowledge processes.

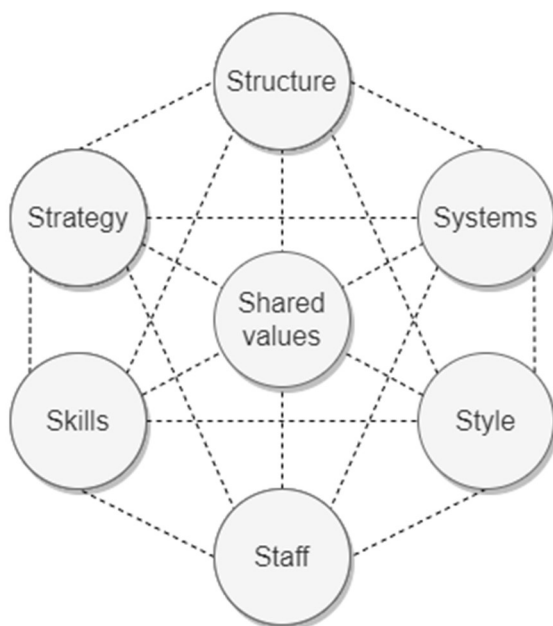


Figure 23: Culture at the heart of McKinsey 7-S framework.

Source: (Waterman, 1982, p. 70)

3.3.2 Research gap

Table 7 provides the tangible output from Achterbergh & Vriens (2002) research. This table lists VSM relevant knowledge and indicates to which VSM function (F1 to F5) that the knowledge is indeed relevant by indicating for each function if the knowledge is generated (G) and/or applied (A) by that function. Achterbergh & Vriens (2002) suggested that from this table can be “deduced what knowledge should be shared among which function” and that “hints for retaining knowledge can be derived” (p. 240). They further provided one example to explain how a dependency diagram can be used to show the processing sequence of knowledge between functions F3, F4 and F5 for the particular example of F5 balancing the interaction between F3 and F4 (see Figure 24).

Knowledge domains	F1	F2	F3	F4	F5
Goals set by, performance and modus operandi of the primary activities in F1	G,A	A	A	A	
Organizational goals	A		A	A	G,A
Expected performance of the primary activity (goals for F1 activity)	A		G,A		
Monitoring and control practices by F3	A		G,A		
Goal and performance misalignment	A		G,A		
Causes and consequences of goal and performance misalignment	G,A		G,A		
Actions to counter goal and performance misalignment by F1	G,A				
Heuristics to implement counteractions	G,A				
Anti-oscillatory measures	A	G,A			
Interdependencies between F1 activities		G,A			
Actual oscillations		G,A			
Actual performance loss due to oscillations		G,A			
Norms for admitted performance loss due to oscillations (goals for F2)		A	G,A		
Gap between norm for admitted and actual performance loss due to oscillations		A	G,A		
Causes of the gap between admitted and actual performance loss due to oscillations		G,A			
Experiences with anti-oscillatory measures		G,A			
Problems and needs of the management of F1 activities	G,A		G,A		
Proposals for innovation made by F4			A	G,A	A
Desired goals for F1 based on proposals for innovation			G,A		
Gap between desired and current goals of F1			G,A		
Required capacity for reorganization of F1 activities			G,A		
Actual capacity for reorganization of F1 activities			G,A		
Gap between required and actual capacity for reorganization of F1 activities			G,A		
Reviews by F3 of proposals for innovation			G,A	A	A
Finalized plans for adaptation of organizational goals (a joint F3 and F4 product)			G,A	G,A	A
Regulatory measures to counter the imbalance between F3 and F4			A	A	G,A
Developments in the relevant environment of the organization				G,A	
Norms for balance between F3 and F4					G,A
Actual imbalance between F3 and F4					G,A
Causes of imbalance between F3 and F4					G,A
Experiences with regulatory measures to counter the imbalance between F3 and F4					G,A

Table 7: Overview of relations between VSM relevant knowledge, functions and processes.

Source: (Achterbergh & Vriens, 2002, p. 236)

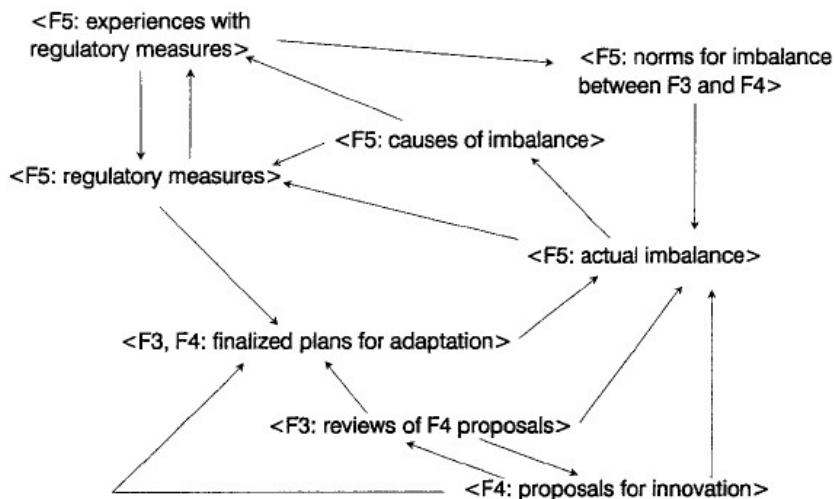


Figure 24: Example of a dependency diagram¹²

Source: (Achterbergh & Vriens, 2002, p. 237)

The fact that multiple dependency diagrams would be required to show the processing sequence of knowledge between functions demonstrates that it is not possible to take any one table row in isolation in order to design required processes. Each row of the table is linked to at least one other table row, and it is not immediately clear how to identify the sub-sets of inter-linked rows. Furthermore, it is also not obvious how to construct dependency diagrams for those sub-sets. For example, in Figure 24 it is not immediately obvious which node is the trigger/starting point in the sequence. It is perhaps also worth to highlight that the fact that an *A* may appear multiple times in a given table row does not mean that the application process is the same for each function (the way that one function processes knowledge will obviously be different to the way that another function processes that knowledge).

Finally, while it is certainly challenging to create descriptions for each table row that are relatively short but also sufficiently informative, many descriptions require a concerted effort to reconcile with VSM functions. Consider, for example, how a novice practitioner should interpret knowledge for “Goals set by, performance and modus operandi of the primary activities in F1” that is generated by F1 and applied by F1-F4. From the point of view of this researcher, all of the above points may be off-putting to practitioners attempting to apply the framework.

During the introduction of their framework buildup, Achterbergh & Vriens (2002) provided some simple examples from an ICT business to demonstrate VSM function interactions. However, they did not then later apply their research output to diagnose that company and

¹² Achterbergh & Vriens (2002) label VSM systems S1-S5 as functions F1-F5.

assess their framework. This means no suggestion was provided as to how to commence and apply such an approach and so no practical application insights were gained including for example: if the framework helped to identify deficiencies of necessary VSM functions, interactions, knowledge processes and instruments to support processes, how VSM function roles were filled and communication interfaces defined, if the application led to the recognition that additional resources, training or outsourcing was required, if single points of knowledge were identified and what knowledge retention process/strategy was established, what new necessary instruments were identified, what types of practical artifacts were produced, and in general, was the VSM framework found to be useful?

This research builds on and advances research from Achterbergh & Vriens (2002) by providing a solid theoretical foundation of pertinent aspects of KM and the VSM, constructing a VSM of a business alliance, creating a visual model that illustrates the link between the VSM and the core elements of KM theory, constructing an application framework to guide implementation steps, applying the framework to a real-world application and sharing tangible artifacts, insights and learnings from the application.

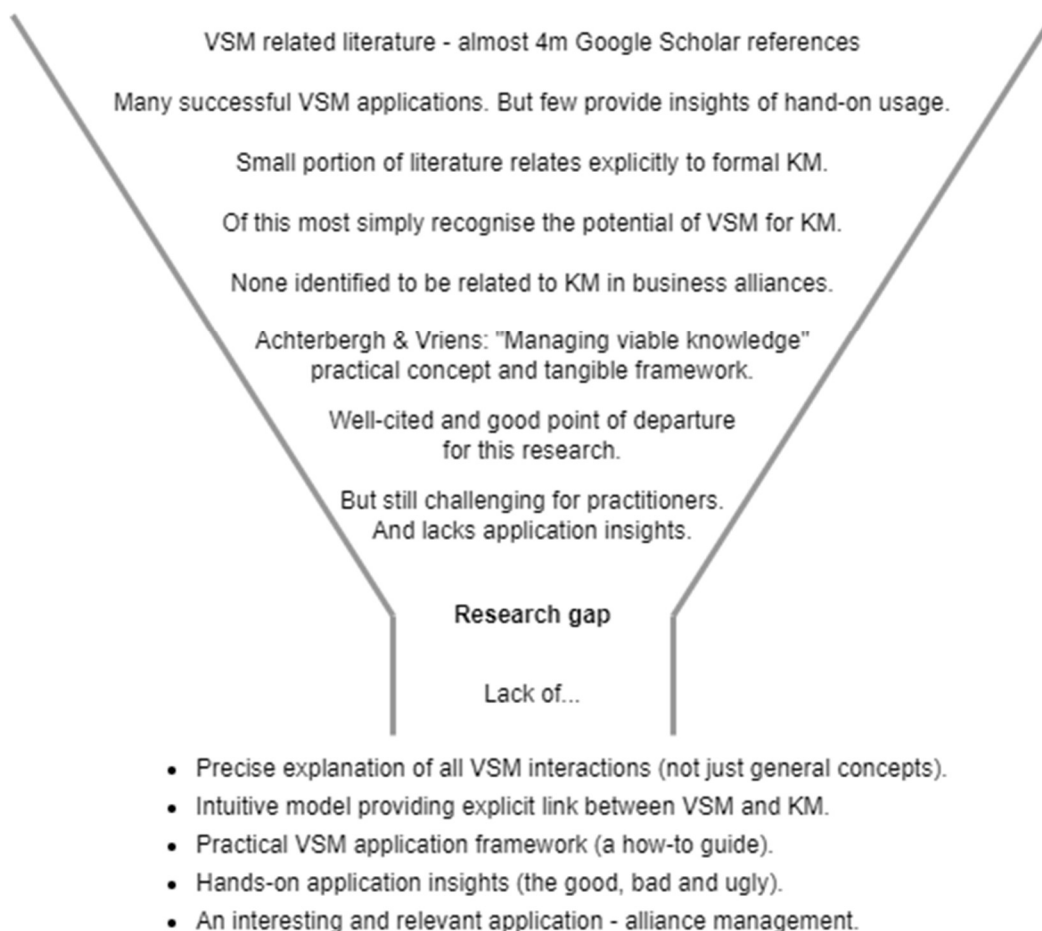


Figure 25: Approximate representation of overall literature review and identified research gap.

Source: Self-created.

4 Empirical results

This chapter seeks to answer the research question posed in Section 1.2. Figure 26 provides a reminder of the research focus to determine how VSM can be utilised to define alliance management functions and relationships, the knowledge required by that management and the processes needed to manage that knowledge. Again, the motivation being that an alliance of two already viable businesses that achieves the cohesive and adaptive properties of VSM synergistically increases complexity capacity (and so market opportunities) and ensures long-term viability of the alliance - recognising that effective KM is an essential element in achieving the desired cohesion and adaption mechanisms between stakeholders within the alliance.

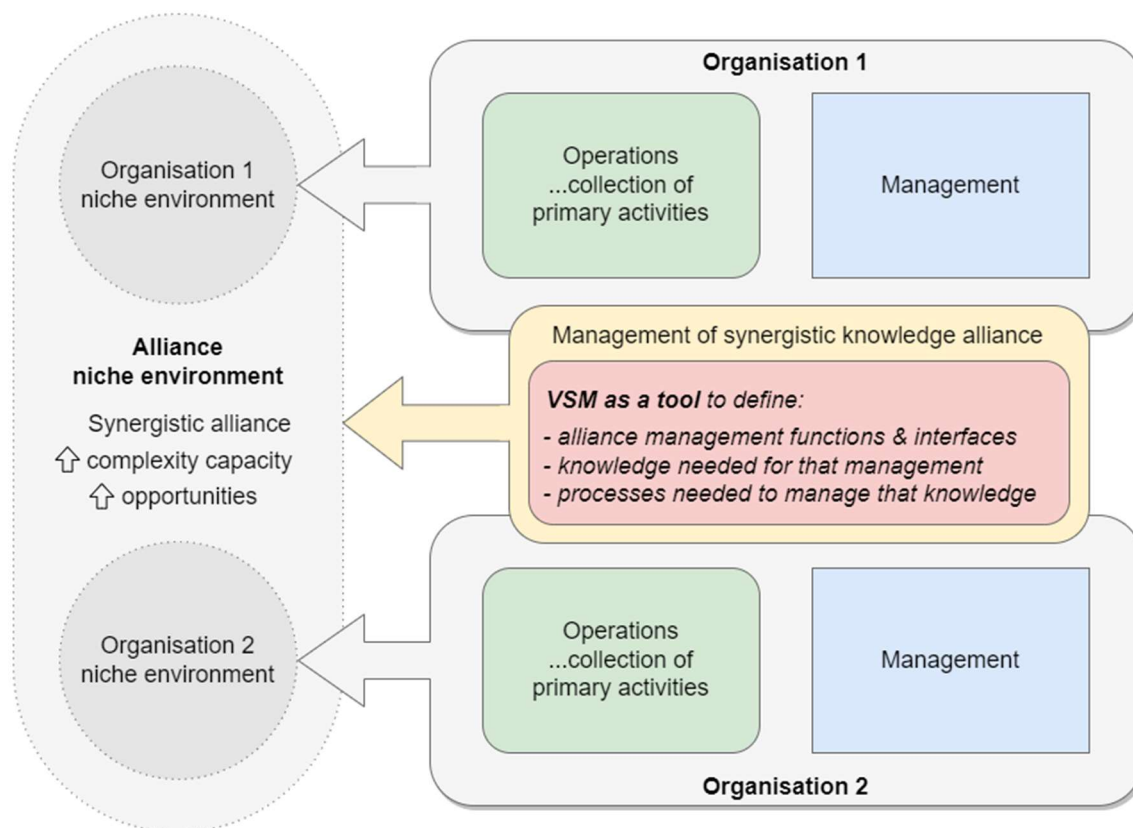


Figure 26: Research focus – VSM as a tool to support the design of synergistic knowledge alliances.
Source: Self-created.

4.1 General model and framework

Based on the solid theoretical foundation of Chapter 3 and collaborative refinements together with practitioners that are actively involved in the organisation of a newly formed alliance, this section presents the following generalised items to address the first three objectives of this research (see Section 1.2):

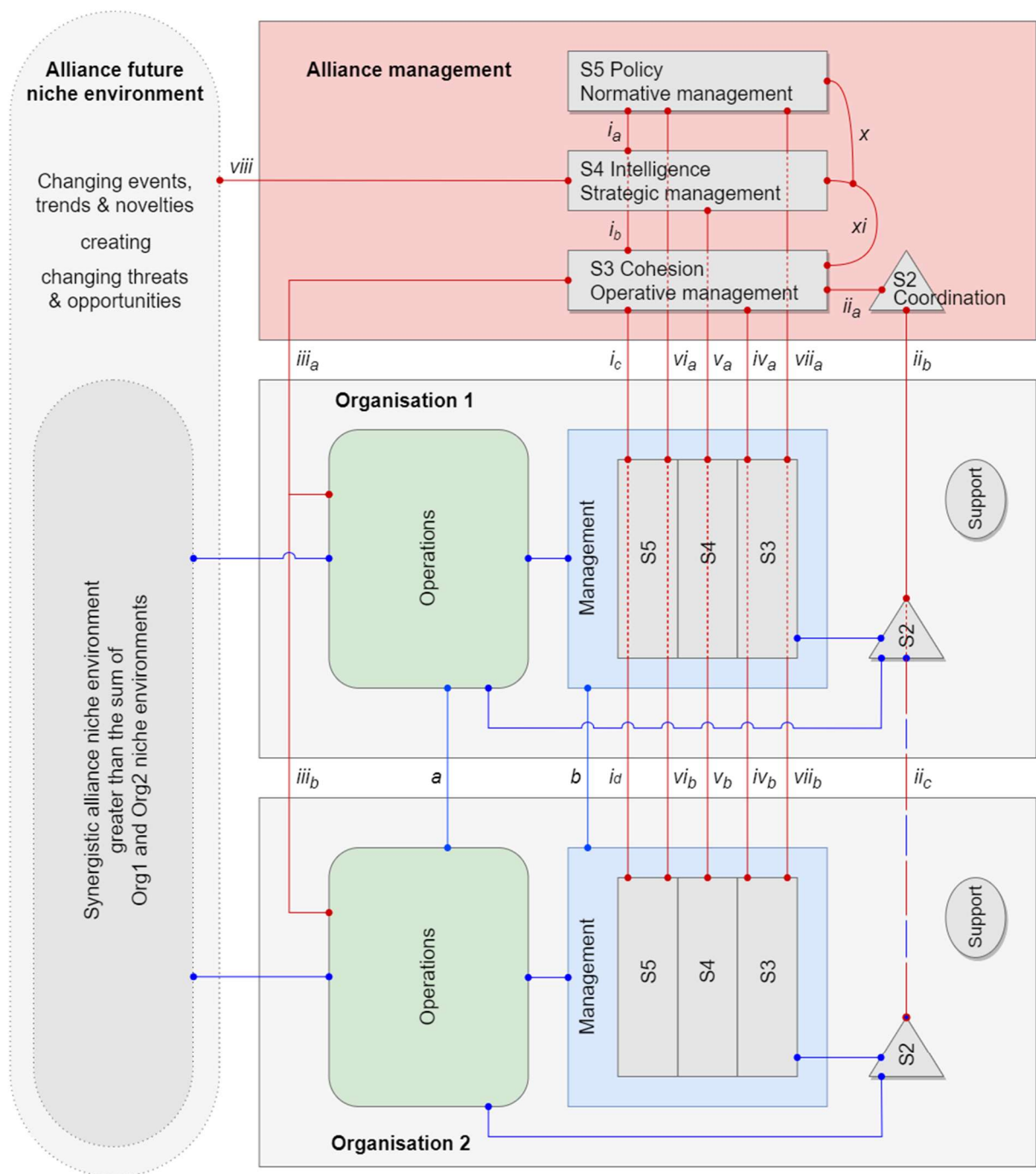
1. A VSM model of a business alliance placing focus on the alliance management functions.
2. A model that links the VSM with the core elements of KM theory and the knowledge processes to be considered during the definition of alliance management actions and interactions.
3. A description of the role, responsibilities, scope of interactions and interfaces and required competencies for each function of the alliance management.
4. A framework to support practitioners with the application of the above items.

4.1.1 Business alliance VSM

The VSM for a business alliance that is put forward by this research is shown in Figure 27. This model assumes an alliance consisting of two independent organisations contributing complementary products and services to the alliance. Since, the model also assumes that both organisations are already viable businesses, each organisation is considered to be a primary activity of the alliance. The model and scope of this research does not consider the VSM of each organisation in detail since, being viable businesses, it is assumed that they contain the necessary and sufficient VSM systems S5 to S1 whether or not this is explicitly recognised by the organisations in VSM terms. Note, however, that it will be necessary, during the design of the alliance management, to identify the stakeholders that make up those VSM systems in each organisation because this then defines with whom the alliance management must interact. This is also useful information because those identified stakeholders of organisation systems may eventually (but not necessarily) form part of the corresponding systems of the alliance management (see the practical application in Section 4.2 - Specific).

The model further assumes that, the two independent organisations retain their own complete set of support functions (invoicing, personnel, finance, marketing, information services, etc.) and that there are no centralised support functions at the alliance management level as was previously seen in the general VSM of Figure 21. Finally, note that the model considers the audit function S3-star to be inside the cohesion function S3 since both functions are performed by the same stakeholders.

In Figure 27, the VSM systems S5-S2 related to the management of the alliance are contained within the reddish-coloured frame and all necessary and sufficient alliance management interactions are represented by the red, labelled channels. In previous sections (3.2.2, 3.2.3 and 3.2.4), these systems and channels of the VSM have been discussed in detail.



- | | | |
|--|---|-------------------------------|
| <i>i</i> Command channel | <i>v</i> Inter-Intelligence (inter level) channel | <i>ix</i> Adaption channel |
| <i>ii</i> Coordination channel | <i>vi</i> Inter-Policy (inter level) channel | <i>x</i> Balance channel |
| <i>iii</i> Audit channel | <i>vii</i> Alegendonic signal | <i>a</i> Operational linkages |
| <i>iv</i> Inter-Cohesion (inter level) channel | <i>viii</i> Environment channel | <i>b</i> Operational linkages |

Figure 27: VSM of business alliance consisting of two independent, complementary organisations.

Source: Self-created.

4.1.2 VSM-KM model

Figure 28 represents a system of the VSM to be a knowledge processor and utilises the six principles outlined in Section 3.3 to now illustrate the link between VSM and the core elements of KM in an intuitive manner. Based on the stated concept of knowledge, the set of VSM system interactions requiring the perception of input signals together with the set of subsequent actions that must be performed according to the VSM define the knowledge that is relevant for each system to fulfill its VSM role and responsibilities. Therefore, in order to define the responsibilities of a given system in the alliance management, it is necessary to consider every interaction of that system and the processes that must take place to process each interaction. In other words, an analysis of the complete set of knowledge episodes experienced by each system in the alliance management allows us to define the responsibilities of each system.

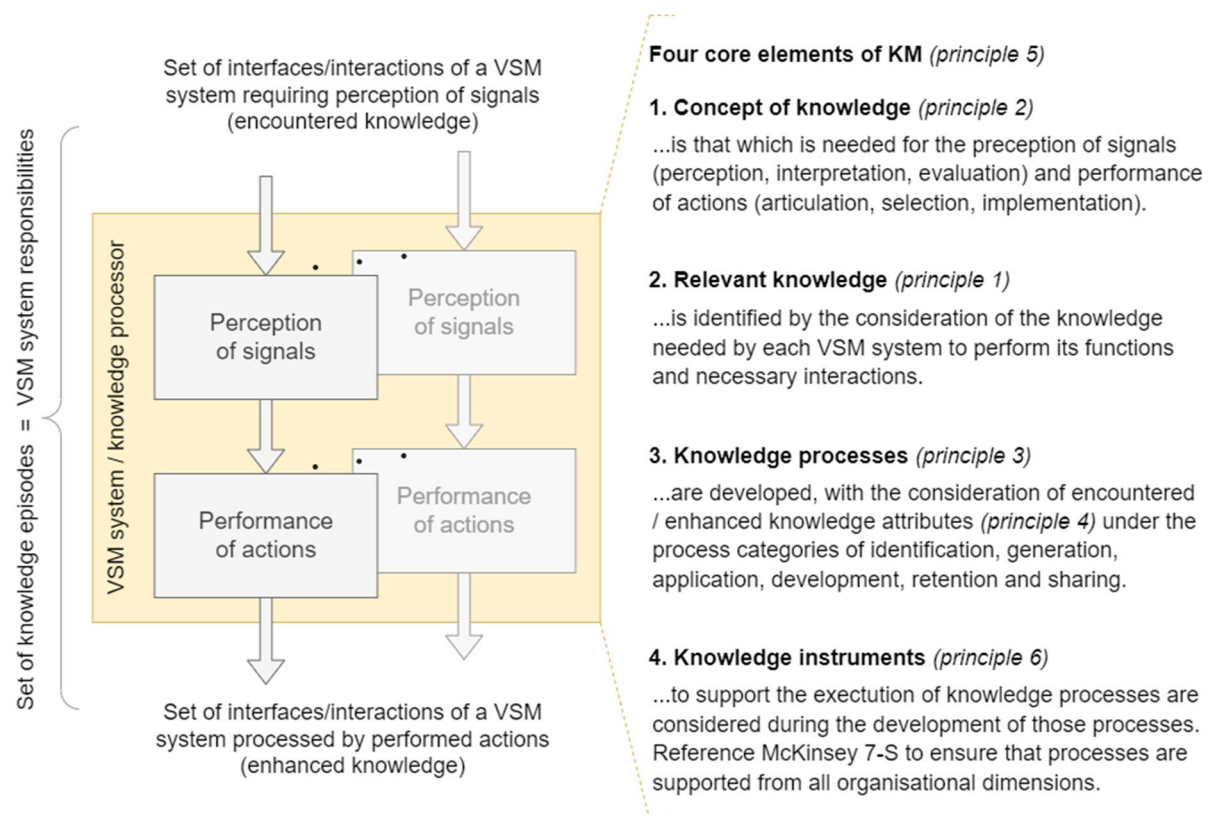


Figure 28: Represents a VSM system as a knowledge processor linking the four core elements of KM. Source: Self-created based on principles outlined in Section 3.3.

Figure 29 shows the knowledge processes that should be developed to support each stage (input, action, output) of a knowledge episode. During the analysis of any given knowledge episode, it is useful to think in terms of the knowledge process sequence: identification, generation, application, retention and sharing, since this helps to guide the logical sequence of a typical knowledge episode. This convention could also be expected to encourage a

mindset that is more conducive to the adoption of formal KM since the processes are developed in support of real purpose and so are a useful and practical tool to the stakeholder. And not the other way around, that as an afterthought, a purpose is invented for the use of KM processes that may be more of a hinderance than a help to the stakeholder.

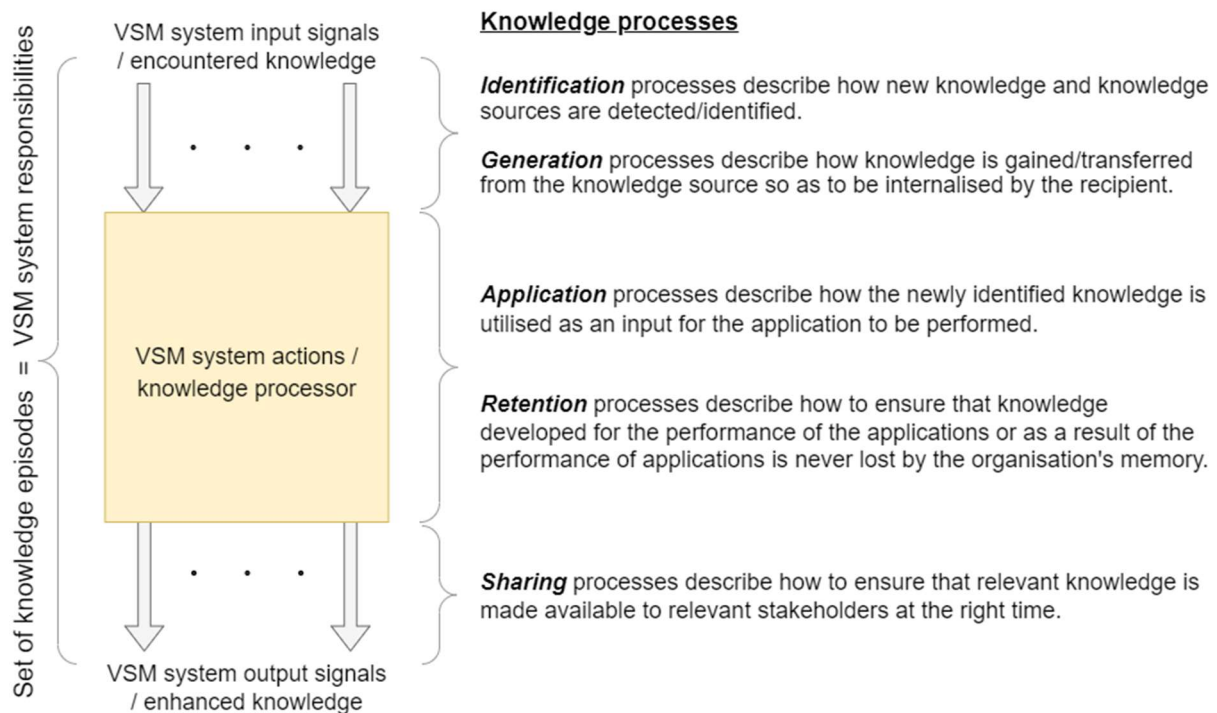


Figure 29: Knowledge processes considered during the definition of VSM system responsibilities.

Source: Self-created.

4.1.3 Alliance VSM S5 job description

Table 8 outlines the complete set and interactions that take place with alliance management system S5 (normative management / policy function) over the channels interfacing with the counterpart stakeholders shown in Figure 27. This table effectively describes the responsibilities of the alliance normative management, directly defines its scope of interfaces and allows the derivation of the role and required competencies of alliance normative management described in Table 9. As described in Section 4.1.2, Table 8 also suggests the type knowledge processes that typically align well with each stage (input, action and output) of an interaction and are expected to be considered (and if helpful, developed) as a natural course of events during the elaboration of the responsibilities of the alliance normative management role.

In order to minimise the amount of descriptive text in Table 8, Figure 30 and Figure 31 help to clarify the meaning behind Table 8 terms: “S4 strategic plan and requested budget”, “S3 operational plan and requested budget” and “S5 monitor for S4-S3 imbalance”.

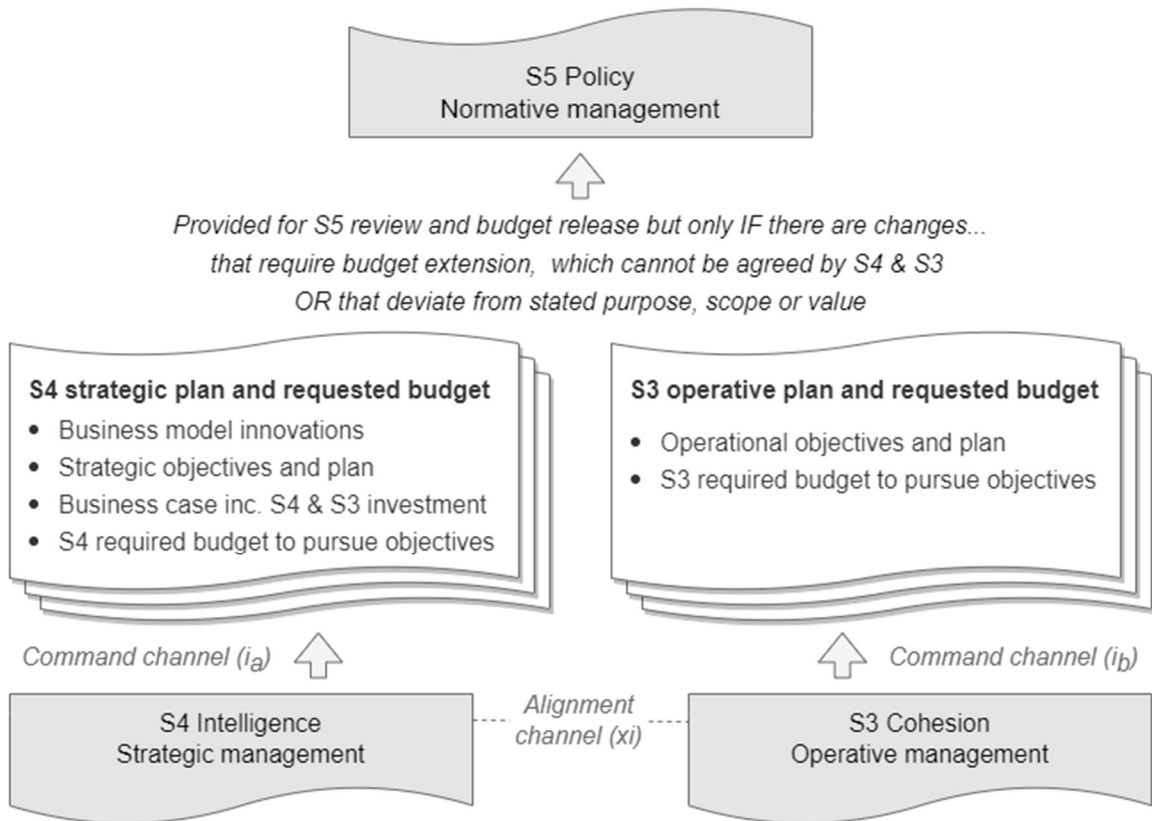


Figure 30: Typical content of S4 strategic and S3 operational plans provided to S5 for budget release.

Source: Self-created.

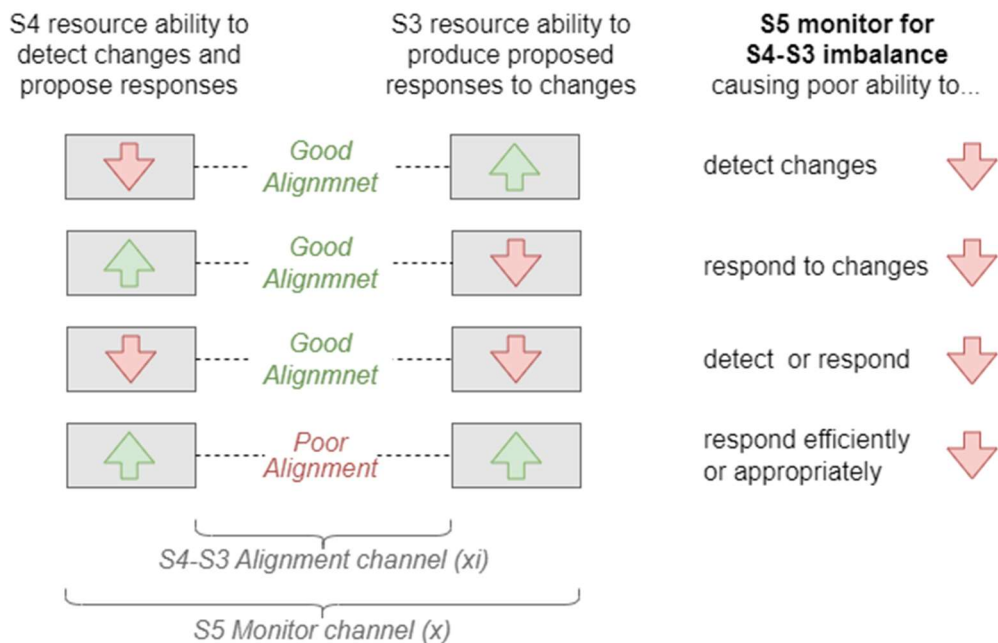


Figure 31: Typical concerns of S5 for S4-S3 imbalance/misalignment.

Source: Self-created.

Alliance management system S5 - Responsibilities and interfaces		
Channel	Interface	Interaction (responsibility)
v_{ia} & v_{ib}	Org1 S5 & Org2 S5	<p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> • Organisations' stated purpose, scope & values. • Input towards statement of alliance purpose, scope & values. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S5 create statement of alliance purpose, scope & values. • If appropriate, S5 adjust statement of alliance purpose, scope & values. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S5 provide statement of alliance purpose, scope & values.
i_a	Alliance S4	<p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> • S4 strategic plan and requested budget (see Figure 30). • S4 progress reports and budget status. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S5 review strategic plan in context of alliance purpose and negotiate budget. • S5 process progress reports and budget status. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S5 release strategic plan and negotiated budget. • S5 make interventions subject to progress reports and budget status. • Always, S5 promotes statement of alliance purpose, scope & values.
i_b	Alliance S3	<p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> • S3 operational plan and requested budget (see Figure 30). • S3 progress reports, budget status and operational performance. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S5 review operational plan in context of alliance purpose and negotiate budget. • S5 process progress reports, budget status and performance. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S5 release operational plan and negotiated budget. • S5 make interventions subject to progress reports, budget status, performance. • Always, S5 promotes statement of alliance purpose, scope & values.
x	Alliance S4/S3	<p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> • S5 monitor for signs of S4-S3 misalignment or imbalance (see Figure 31). <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S5 determine together with S4 (i_a) and S3 (i_b) if concerns are legitimate, the root cause and corrective and preventive actions. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S5 initiate measures to resolve S3-S4 misalignment or imbalance. • Always, S5 promotes statement of alliance purpose, scope & values.

<i>vii_a</i> & <i>vii_b</i>	Org1 S3 & Org2 S3	<p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> Escalation of any form from either organisation that it is (or soon will be) unable to produce its part of the alliance stated purpose. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> S5 activate alliance S3 (<i>i_b</i>) and Org1 S5 (<i>v_{i_a}</i>) or Org2 S5 (<i>v_{i_b}</i>), who should be aware of the purpose, progress and status, to diagnose and form plan of action. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> S5 communicates prioritised plan of action to resolve escalation.
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Table 8: Alliance management S5 interfaces and interactions define responsibility.

Source: Self-created.

Alliance management system S5 – Role and competencies	
Role	<ul style="list-style-type: none"> Formulate, disseminate & promote in a clear, unambiguous, consistent manner: <ul style="list-style-type: none"> the purpose of the alliance ‘the why’, but not ‘the what’ or ‘the how’) the scope of the alliance (context, policies, restrictions) the values that are important to the alliance Facilitate, monitor and control pursuant activities.
Competencies	<ul style="list-style-type: none"> Intuitive visionary, conviction to stay the course, financial wherewithal.

Table 9: Alliance management S5 role and competencies.

Source: Self-created.

4.1.4 Alliance VSM S4 job description

Table 10 outlines the complete set and interactions that take place with alliance management system S4 (strategic management / intelligence function) over the channels interfacing with the counterpart stakeholders shown in Figure 27. This table effectively describes the responsibilities of the alliance strategic management, directly defines its scope of interfaces and allows the derivation of the role and required competencies of alliance strategic management described in Table 11. Table 10 also suggests the type knowledge processes that typically align well with each stage (input, action, output) of an interaction and are expected to be considered (and if helpful, developed) as a natural course of events during the elaboration of the responsibilities of the alliance strategic management role.

In order to minimise the amount of descriptive text in Table 10, Figure 32 helps to visualise the sources from which alliance strategic management eventually (and continuously) arrive at an innovative business model for the alliance and “S4 strategic plan and budget required to pursue innovation”.

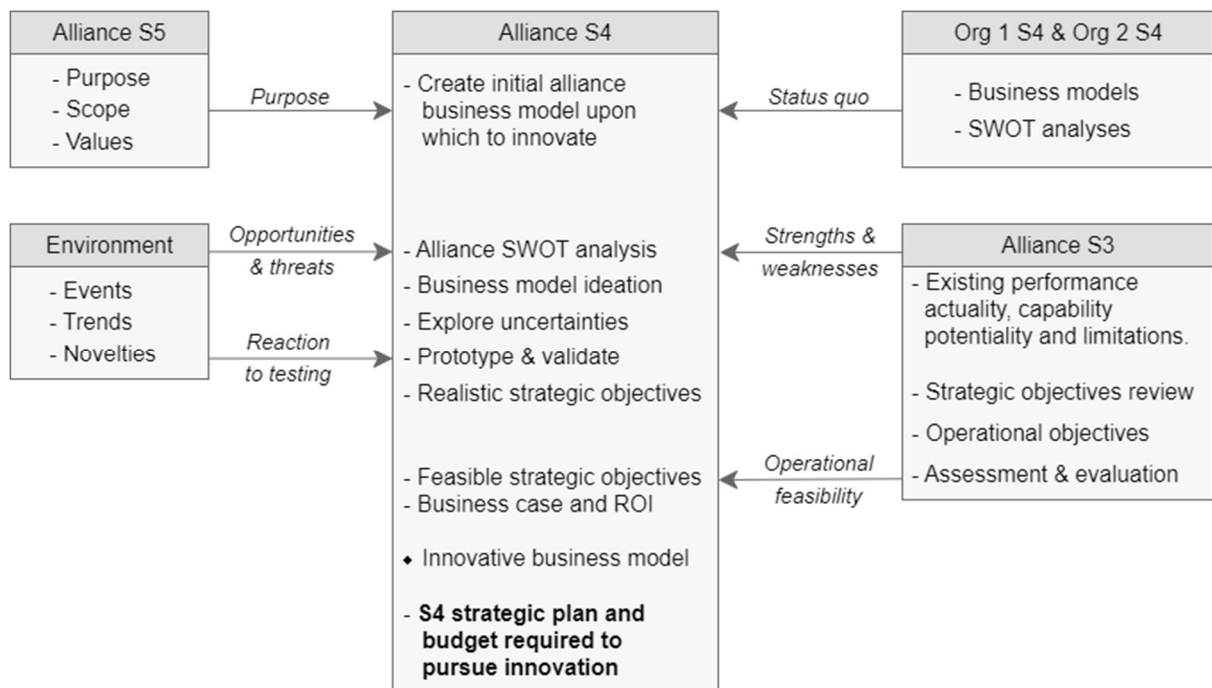


Figure 32: Input knowledge required by S4 during the development of innovative business models.
 Source: Self-created.

Alliance management system S4 - Responsibilities and interfaces		
Channel	Interface	Interaction (responsibility)
<i>i_a</i>	Alliance S5	<p>Input (knowledge identification, generation) (see Figure 32):</p> <ul style="list-style-type: none"> S5 statement of alliance purpose, scope and values. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> S4 utilise S5 statement of alliance purpose, scope and values as part input for the creation of a business model for the alliance. Subsequently, S4 develop strategic objectives and business case. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> S4 strategic plan and budget required to pursue innovative activities (Figure 32) S4 report progress of the plan and budget status.
<i>v_a</i> & <i>v_b</i>	Org1 S4 & Org2 S4	<p>Input (knowledge identification, generation) (see Figure 32):</p> <ul style="list-style-type: none"> Organisations' business models. Organisations' SWOT analysis of own niche environment. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> S4 utilise organisations' business models and assessments as part input for the creation of a realistic business model of the alliance upon which to innovate. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> S4 S4 continuously align individual and alliance business models.

viii	Environ.	<p>Input (knowledge identification, generation) (see Figure 32):</p> <ul style="list-style-type: none"> • Events, trends and novelties posing opportunities and threats to the alliance. • Responses to S4 environment experiments. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S4 monitor and actively research the alliance niche environment to detect events, trends and novelties and seek to discover opportunities and threats. • S4 utilise discovered opportunities and threats as part input in the design of innovations to any aspect of the alliance business model. • S4 create experiments to validate hypothesised innovations (e.g. MVPs) or to explore questions of uncertainty (e.g. market research) to establish realistic strategic objectives. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S4 experiments to validate hypothesised business model innovations or to explore environment uncertainties needed for business model innovation.
xi	Alliance S3	<p>Input (knowledge identification, generation) (see Figure 32):</p> <ul style="list-style-type: none"> • S3 overview of alliance primary activities (organisations' operations) performance actuality, capability, potentiality and limitations. • S3 operational objectives needed to satisfy S4 strategic objectives and estimation of investment, resources, time, risk (feasibility / operational plan). <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S4 utilise S3 alliance performance overview as part input for the creation of a realistic business model of the alliance upon which to innovate. • S4 utilise S3 feasibility check and operational plan as part input for the creation of a business case for the implementation of a business model innovation. • S4 and S3 negotiate and agree implementation details and/or if necessary seek alignment with S5 (see Figure 30). <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S4 query S3 for alliance performance details. • S4 prospective strategic objectives for S3 appraisal.

Table 10: Alliance management S4 interfaces and interactions define responsibility.

Source: Self-created.

Alliance management system S4 – Role and competencies	
Role	<ul style="list-style-type: none"> • Continuously assess strengths, weaknesses, opportunities and threats of the alliance in its niche environment. • Drive discovery, design and validation of innovations to all aspects of the alliance business model (including but not limited to products and services). • Determine feasible and viable strategic objectives that will allow the alliance to continue to produce its stated purpose with it stated scope and values.

	<ul style="list-style-type: none"> If S5 stated purpose indicates ‘the why’ of the alliance, then S4 strategic objectives can be seen as ‘the what’...will be done to satisfy this purpose.
Competencies	<ul style="list-style-type: none"> Include: market research, SWOT analysis, product and service innovation, business model innovation, feasibility studies and market testing, business case and ROI, and strategic thinking.

Table 11: Alliance management S4 role and competencies.

Source: Self-created.

4.1.5 Alliance VSM S3 job description

Table 12 outlines the complete set and interactions that take place with alliance management system S3 (operative management / cohesion function) over the channels interfacing with the counterpart stakeholders shown in Figure 27. This table effectively describes the responsibilities of the alliance operative management, directly defines its scope of interfaces and allows the derivation of the role and required competencies of alliance operative management described in Table 13. Table 12 also suggests the knowledge process types that typically align well with each stage (input, action, output) of an interaction and are expected to be considered (and if helpful, developed) as a natural course of events during the elaboration of the responsibilities of the alliance operative management role.

In order to minimise the amount of descriptive text in Table 12, Figure 33 helps to clarify terminology and to visualise the distribution of “Alliance operational objectives” by alliance operative management for the purpose of generating a cohesive “Alliance operational plan”. To further support understanding of Table 12, it is worth to make some short thought exercises related to Figure 33 by raising the following questions:

- If there are strong operational linkages between S5, S3 and S2 of the organisations in the alliance (represented by the dotted lines in Figure 33) then aren’t the roles of the alliance S3 and S2 redundant? In theory, yes! However, in everyday business, consistent alignment is not always guaranteed at all levels and so the important role of the alliance S3 and S2 is to maintain the operational overview and ensure alignment and cohesion with a consistent, sharp focus on the alliance purpose and strategic objectives.
- Aren’t the “Alliance implementation plan” and the sum of the “Org1 opnl. plan” and “Org1 opnl. plan” the same and so why have both return paths to the alliance S3? If the alliance S2 has been successful in performing its role then yes! However, the alliance S3 must align this plan with the understanding of the plan as viewed by S5 of both organisations because eventually they must buy into the purpose of the alliance, release resources and be accountable for their portion of plan (the alliance S2 maintains organisation alignment during implementation of a plan but is not accountable for organisation performance).

The separated paths also mean that if alliance S2 has not been successful to formulate a plan that meets alliance operational objectives then it can escalate to alliance S3 to attempt to resolve with the organisations' S5.

- Aren't the objectives for each function of Figure 33 basically the same and so does every VSM system of the organisations really need to be involved? Beer's VSM would say, yes, every functions plays an important part in the viability of a system. For a complex objective in a large organisation this provides necessary complexity distribution. In the other extreme of a elementary objective in a small organisation, even if one person possesses requisite variety to performs all functions of S5, S4, S3 and S2, they still need to perform progressive detailing of objectives/plans from the organisational perspectives of those different roles.

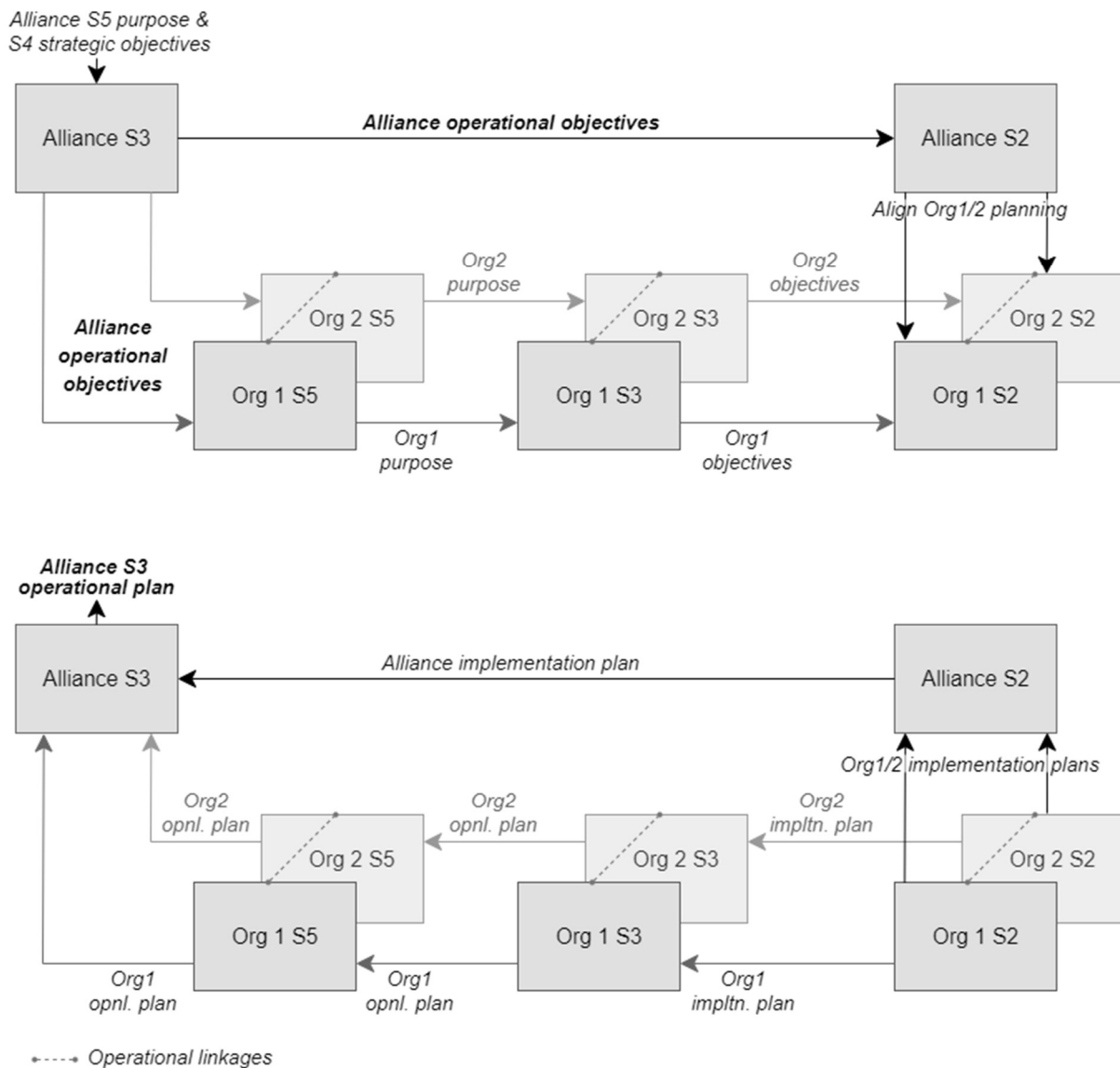


Figure 33: S3 distribution of alliance operational objectives and generation of alliance operational plan. Source: Self-created.

Alliance management system S3 - Responsibilities and interfaces		
Channel	Interface	Interaction (responsibility)
<i>xi</i>	Alliance S4	<p>Input (knowledge identification, generation) (see Figure 32):</p> <ul style="list-style-type: none"> • S4 query for alliance performance details. • S4 prospective strategic objectives for appraisal. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S3 compile and maintain overview of alliance performance actuality and capability and assess potentiality and limitations subject to S4 specific query. • S3 determine operational objectives corresponding to strategic objectives and estimate required investment, resources, time, risk (an operational plan). • S3 and S4 negotiate and agree implementation details and/or if necessary seek alignment with S5 (see Figure 30). <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S3 overview of alliance performance actuality, capability, potentiality, limitations. • S3 feasibility check and operational plan to satisfy S4 strategic objectives.
<i>i_b</i>	Alliance S5	<p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> • S5 statement of alliance purpose, scope and values. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S3 utilise S5 statement of alliance purpose, scope and values as part input for the creation of an operational plan corresponding to S4 strategic objectives. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S3 operational plan and budget required to pursue operational changes. • S3 report progress of the plan and budget status. • Always, S3 reports operational performance actuality.
<i>ii_a</i>	Alliance S2	<p>See Figure 33</p> <p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> • S2 implementation plan corresponding to S3 operational objectives including estimation of resources, timeline and risks. • S2 progress report for initiated implementation plan. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S3 utilise S2 implementation plan as its primary input for estimation of alliance operational plan corresponding to S4 strategic objectives. • S3 utilise S2 progress report of initiated plan as part input in determining if intervention is required for either primary activities (organisation) of the alliance. <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S3 alliance operational objectives as input for S2 implementation plan. • S3 fine-tuning and initiation of implementation plan.

<i>i_c</i> & <i>i_d</i>	Org1 S5 & Org2 S5	See Figure 33 Input (knowledge identification, generation): <ul style="list-style-type: none"> • Organisations' individual operational plans and required budget. • Organisations' progress reports, budget status and operational performance. Action (knowledge application, retention): <ul style="list-style-type: none"> • S3 utilise organisations' operational plans and required budget to verify alignment with alliance operational plan prepared together with S2. • S3 negotiate and obtain commitment from organisations to alliance operational plan and budget. Output (knowledge sharing): <ul style="list-style-type: none"> • S3 alliance operational objectives. • S3 release operational plans and negotiated budget. • S3 interventions subject to progress reports, budget status and performance.
<i>iii_a</i> & <i>iii_b</i>	Org1 OP & Org2 OP	Input (knowledge identification, generation): <ul style="list-style-type: none"> • General knowledge gained from informal, open, unscheduled, and infrequent audit-type on-site visits of organisations' operational units. Action (knowledge application, retention): <ul style="list-style-type: none"> • S3 utilise knowledge of organisations' operational units to better understand the language, context and subtleties of organisations' reporting (<i>i_c</i> & <i>i_d</i>) and determine if intervention is required. Output (knowledge sharing): <ul style="list-style-type: none"> • S3 demonstrate interest and willingness to learn and understand at first-hand.
<i>iv_a</i> & <i>iv_b</i>	Org1 S3 & Org2 S3	Input (knowledge identification, generation): <ul style="list-style-type: none"> • Organisations' consent to informal, open, unscheduled, and infrequent audit-type on-site visits of organisations' operational units. Action (knowledge application, retention): <ul style="list-style-type: none"> • - Output (knowledge sharing): <ul style="list-style-type: none"> • S3 request organisations' consent to visit operational units.

Table 12: Alliance management S3 interfaces and interactions define responsibility.

Source: Self-created.

Alliance management system S3 – Role and competencies	
Role	<ul style="list-style-type: none"> • Determine operational objectives that satisfy strategic objectives and allow the alliance to produce its stated purpose with its stated scope and values. • Develop feasible operational plans, including estimation of investment, resources, timeline and risks, ensuring consideration of and commitment from stakeholders.

	<ul style="list-style-type: none"> • Initiate, monitor and control progress and budget of alliance operational plan, intervening as needed to ensure cohesion of alliance primary activities. • Maintain overview of alliance performance and actuality, capability and familiarity of potentiality and limitations. • If S4 strategic objectives indicate 'the what' will be done, then S3 operational objectives can be seen as 'the how' ...will strategic objectives be achieved.
Competencies	<ul style="list-style-type: none"> • Analytical skills, systems thinking, multi-project management, risk assessment, strong leadership skills, generalist.

Table 13: Alliance management S3 role and competencies.

Source: Self-created.

4.1.6 Alliance VSM S2 job description

Table 14 outlines the complete set and interactions that take place with alliance management system S2 (coordination function) over the channels interfacing with the counterpart stakeholders shown in Figure 27. This table effectively describes the responsibilities of the alliance management coordination function, directly defines its scope of interfaces and allows the derivation of the role and required competencies of the coordination function of the alliance management described in Table 15. As described in Section 4.1.2, Table 14 also suggests knowledge processes that typically align well with each stage (input, action, output) of an interaction and are expected to be considered (and if helpful, developed) as a natural course of events during the elaboration of the responsibilities of the coordination function role.

Alliance management system S2 - Responsibilities and interfaces		
Channel	Interface	Interaction (responsibility)
<i>ii_a</i>	Alliance S3	<p>See Figure 33</p> <p>Input (knowledge identification, generation):</p> <ul style="list-style-type: none"> • S3 alliance operational objectives. • S3 initiation of reviewed and released plan for implementation. <p>Action (knowledge application, retention):</p> <ul style="list-style-type: none"> • S2 utilise S3 operational objective as part input for the creation of an alliance implementation plan (including estimated resources, timeline, risks). • S2 coordinate released implementation plan ensuring alignment and support of the organisations' S2 functions (<i>ii_b</i> & <i>ii_c</i>). <p>Output (knowledge sharing):</p> <ul style="list-style-type: none"> • S2 implementation plan corresponding to S3 operational objectives. • S2 progress report of initiated implementation plan.

<i>ii_b</i> & <i>ii_c</i>	Org1 S2 & Org2 S2	See Figure 33 Input (knowledge identification, generation): <ul style="list-style-type: none"> • Organisations' implementation plans including estimation of resources, timeline and risks. • Organisations' progress reports of initiated implementation plans. Action (knowledge application, retention): <ul style="list-style-type: none"> • S2 utilise organisations' implementation plans as part input for the creation of an alliance implementation plan. • S2 utilise organisations' progress reports to determine overall progress of the alliance implementation plan and detect misalignments/oscillations. Output (knowledge sharing): <ul style="list-style-type: none"> • S2 alliance operational objectives. • S2 coordination and alignment.
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Table 14: Alliance management S2 interfaces and interactions define responsibility.

Source: Self-created.

Alliance management system S2 – Role and competencies	
Role	<ul style="list-style-type: none"> • Align organisations' operational objectives with alliance operational objectives. • Develop detailed implementation plans, including workpackages, resources, timeline and risks, to achieve alliance operational objectives. • Maintain overview of initiated alliance implementation plan progress. Detect and rectify misalignments between organisations and escalated when necessary. • If S3 operational objectives indicate 'the how' will strategic objectives be achieved, then S2 implementation plan can be seen as 'the when' ...will operational objectives be achieved.
Competencies	<ul style="list-style-type: none"> • Analytical skills, project management, risk management, interpersonal, problem-solving and conflict-resolution skills, practicalist.

Table 15: Alliance management S2 role and competencies.

Source: Self-created.

4.1.7 Application framework

Table 16 outlines the framework to support the application of the alliance management model shown in Figure 27 which utilises the VSM job descriptions of Sections 4.1.3 - 4.1.6 and the knowledge processes summarised by Figure 29. The flowchart of Figure 34 then, summarises the application framework put forward by this research to serve as a tool to ensure that knowledge processes and supporting instruments for all necessary and sufficient actions and interactions of all VSM roles in the alliance management are considered in a systematic

manner. As can be seen, the framework continues the HR theme of job descriptions by dividing the application into the following logical phases:

1. *Recruitment*: In this phase, candidates are gradually identified, interviewed and recruited for each VSM role. At this stage it is only important that candidates have a high level understanding of the alliance management model, their role and responsibility within the model and the next steps of the application. Candidates should possess necessary capabilities (not necessarily all competencies) and display a willingness to engage.
2. *Onboarding*: In this phase, recruited stakeholders are brought together to align understanding and align expectations of inputs received and outputs required from interactions. The framework suggests limiting the size of stakeholder discussions by focusing on one VSM role at a time and to limit scope of discussions by agreeing to focus on what needs to be done and not yet on how it will be done. The goal is only to achieve a general alignment of stakeholder understanding and agreement in principle.
- 3a. *Development (of interfaces)*: Before being able to design processes for the activities performed by each VSM role, it is first necessary to define the interfaces and the interaction processes for each VSM role in detail. In this phase, stakeholders come together to define the knowledge exchanged and the instruments that support interactions. The framework suggests limiting the size of stakeholder discussions by selecting one interaction of one VSM role at a time so that discussions are focused on the design of a specific interface.
- 3b. *Development (of activities)*: In this phase, stakeholders define the knowledge and instruments needed to support VSM role activities. The framework suggests limiting the size of stakeholder discussions by selecting one VSM role at a time and limiting the scope of discussions by focusing on one activity at a time (noting that every interaction triggers a VSM role activity but that in some cases multiple interactions are necessary before the activity amounts to the completion of an action).

Alliance management model application framework

Phase 1 - Recruitment: Identify candidates to fill alliance management roles.

- 1.1. Select an alliance management VSM job description in the order of S5, S4, S3 and then S2.

Reference material:

- Alliance VSM job description Sections 4.1.3, 4.1.4, 4.1.5 and 4.1.6.

- 1.2. Identify candidates for the selected alliance management VSM role.

Reference material:

- Alliance management role and competencies Tables 9, 11, 13 and 15.

Notes:

- More than one person can and likely will occupy a role. And more than one role can be occupied by any one person.

Tips:

- Organisational charts are a good starting point! But do not assume a one-to-one match between organigram title/hierarchy and the VSM model.

- 1.3. Interview and recruit candidates explaining the alliance management VSM roles and competencies, responsibilities and scope of interaction/interfaces.

Reference material:

- Alliance VSM model (Figure 27).
- Alliance management role and competencies Tables 9, 11, 13 and 15.
- Alliance management responsibility/interactions Tables 8, 10, 12 and 14.

Tips:

- Ask candidates for suggestions and recommendations for other candidates to share their role or for interfacing/counterpart positions. In many cases, their alliance VSM role counterpart at the organisation level may well be themselves!

- 1.4. Return to step 1.1 selecting the next alliance management VSM role.

- 1.5. Draw the alliance VSM model showing the names of people filling each VSM role.

Reference material:

- Alliance VSM model (Figure 27).

Phase 2 - Onboarding:

Align role understanding and expectations of interactions.

- 2.1. Select an alliance management VSM job description (S5, S4, S3 or S2).

Reference material:

- Alliance VSM job description Sections 4.1.3, 4.1.4, 4.1.5 and 4.1.6.

- 2.2. For each interaction of the selected VSM role, align stakeholder high level understanding and expectations regarding interaction input, action performed and interaction output.

- Refine interaction descriptions to improve clarity and understanding of responsibilities.
- Reach stakeholder consensus of VSM roles and responsibilities in principle.

Stakeholders:

- Those that occupy and those that interact with the selected VSM role according to the alliance management responsibility/interactions tables.

Reference material:

- Alliance management responsibility/interactions Tables 8, 10, 12 and 14.

- With related Figure 30, Figure 31, Figure 32 and Figure 33 to support discussions.

2.3. Return to step 2.1 selecting the next alliance management VSM role.

Tips:

- The goal of Phase 2 is only to achieve a general alignment of understanding and agreement in principle and so overly detailed discussions should be avoided at this stage. It is first and foremost important ensure all stakeholders are aligned and on board!

Phase 3a – Development (of interfaces):

Define processes and instruments to support role interfaces.

3a.1. Select an alliance management VSM job description (S5, S4, S3 or S2).

Reference material:

- Alliance VSM job description Sections 4.1.3, 4.1.4, 4.1.5 and 4.1.6.

3a.2. Select a specific interaction of the selected VSM role.

Reference material:

- Alliance management responsibility/interactions Tables 8, 10, 12 and 14.

3a.3. From the perspective of the selected VSM role:

- Define input knowledge required by the role from its interaction counterpart.
- Define output knowledge required of the role for its interaction counterpart.
- Identify attributes of this knowledge e.g. mode, format, immediacy, accessibility, etc.
- Define interaction processes of knowledge identification, generation and sharing.
- Identify instruments required to support defined processes.

Stakeholders:

- Those involved in the single selected interaction of the selected VSM role according to the alliance management responsibility/interactions tables.

Reference material:

- Alliance management responsibility/interactions Tables 8, 10, 12 and 14.
- With related Figure 30, Figure 31, Figure 32 and Figure 33 to support discussions.

Tips:

- Use Figure 6 as a reminder of knowledge attributes that may be relevant.
- Use McKinsey 7-S framework (Figure 23) as a reminder of alliance dimensions that may need to be considered to support defined processes.

3a.4. Return to step 3a.2 selecting the next interaction for the selected VSM role.

- Proceed to next step after all interactions of the selected VSM role have been processed

3a.5. Return to step 3a.1 selecting the next alliance management VSM role.

Phase 3b – Development (of activities):

Define processes and instruments to support role activities.

3b.1. Select an alliance management VSM job description (S5, S4, S3 or S2).

Reference material:

- Alliance VSM job description Sections 4.1.3, 4.1.4, 4.1.5 and 4.1.6.

3b.2. Select a specific interaction for the selected VSM role.

Reference material:

- Alliance management responsibility/interactions Tables 8, 10, 12 and 14.

3b.3. Define the actions needed to process the input and produce the output defined in Phase 3a.

- Define knowledge required by the role to be able to perform those actions.
- Define knowledge possessed by the role and should be retained.
- Identify attributes of this knowledge e.g. mode, format, immediacy, accessibility, etc.
- Define processes of knowledge application and retention.
- Identify instruments required to support processes (e.g. ICT, resources, training, etc.).

Stakeholders:

- Those involved in the selected VSM role.

Reference material:

- Alliance management responsibility/interactions Tables 8, 10, 12 and 14.
- With related Figure 30, Figure 31, Figure 32 and Figure 33 to support discussions.

Tips:

- Use Figure 6 as a reminder of knowledge attributes that may be relevant.
- Use McKinsey 7-S framework (Figure 23) as a reminder of alliance dimensions that may need to be considered to support defined processes.

Notes:

- Phase 3b is separated from Phase 3a because firstly, not all stakeholders involved in the interface definitions of a given role (Phase 3a) are then interested in the detailed definition of the activity for that role (Phase 3b). And secondly, it is useful for any given role to first define all its interfaces (Phase 3a) since there are cases where multiple interface inputs are required before a role activity can be performed to completion (Phase 3b).

3b.4. Return to step 3b.1 selecting the next alliance management VSM role.

Table 16: Alliance management model application framework table.

Source: Self-created.

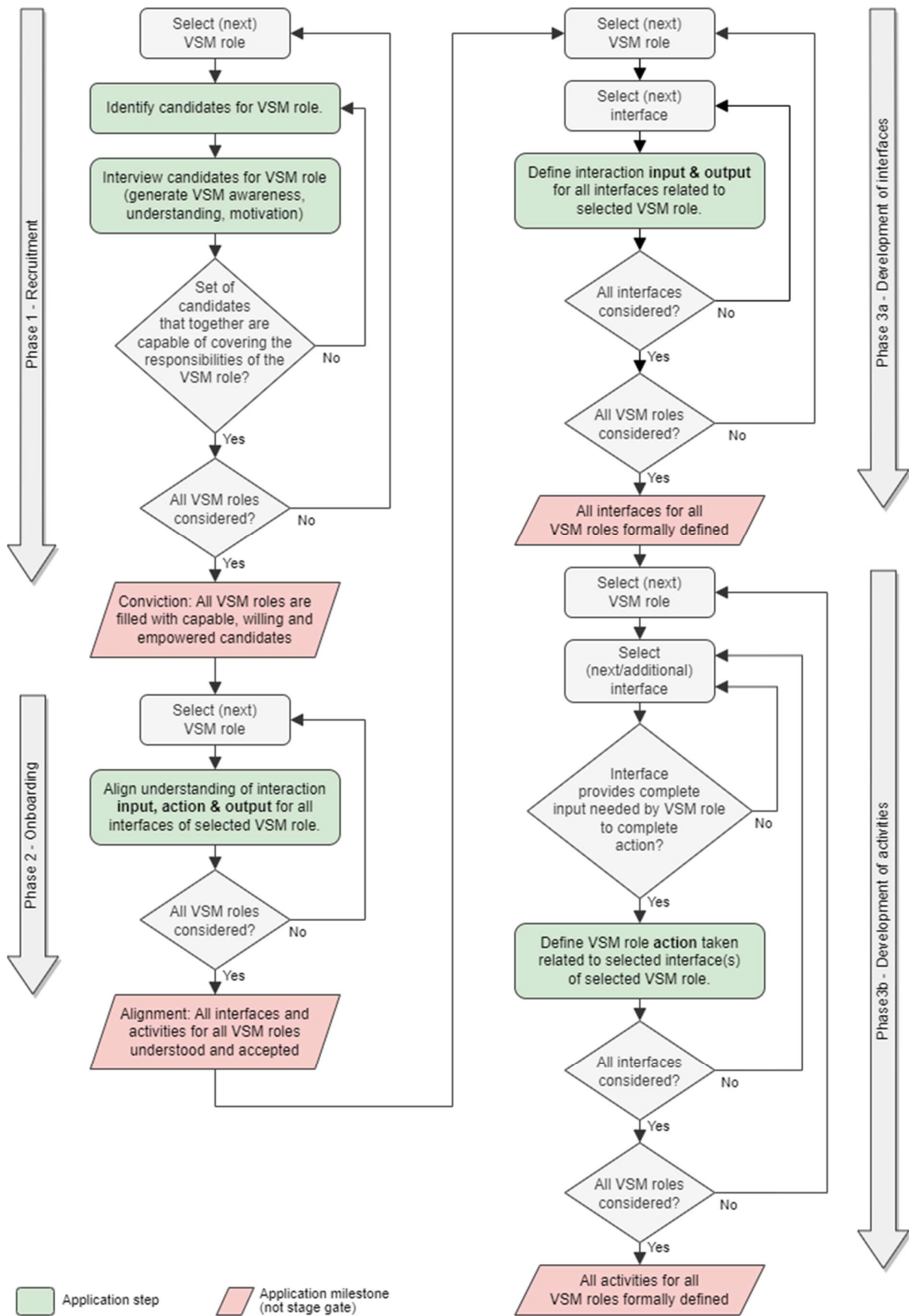


Figure 34: Alliance management model application framework flowchart.

Source: Self-created.

4.2 Specific application

This section applies the general alliance management VSM model and application framework of the previous section to the specific case of the newly formed alliance outlined in Section 2.3 in order to address the final two objectives of this research (Section 1.2).

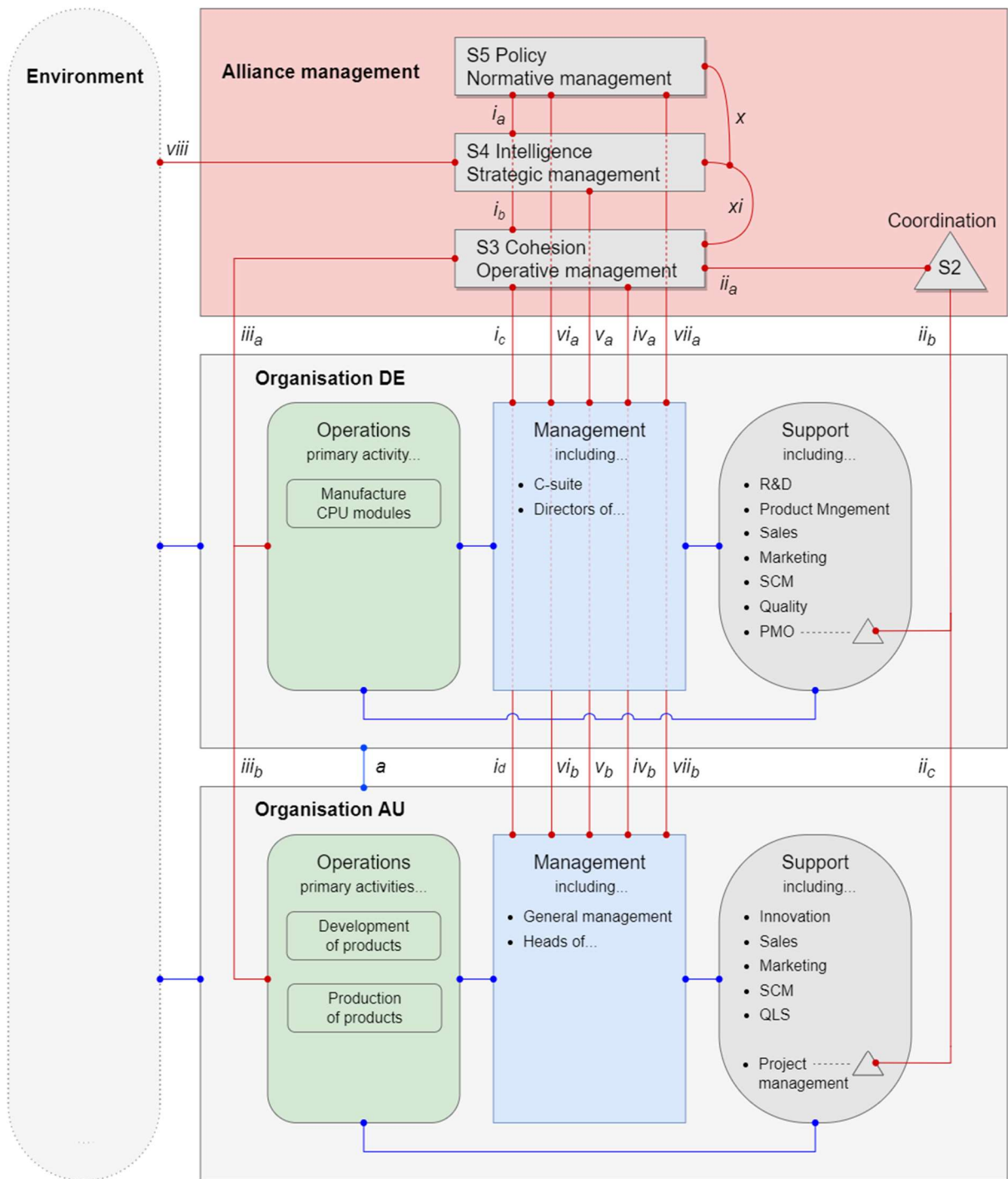
As mentioned in Section 2.3, the alliance formation was publicly announced in early 2022 and many discussions and activities have taken place prior to this research to which the researcher is not privy. However, practitioners that are actively involved in the alliance formation have agreed to review, together with the researcher, the alliance planning/integration status in the context of the VSM model and application framework. In other words, the framework is used as a checklist/diagnostic tool to determine conditions that may be missing, according to the VSM model, that are necessary for the management of a synergistic and long-term viable alliance (see Sections 4.2.3 to 4.2.6). This then allows for an analysis of the consequences of missing conditions and overall recommendations for the alliance strategists (Section 4.2.7) as well as an assessment of the VSM model and application framework in this purpose (Section 4.2.8).

4.2.1 VSM of specific alliance

The VSM model of the specific business alliance assumed at the start of the analysis of the alliance management is shown in Figure 35 and allows here a brief introduction of context and terminology related to the involved organisations and stakeholders before outlining the alliance status in the next section.

As mentioned previously, the model and scope of this research does not consider the VSM of each individual organisation in detail since, when considering existing viable businesses, it is assumed that they contain the necessary and sufficient VSM systems S5 to S1 whether or not this is explicitly recognised by the organisations in VSM terms. Therefore, as can be seen, each organisation is represented simply by *Operations*, *Management* and *Support* functions with each organisation as a whole interacting with the environment and interacting with one another, at whatever level, via operational linkages (link a).

In the case of the module vendor (also referred to as *Organisation DE* or *Org. DE*), its primary activity is to manufacture standard and customised standard CPU modules. The support required to facilitate this activity includes, but is not limited to, R&D, product management, sales, marketing, SCM, quality and PMO (a typical VSM S2 support function). And senior management level includes c-suite as well as directors related to the operations and support functions mentioned.



- i* Command channel
- ii* Coordination channel
- iii* Audit channel
- iv* Inter-Cohesion (inter level) channel
- v* Inter-Intelligence (inter level) channel
- vi* Inter-Policy (inter level) channel
- vii* Alegedonic signal
- viii* Environment channel
- ix* Adaption channel
- x* Balance channel
- a* Operational linkages

Figure 35: Assumed VSM of specific business alliance before analysis.

Source: Self-created.

In the case of the system developer (also referred to as *Organisation AU* or *Org. AU*), its primary activities are to develop and/or produce full custom products or sub-systems for

OEMs. The support required to facilitate this activity includes, but is not limited to, SCM, quality, sales, marketing, innovation and project management (a typical VSM S2 support function). And senior management level includes general management as well as department heads related to the operations and support functions mentioned.

4.2.2 Status of specific alliance

The formal kick-off of activities in the formation of the specific alliance commenced with two separate 2-day face-to-face group workshops that took place in a neutral venue in January and February 2022 with the following stakeholders:

<u>Team</u>	<u>Organisation DE</u>	<u>Organisation AU</u>
1. C-Suite	<ul style="list-style-type: none"> • CEO • CSO (Chief Strategy Officer) • COO & CTO (1 person) 	<ul style="list-style-type: none"> • GM for business development
2. Development	<ul style="list-style-type: none"> • Director of R&D 	<ul style="list-style-type: none"> • GM for operations • Head of development
3. Production	<ul style="list-style-type: none"> • Director of global operations 	<ul style="list-style-type: none"> • Head of production
4. Innovation	<ul style="list-style-type: none"> • Director of product management 	<ul style="list-style-type: none"> • Head of innovation
5. Sales	<ul style="list-style-type: none"> • Director of sales 	<ul style="list-style-type: none"> • Head of Sales
6. Marketing	<ul style="list-style-type: none"> • Director of marketing 	<ul style="list-style-type: none"> • Head of Marketing
7. SCM	<ul style="list-style-type: none"> • Director of sourcing & SCM 	<ul style="list-style-type: none"> • Head of strategic purchasing
8. QLS	<ul style="list-style-type: none"> • Director of quality & compliance 	<ul style="list-style-type: none"> • Head of quality and PLM

Table 17: Alliance formation committee members.

Source: Self-created with the support of involved stakeholders.

The combined agendas of both workshops included the following points of discussion:

1. Company presentations - Share current performance and capabilities.
2. Shared success stories - Reminder of already successful collaborations.
3. Alliance concept and potential - Shared customers and potential of vertical integration alliance.
4. Vision and mission statements - Define purpose, scope, and values.
5. Alliance management team - Define roles and interfaces of alliance formation committee.
6. Developing trust and openness - What is needed to work together with full transparency?
7. Concrete next steps - Agree planned next steps together.

Table 18: Agenda of initial alliance planning workshops.

Source: Self-created with the support of involved stakeholders.

All 19 aforementioned alliance formation committee members together successfully reached a consensus on the purpose and values of the alliance, an outline of the foreseen working

relationship and the summary vision and mission statements (see Appendix C). In short, the alliance growth strategy is to improve the existing supplier-customer relationship (integration along the vertical value chain) in order to add value for the end customer. The intention therefore is that for new system developments Org. AU uses CPU modules from Org. DE where appropriate. And where the opportunity arises, Org. DE recommends Org. AU exclusively as its trusted system integrator to end customers.

In order to present a united front, a joint press release announcing the value-adding alliance was made in March 2022 and both organisations included products and services available from alliance partners on their respective websites. Furthermore, both organisations shared a booth at a large annual technology trade fair in Nuremberg June 2022 and again at an equally large annual trade fair in Dusseldorf November 2022.

The alliance formation committee recognised that much improvement of existing cross-border interfaces and interactions is needed at all levels and for all disciplines in order to implement an alliance that works as an effective cohesive unit that adds value for end customers. As a first step of relationship building, all stakeholders agreed that several face-to-face meetings should take place at one another's premises and be extended to include additional key stakeholders. For example, Org. DE director of R&D and Org. AU head of development organised on-site visits of members of their respective teams to share insights into their respective working processes and tools as well as for specific technology training events.

During first workshops, Org. DE director of product management and Org. AU head of innovation presented possible topics on which the alliance might choose to focus. As illustrated in Figure 36, the topics relate to typical business model categories: technology (offerings), market sector (target group) and sales approach (channels). All 19 alliance formation committee members together reached a consensus to focus on increasing knowledge around a particular leading-edge technology on Org. DE product roadmap, better understanding the needs of the target market sectors related to this technology and enabling sales to add value through joint consulting expertise.

In particular, the assembled stakeholders decided together to create an MVP to validate the hypothesis that the selected technology is highly attractive for customers of two particular market sectors and that a joint sales approach is effective for winning new business. The creation of the MVP (a high-performance industrial computer unit) would be managed by the joint innovation team and supported by the certain members of the joint development and SCM teams. The specification for the computer unit (to be termed as ICE for Industrial Computer Enabler) would be defined by customer requirements elicited by the joint sales team targeting two high profile customers. The sales team themselves are an element of the MVP requiring technology training from the innovation team as well as regulatory affairs and

compliance training from the joint QLS team to enable effective customer consultancy and acquisition.

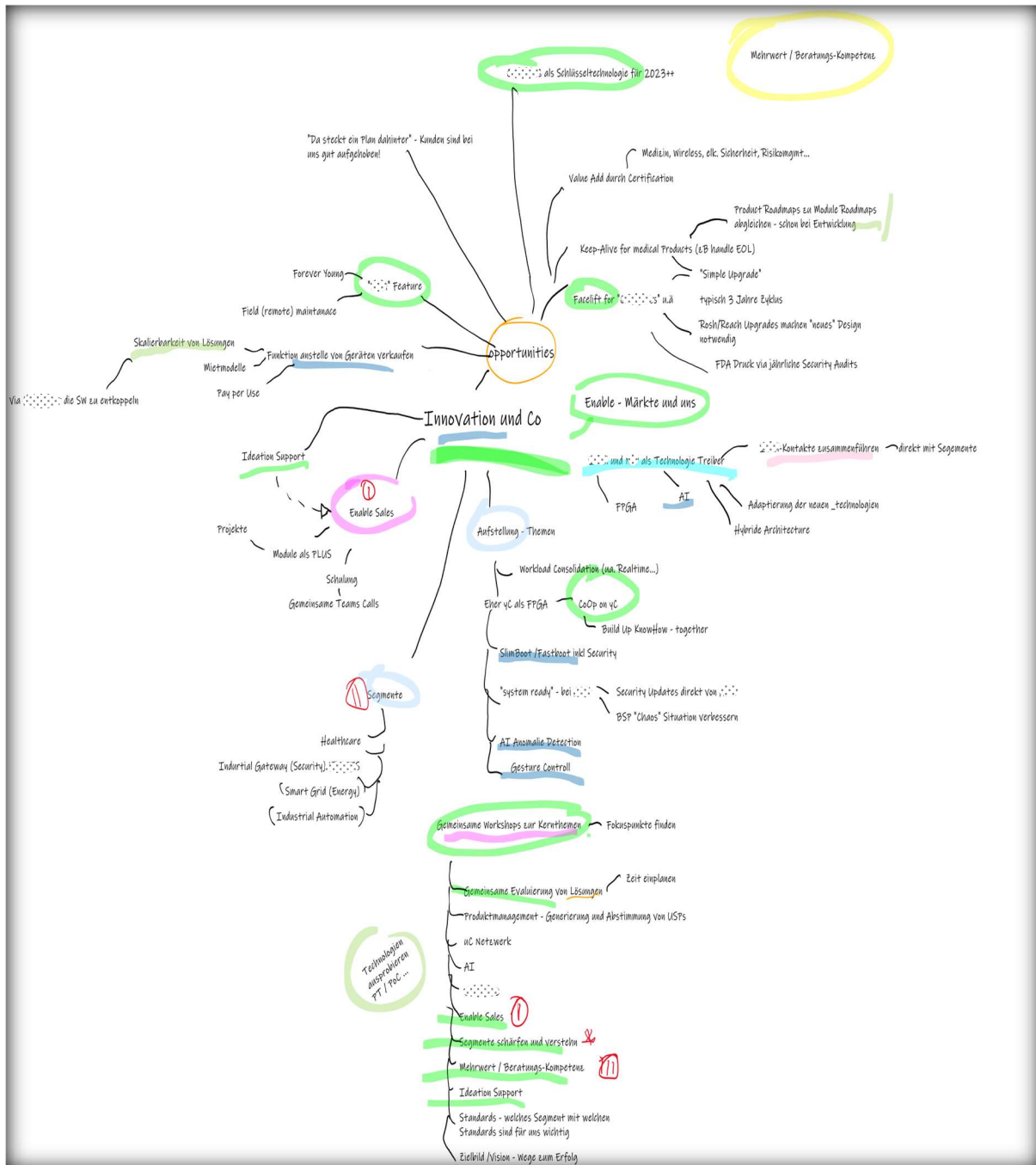


Figure 36: Specific alliance - mindmap of possible focus points for innovation.

Source: Specific alliance artifact. Sensitive text has been intentionally blurred.

The RASI matrix compiled by alliance formation committee to capture many of the previously mentioned activities is provided in Appendix D. The matrix represents the alliance's initial summary view of relevant activities and interaction types (or involvement) between

stakeholders that are *responsible* for completing the activities, those *accountable* for the outcome of the activities, those that provide *support* to the responsible stakeholders and those that must be *informed* of the outcome of the activity. The RASI matrix together with meeting protocols reveal the following general rules for interactions of the alliance formation committee:

1. Each joint team is permitted to determine activities as they see necessary and are responsible and accountable for those activities.
2. Each joint team is encouraged to have bi-weekly calls to align their activities.
3. Maintaining the summary overview of alliance-wide activities and supporting the alignment of inter-team activities is managed by Org. AU GM for business development.
4. The status of all activities is shared with all 19 alliance formation committee members at quarterly meetings so that everyone is informed and aligned.
5. The joint C-suite team are the eventual decision makers when needed.

Table 19: Alliance formation committee interaction rules.

Source: Self-created with the support of involved stakeholders.

The joint innovation team commenced MVP planning activities in July 2022. Since then, the requirements for the industrial computer enabler MVP (ICE) to enable the sales team to attract the business of two high profile customers have gone through multiple protracted iterations resulting in not one but rather a portfolio of potential ICE products. This was due in a large part to diverging views of the individual organisations regarding the exact purpose of the MVP as well as the difficulty to maintain stakeholder alignment needed for informed decision making. To compound matters, during the fourth quarter 2022, both the CEO and the director of sales departed Org. DE and were replaced which had the effect of disrupting the focus and dynamic of the alliance formation committee. To date, no MVP has actually been produced that can be provided to the sales team for training and customer acquisition purposes.

During the second quarter 2022, each joint team organised at least two on-site visits of their extended teams. Overall, the visits were deemed beneficial to kickstart relationship building and general knowledge generation in preparation for future joint projects. However, since no such joint project has as yet materialized (even in the form of a first MVP), further follow-up visits served no purpose and even the intended bi-weekly alignment calls have slowly petered out since the fourth quarter 2022.

For various reasons, it has not been possible to assemble all 19 senior managers of the alliance formation committee for a face-to-face meeting since the initial workshops in January and February 2022. And only one online video call took place in June 2022 that could be

attended by all 19 stakeholders. Individual team meetings continued during 2022 but since the fourth quarter 2022 only occasional joint c-suite team meeting have taken place.

Currently joint activity related to the MVP is stopped. Despite this fact, relationships at a human level are good and there is still optimism that the alliance makes complete sense and that an MVP containing such leading-edge technology is still highly relevant for winning joint projects. However, it is not completely clear to all involved stakeholders why the seemingly relatively simple objective set by senior management of producing an MVP has not been achieved and so naturally this has raised some concerns and frustrations. It is currently not defined how to re-start joint activities.

4.2.3 Application framework - Phase 1

The following Table 20, which has been populated together practitioners involved in the specific alliance, attempts to discover if the alliance management system roles S5-S2 are filled by capable, willing, and empowered stakeholders. In other words, Table 20 (which summaries all S5-S2 actions taken directly from the responsibilities and interfaces Table 8, Table 10, Table 12, and Table 14) attempts to establish the approximate completeness of phase 1 (the recruitment phase) of the application framework and to identify any significant gaps or deviations according to the framework.

It is important to highlight that the alliance management must not necessarily be filled by managers from equivalent positions of both organisations (although this is a certainly a good starting point for initial candidate selection). The eventual alliance management system is not intended to become a hierarchical overlord of the individual organisations but rather is a facilitating metasystem dedicated to providing direction, adaption, and cohesion for the alliance of two independent organisations. Therefore, it is most important that roles are filled with willing stakeholders (motivated, focused, dedicated) that are empowered (facilitated with the capacity and a level of authority to pursue accountable counterparts) and have the capability to fulfill the responsibilities of the role (not necessarily all required competencies, since these can be learned, delegated, and outsourced as needed – see phase 3b).

It may well be that, for example, an alliance is formed with only a vague purpose, not yet any concrete strategic objectives and just a handful of operational objective ideas - phase 1 of the framework does not stipulate any particular starting condition. However, what should be demonstrated by the end of phase 1 is a recognition of the necessary roles to be filled and that people that are capable, willing, and empowered to fill those roles are made available. This demonstrates a real buy-in and united commitment to the formation of a long-term viable and synergistic alliance (and not just a short-term complementary operational collaboration). While the completion of phase 1 does not block the commencement of phase 2 or 3, the lack

of role functions will eventually block the completion of phase 2 and 3 leaving gaps in the VSM. And so, it is helpful to establish the approximate level of completeness of phase 1 for the specific alliance so that potential consequences of gaps can be flagged.

The alliance formation committee listed in Table 17 demonstrates that both organisations have put forward very capable persons to participate in the alliance planning, each with clear counterparts and each empowered with resources to pursue activities. This, together with the forward-looking agenda (Table 18) of the initial planning workshops demonstrates management commitment and a general willingness and motivation to build a trustful and mutually beneficial alliance. This commitment to move beyond exploratory discussions is further demonstrated by the joint press release of March 2022 and a shared booth at a large annual trade fairs in Nuremberg June 2022 and Dusseldorf November 2022.

So, looking at the descriptions of responsibilities in Table 20 it is easy to see that stakeholders that are more than capable, willing, and empowered have indeed been brought together to fill VSM roles (incidentally, this also gives an indication that Table 20 would serve as a useful tool for the initial selection of suitable stakeholders in new applications).

However, strictly speaking, in terms of the application framework put forward by this research, not all responsibilities have as yet been explicitly discussed and accepted by stakeholders. These unassigned responsibilities are marked as “*Not considered*” in Table 20 and the potential consequences of leaving these responsibilities to the assumptions of others are discussed in the overall assessment of the specific alliance in Section 4.2.7. Other observations pertaining to Table 20 are briefly discussed in the following Notes 1.1 to 1.8.

Are the following responsible actions accepted by capable, willing, and empowered stakeholders?	Alliance	
	Organisation DE	Organisation AU
S5 create, and as necessary refine, statement of alliance purpose, scope & values.	CEO and CSO COO / CTO Note 1.1	GM business dev. GM operations
S5 review S4 strategic plan and S3 operational plan in context of alliance purpose.	<i>Not considered</i> <i>Plans were not requested by S5</i>	
S5 negotiate and release budget for S4 strategic plan and S3 operational plan.	<i>Not considered</i> <i>See above – no budget of effort, cost, time</i>	
S5 process S4 and S3 progress reports, budget status and performance and determine if intervention is required.	<i>Org. AU GM for business development</i> Note 1.2	
S5 monitor for signs of misalignment or imbalance of S4 and S3 and initiate resolution measures.	<i>Not considered</i>	
S5 initiate fast action when alerted that either operational unit of the alliance is unable to produce its purpose.	<i>Not considered</i>	

S4 create and maintain alliance business model upon which to innovate (based on alliance purpose and organisations' business models and SWOT analyses).	<i>Not considered</i>	
S4 drive active research of alliance niche environment to detect events, trends and novelties and seek to discover opportunities and threats.	<i>Not considered</i> Note 1.3	
S4 drive ideation to any aspect of the alliance business model (considering organisations' performance actuality, capability, potentiality, and limitations).	<i>Director of product management</i> Note 1.4	<i>Head of innovation</i>
S4 drive creation of experiments to validate innovations (MVPs) or to explore questions of uncertainty (market research) to establish realistic strategic objectives.	<i>Director of product management</i> Note 1.5	<i>Head of innovation</i>
S4 create business case for the implementation of the business model innovation in line with operative feasibility checks and estimates.	<i>Not considered</i> Note 1.6	
S4 create strategic objectives, plan, and budget for the implementation of the business model innovation in line with operative feasibility checks and estimates.	<i>Not considered</i>	
S3 develop and maintain familiarity and understanding of organisations' operational units (performance actuality, capability, potentiality and limitations).	<i>CTO</i> Note 1.7	<i>Head of development</i>
S3 determine alliance operational objectives corresponding to strategic objectives an in line with alliance purpose, scope and values.	<i>Not considered</i>	
S3 drive comprehensive estimates of required investment, resources, time, risk, etc. to achieve operational objectives (an alliance operational plan).	<i>Not considered</i>	
S3 negotiate and release budget for operational plans of individual operations.	<i>Not considered</i>	
S3 process organisations' progress reports, budget status and performance and alliance S2 progress report to determine if organisation intervention is required.	<i>Not considered</i>	
S2 create an implementation plan to achieve alliance operational objectives based on organisations' individual implementation plans.	<i>Not considered</i>	
S2 maintain alignment of organisations during execution of released implementation plans.	<i>Org. AU GM for business development</i> Note 1.8	

Table 20: Check if S5-S2 roles are filled with capable, willing and empowered stakeholders.

Source: Self-created and populated with the support of involved stakeholders.

Note 1.1: As outlined in Section 4.2.2, all alliance formation committee members together reached a consensus on the starting purpose, scope and values of the alliance. Note that this does not mean that all stakeholders are automatically part of the S5 role. The VSM encourages that S5 utilise input from the next lower level of recursion (see Figure 27 interfaces

v_{ia} & v_{ib}), who can in turn also call upon support functions as well as the next lower level of recursion, as is the case here. Meeting protocols clearly reflect that c-suite stakeholders are responsible for the alliance vision and mission statements and are the eventual decision makers when needed. Therefore, it would appear that the c-suite team listed in Table 17 have naturally assumed the alliance normative management role S5.

Note 1.2: As mentioned in Section 4.2.2, it was agreed that Org. AU GM for business development from the c-suite team has the responsibility of maintaining the summary overview of alliance formation activities and supporting the alignment of inter-team activities. Note however that, since plans of required resources, effort, time, cost, or risk were not requested by S5 and not forthcoming from S4 and S3, there is no baseline upon which to judge progress and trigger intervention. Therefore, this responsibility cannot truly be fulfilled, and this is especially true if the responsible stakeholder does not possess the requisite variety to absorb the topic complexity.

Note 1.3: There is no evidence of responsibility being assigned by the alliance formation committee to drive continuous active research of the environment. The basis for the creation of an MVP appears to be purely that the selected technology happens to be newest available from Org. DE and that the selected market sectors are existing overlapping markets for both organisations. The joint sales team have been assigned to support the elicitation of MVP requirements from two large customers shared by Org. DE and Org. AU. So the customers were selected by their commercial potential (which of course is important) but they were also selected out of convenience and not necessarily because they are representative of their respective market sectors.

Note 1.4: As outlined in Section 4.2.2, the joint innovation team presented possible ideas from certain typical aspects of a business model (offering, target group and channels) and the alliance formation committee together reached a consensus on which ideas to focus. Note that this does not mean that all stakeholders are automatically part of the S4 role. Similar to Note 1.1, the VSM encourages that S4 utilise input from the next lower level of recursion (see Figure 27 interfaces v_a & v_b), who can in turn also call upon their support functions. Furthermore, the VSM encourages that S4 is highly interconnected with S3 cross-checking ideas and proposals (interface x_i) and S5 is permitted at any time to monitor such interactions (interface x). And so, the assembly of the alliance formation committee for the purpose of opinion forming of possible innovations to the alliance business model and deciding next steps makes good sense in the view of the VSM.

Note 1.5: Also, as outlined in Section 4.2.2, the alliance formation committee together decided to create an MVP to validate the hypothesis that the selected technology is highly attractive for customers of two particular market sectors and that a joint sales approach is effective for

winning new business. It was agreed the joint innovation team has the responsibility for the creation of the MVP, supported by the development, SCM, sales and QLS teams and with the overview and alignment of activities maintained by Org. AU GM for business development from the c-suite team. Therefore, it would appear that it is the joint innovation team that have assumed at least two of the roles of the alliance strategic management role S4 (Notes 1.4 & 1.5).

Note 1.6: During first workshops, the sales team summed all potential customers that could potentially use the selected technology over the next 5 years. Needless to say, the projections generated sufficient stakeholder enthusiasm to warrant the creation of an MVP intended to enable sales acquisitions. However, potential projections alone do not constitute a business case and no responsibility was assigned to pursue the estimation of the necessary long-term investment and realistic returns.

Note 1.7: As mentioned in Section 4.2.2, Org. DE director of R&D and Org. AU head of development agreed to on-site visits of one another's operational units to include also key members of their respective teams as well as specific technology training events. In VSM terms, this can be seen as an effort by senior management to increase their individual complexity so that they can better understand the language, context, and subtleties of their counterpart's operational units. However, this particular S3 responsibility alone without the four other S3 responsibilities listed in Table 20 (which are associated with managing operational objectives) means that it cannot be concluded that the joint development team have the alliance operative management role S3. The joint development team would indeed be well suited to fill the operative management role (perhaps together with the joint production team) but the responsibilities related to this role have not been allocated by the alliance formation committee at this point.

Note 1.8: As mentioned in Section 4.2.2, it was agreed that Org. AU GM for business development from the c-suite team has the responsibility of maintaining the summary overview of alliance formation activities and supporting the alignment of inter-team activities. As for Note 1.2 however, no plans were requested by S5 and none were forthcoming from S4 and S3. Furthermore since Org. AU GM for business development does not have the requisite variety to create an implementation plan for the MVP, there is no baseline upon which to judge progress. Therefore, while this responsibility has been taken by Org. AU GM for business development, it cannot truly be fulfilled.

4.2.4 Application framework - Phase 2

The RASI matrix compiled by the alliance formation committee (Appendix D) provides some insight into the mindset of the alliance organisational thinking on how to proceed with the

alliance formation. The following Table 21, which has been populated using insights from the RASI matrix as well as additional background shared by involved practitioners, is designed to discover if all the interactions necessary for the management of a viable alliance (according to the VSM) are already recognised and accepted in principle by all stakeholders. In other words, Table 21 (which is a compilation of all S5-S2 interactions taken directly from the responsibilities and interfaces Table 8, Table 10, Table 12, and Table 14) forms a checklist that attempts to establish the approximate completeness of phase 2 (the onboarding phase) of the application framework so that any significant gaps or deviations from the framework can be identified.

Remember that the goal of phase 2 is not to design formal processes for the interactions between the alliance management roles. It is instead simply to achieve that all roles, which ideally have been filled in phase 1, now share a common overview, understanding and acceptance of the necessary interfaces and interactions that must take place between their roles. While the completion of phase 2 does not block the commencement of phase 3, the lack of alignment of all stakeholders will eventually block the completion of phase 3 leaving gaps in the VSM. And so, it is helpful to establish the approximate level of completeness of phase 2 for the specific alliance so that potential consequences of gaps can be flagged.

Note that for Table 21 brevity, alliance management roles S5-S2 are identified simply as S5-S2 and are distinguished from roles at an organisational level which are identified with the *OrgDE* or *OrgAU* prefix. Note also that the previous section did not attempt to establish the stakeholders occupying *OrgDE/OrgAU* S5-S2 roles since, if the alliance management S5-S2 roles are filled and understood by stakeholders, then their counterparts at an organisational level will be obvious to them (and in many cases may be themselves). It is important to point out that the fact that a stakeholder may occupy the same role at an alliance management level as at an organisational level does not make the interaction between those roles redundant. Remember, that at an alliance management level, roles are shared by stakeholders from both organisations and at an organisational level, roles which are also populated by multiple stakeholders will not have exactly the same representation at the alliance management level – making the relationships and so the group behaviour different at each level of recursion.

Following on from the phase 1 analysis of the specific alliance in the previous section, it is perhaps not surprising that, since most of the necessary role responsibilities have not yet been allocated to stakeholders, it is then not possible to define interfaces and interactions between those unfilled roles. These undefined interfaces and interactions are marked in Table 21 as “*Not defined*” and the potential consequences of this are discussed in the overall assessment of the specific alliance in Section 4.2.7.

Interface	Are the following interactions recognised as being necessary and are accepted by the responsible stakeholders?	Comment
S5 with OrgDE S5 & OrgAU S5 (v _{1a} & v _{1b})	<ul style="list-style-type: none"> Organisations' normative management provide statement of individual purpose, scope & values. S5 provide statement of alliance purpose, scope and values. Organisations provide input towards alliance purpose, scope & values. S5 adjust statement of alliance purpose, scope and values if necessary. 	<p>Yes See Table 20 Note 1.1</p>
S5 - S4 (i _a)	<ul style="list-style-type: none"> S5 provide statement of alliance purpose, scope and values (Figure 32). S4 provide strategic plan and requested budget (Figure 30). S5 provide release of strategic plan and negotiated budget. S4 provide progress report and budget status. S5 make interventions subject to progress and budget status. 	<p>Not defined Only purpose</p>
S5 - S3 (i _b)	<ul style="list-style-type: none"> S5 provide statement of alliance purpose, scope and values. S3 provide operational plan and requested budget (see Figure 30). S5 provide release of operational plan and negotiated budget. S3 provide progress report, budget status and performance report. S5 make interventions subject to progress, budget and performance. 	<p>Not defined</p>
S4–S5–S3 (x)	<ul style="list-style-type: none"> S5 monitor for signs of S4-S3 misalignment and imbalance (Figure 31). S5 initiate measures to resolve S3-S4 misalignment or imbalance. 	<p>Not defined See Table 20 Note 1.2</p>
S5 with OrgDE S3 & OrgAU S3 (vii _a & vii _b)	<ul style="list-style-type: none"> Organisations' operative management escalate issues are preventing the alliance stated purpose to be produced (Figure 27). S5 communicate prioritised plan of action to resolve escalation. 	<p>Not defined</p>
S4 with OrgDE S4 & OrgAU S4 (v _a & v _b)	<ul style="list-style-type: none"> Organisations' strategic management provide business models and SWOT of own individual niche environment (Figure 32). S4 continuously align individual and alliance business models. 	<p>Not defined See Table 20 Note 1.4</p>
S4 with Environ. (viii)	<ul style="list-style-type: none"> S4 create experiments to validate hypothesised business model innovations or to explore questions of uncertainty as part of the business model innovation (Figure 32). S4 actively monitor and research events, trends and novelties posing opportunities and threats to the alliance. 	<p>Partial See Table 20 Notes 1.3 and 1.5</p>
S4 – S3 (xi)	<ul style="list-style-type: none"> S4 query S3 for alliance performance details. S3 provide overview of performance actuality, capability, potentiality, and limitations of alliance primary activities. 	<p>Not defined</p>

	<ul style="list-style-type: none"> • S4 provide prospective strategic objectives for S3 appraisal. • S3 provide feasible operational objectives needed to satisfy S4 strategic objectives and corresponding operational plan. 	
S3 – S2 (ii _a)	<ul style="list-style-type: none"> • S3 provide alliance operational objectives (Figure 33). • S2 provide detailed implementation plan including estimated budget. • S3 initiate execution of the reviewed implementation plan. • S2 provide progress report for initiated implementation plan. 	<i>Not defined</i>
S3 with OrgDE S5 & OrgAU S5 (i _c & i _d)	<ul style="list-style-type: none"> • S3 provide alliance operational objectives (Figure 33). • Organisations' normative management provide individual operational plans and required budget. • S3 provide release of operational plan and negotiated budget. • Organisations provide progress, budget status and performance reports. • S3 make interventions subject to progress, budget and performance. 	<i>Not defined</i>
S3 with OrgDE OP & OrgAU OP (iii _a & iii _b)	<ul style="list-style-type: none"> • S3 demonstrate interest to understand and appreciate organisations' operational units. • S3 gain first-hand knowledge from organisations' operational units. 	Yes See Table 20 Note 1.7
S3 with OrgDE S3 & OrgAU S3 (iv _a & iv _b)	<ul style="list-style-type: none"> • S3 request consent from organisations' operative management to make knowledge-gaining visits operational units. • Operative management consent to visits. 	Yes See Table 20 Note 1.7
S2 with OrgDE S2 & OrgAU S2 (ii _b & ii _c)	<ul style="list-style-type: none"> • S2 provide alliance operational objectives (Figure 33). • Organisations' coordination functions provide individual implementation plans including estimated budget. • S2 provide alignment and coordination of initiated alliance implementation plan. • Organisations provide progress reports of initiated implementation plans. 	<i>Not defined</i> See Table 20 Note 1.8

Table 21: Check if management interactions are understood and accepted by responsible roles.

Source: Self-created and populated with the support of involved stakeholders.

4.2.5 Application framework - Phase 3a

The previous Table 21 sought simply to discover if all the interactions necessary for the management of a viable alliance (according to the VSM) have been recognised as being necessary and are accepted by all the capable, willing and empowered stakeholders identified in Table 20. To use again the earlier analogy of the old Chinese game Tangram (see Figure 20), before beginning to play, it is first necessary to check that all pieces of the puzzle are on the table (the goal of phase 1) and that everyone knows and agrees to the rules of the game (the goal of phase 2). Noting the flexibility that it is possible to start the puzzle without having

all pieces and with a few late comers learning the rules along the way. But that is it is impossible to complete the puzzle without all pieces and agreement of the rules.

The following Table 22 lists the same interfaces and interactions as Table 21 but seeks to discover to what degree those interactions have been formulated in the form of agreed processes and if instruments have been identified to support those processes. In other words, Table 22 forms a checklist that attempts to establish the approximate completeness of phase 3a (development of interfaces) of the application framework so that any significant gaps or deviations from the framework can be identified.

Table 22 has been reviewed together with practitioners involved in the specific alliance by considering if, as described in the application framework, processes (or even starting outline agreements) have been developed that describe how new knowledge is shared by a transmitter, how that knowledge is detected by the receiver, how that knowledge is then generated (internalised) by the receiver. And further, using McKinsey 7-S to consider if instruments have been identified to support those processes such as ICT tools, resources from support functions (e.g., R&D, Sales, QLS), organisational structures, necessary trainings and so on.

Following on from the phase 2 analysis of the specific alliance in the previous section, it is completely unsurprising that, since most of the necessary interfaces and interactions between roles have not yet been defined, the detailing of those interfaces in the form of an agreed processes (no matter how simple) as well as a consideration of the instruments that may be needed to support those processes have also not yet been defined. Despite the lack of additional insights to the specific application captured by Table 22, this section has nonetheless been included to demonstrate the intended usage of the application framework.

Interface	Have processes and supporting instruments been defined for the following interactions and agreed by the responsible stakeholders?	Comment
S5 with OrgDE S5 & OrgAU S5 (v_{1a} & v_{1b})	<ul style="list-style-type: none"> • Organisations' normative management provide statement of individual purpose, scope & values. • S5 provide statement of alliance purpose, scope and values. • Organisations provide input towards alliance purpose, scope & values. • S5 adjust statement of alliance purpose, scope and values if necessary. 	<p><i>Not defined</i></p> <p>Note 3a.1</p>
S5 - S4 (i_a)	<ul style="list-style-type: none"> • S5 provide statement of alliance purpose, scope and values (Figure 32). • S4 provide strategic plan and requested budget (Figure 30). • S5 provide release of strategic plan and negotiated budget. • S4 provide progress report and budget status. • S5 make interventions subject to progress and budget status. 	<p><i>Not defined</i></p>

S5 - S3 (ib)	<ul style="list-style-type: none"> • S5 provide statement of alliance purpose, scope and values. • S3 provide operational plan and requested budget (see Figure 30). • S5 provide release of operational plan and negotiated budget. • S3 provide progress report, budget status and performance report. • S5 make interventions subject to progress, budget and performance. 	<i>Not defined</i>
S4–S5–S3 (x)	<ul style="list-style-type: none"> • S5 monitor for signs of S4-S3 misalignment and imbalance (Figure 31). • S5 initiate measures to resolve S3-S4 misalignment or imbalance. 	<i>Not defined</i> Note 3a.1
S5 with OrgDE S3 & OrgAU S3 (vii _a & vii _b)	<ul style="list-style-type: none"> • Organisations' operative management escalate issues are preventing the alliance stated purpose to be produced (Figure 27). • S5 communicate prioritised plan of action to resolve escalation. 	<i>Not defined</i>
S4 with OrgDE S4 & OrgAU S4 (v _a & v _b)	<ul style="list-style-type: none"> • Organisations' strategic management provide business models and SWOT of own individual niche environment (Figure 32). • S4 continuously align individual and alliance business models. 	<i>Not defined</i>
S4 with Environ. (viii)	<ul style="list-style-type: none"> • S4 create experiments to validate hypothesised business model innovations or to explore questions of uncertainty as part of the business model innovation (Figure 32). • S4 actively monitor and research events, trends and novelties posing opportunities and threats to the alliance. 	<i>Not defined</i> Note 3a.2
S4 – S3 (xi)	<ul style="list-style-type: none"> • S4 query S3 for alliance performance details. • S3 provide overview of performance actuality, capability, potentiality, and limitations of alliance primary activities. • S4 provide prospective strategic objectives for S3 appraisal. • S3 provide feasible operational objectives needed to satisfy S4 strategic objectives and corresponding operational plan. 	<i>Not defined</i>
S3 – S2 (ii _a)	<ul style="list-style-type: none"> • S3 provide alliance operational objectives (Figure 33). • S2 provide detailed implementation plan including estimated budget. • S3 initiate execution of the reviewed implementation plan. • S2 provide progress report for initiated implementation plan. 	<i>Not defined</i>
S3 with OrgDE S5 & OrgAU S5 (i _c & i _d)	<ul style="list-style-type: none"> • S3 provide alliance operational objectives (Figure 33). • Organisations' normative management provide individual operational plans and required budget. • S3 provide release of operational plan and negotiated budget. • Organisations provide progress, budget status and performance reports. • S3 make interventions subject to progress, budget and performance. 	<i>Not defined</i>

S3 with OrgDE OP & OrgAU OP (iii _a & iii _b)	<ul style="list-style-type: none"> • S3 demonstrate interest to understand and appreciate organisations' operational units. • S3 gain first-hand knowledge from organisations' operational units. 	<i>Not defined</i> Note 3a.1
S3 with OrgDE S3 & OrgAU S3 (iv _a & iv _b)	<ul style="list-style-type: none"> • S3 request consent from organisations' operative management to make knowledge-gaining visits operational units. • Operative management consent to visits. 	<i>Not defined</i> Note 3a.1
S2 with OrgDE S2 & OrgAU S2 (ii _b & ii _c)	<ul style="list-style-type: none"> • S2 provide alliance operational objectives (Figure 33). • Organisations' coordination functions provide individual implementation plans including estimated budget. • S2 provide alignment and coordination of initiated alliance implementation plan. • Organisations provide progress reports of initiated implementation plans. 	<i>Not defined</i>

Table 22: Check if processes and instruments are defined for alliance management interactions.

Source: Self-created and populated with the support of involved stakeholders.

Note 3a.1: The guidelines for the alignment of alliance formation committee actions/ interactions outlined in Table 19 appear to be the only semi-formal joint agreement resembling a process to govern consistency.

Note 3a.2: As outlined in Section 4.2.2, it was agreed that the joint sales team support the joint innovation team with the elicitation of MVP requirements from two high profile customers. However, despite this initial agreement, any subsequent detailing of a documented strategy/process to identify, interpret, record, share, prioritise and decide upon MVP requirements are completely lacking.

4.2.6 Application framework - Phase 3b

The following Table 23 lists the same alliance management role activities as Table 20 but, in a similar manner to phase 3a, seeks to discover to what degree those activities have been formulated in the form of agreed processes and if instruments have been identified to support those processes. In other words, Table 23 forms a checklist that attempts to establish the approximate completeness of phase 3b (development of activities) of the application framework so that any significant gaps or deviations from the framework can be identified.

Table 23 has been reviewed together with practitioners involved in the specific alliance by considering if, as described in the application framework, processes (or even starting outline agreements) have been developed that describe how new knowledge is utilised by the processor as an input for the action (application) to be performed and how to ensure that the

knowledge developed by the processor as a result of performing the application is retained (i.e. developed knowledge, in its many forms, is still available to the alliance even if any given processor should depart). And further, by considering if instruments have been identified to support those processes such as ICT tools, resources from support functions (e.g., R&D, Sales, QLS), organisational structures, necessary trainings and so on.

Unlike phase 1 which sought only that necessary roles are recognised and filled with willing candidates, it is in this phase 3b, when processes to describe the actions of those roles are developed. It is worth highlighting that this phase forces the definition of the inner-role interactions between stakeholders from both organisations working within the same role bringing the alignment needed for an overall proper functioning role.

Following on from the analysis of the earlier phases of the specific alliance in the previous sections, it is again of no surprise that, since most of the necessary role responsibilities have not yet been allocated to stakeholders and since most of the necessary interfaces and interactions between roles have not yet been defined, the detailing of those responsibilities in the form of agreed processes as well as a consideration of the instruments that may be needed to support those processes have also not yet been defined. Again, however, despite the lack of additional insights to the specific application captured by Table 23, this section has nonetheless been included to share the intended usage of the application framework.

Have processes and supporting instruments been defined for the following actions and agreed by the responsible stakeholders?	Comment
S5 create, and as necessary refine, statement of alliance purpose, scope & values.	<i>Not defined</i>
S5 review S4 strategic plan and S3 operational plan in context of alliance purpose.	<i>Not defined</i>
S5 negotiate and release budget for S4 strategic plan and S3 operational plan.	<i>Not defined</i>
S5 process S4 and S3 progress reports, budget status and performance.	<i>Not defined</i>
S5 monitor for signs of misalignment or imbalance of S4 and S3 and initiate resolution measures.	<i>Not defined</i>
S5 initiate fast action when alerted that either operational unit of the alliance is unable to produce its purpose.	<i>Not defined</i>
S4 create and maintain alliance business model upon which to innovate (based on alliance purpose and organisations' business models and SWOT analyses).	<i>Not defined</i>
S4 drive active research of alliance niche environment to detect events, trends and novelties and seek to discover opportunities and threats.	<i>Not defined</i>
S4 drive ideation to any aspect of the alliance business model (considering organisations' performance actuality, capability, potentiality, and limitations).	<i>Not defined</i>

S4 drive creation of experiments to validate innovations (MVPs) or to explore questions of uncertainty (market research) to establish realistic strategic objectives.	<i>Partial Note 3b.1</i>
S4 create business case for the implementation of the business model innovation in line with operative feasibility checks and estimates.	<i>Not defined</i>
S4 create strategic objectives, plan and budget for the implementation of the business model innovation in line with operative feasibility checks and estimates.	<i>Not defined</i>
S3 develop and maintain familiarity and understanding of organisations' operational units (performance actuality, capability, potentiality and limitations).	<i>Not defined</i>
S3 determine alliance operational objectives corresponding to strategic objectives an in line with alliance purpose, scope and values.	<i>Not defined</i>
S3 drive comprehensive estimates of required investment, resources, time, risk, etc. to achieve operational objectives (an alliance operational plan).	<i>Not defined</i>
S3 negotiate and release budget for operational plans of individual operations.	<i>Not defined</i>
S3 process organisations' progress reports, budget status and performance and alliance S2 progress report to determine if organisation intervention is required.	<i>Not defined</i>
S2 create an implementation plan to achieve alliance operational objectives based on organisations' individual implementation plans.	<i>Not defined</i>
S2 maintain alignment of organisations during execution of released implementation plans.	<i>Not defined</i>

Table 23: Check if processes and instruments are defined for alliance management actions.

Source: Self-created and populated with the support of involved stakeholders.

Note 3b.1: As outlined in Section 4.2.2, it was agreed that the joint innovation team manage the creation of the MVP. Some attempt has been made by Org. AU head of innovation to retain knowledge generated during this activity using a document collaboration tool called *Confluence* (see Appendix E). However, the complete design of an experiment that clearly defines the scope of input, the expected output and completion criteria for the experiment activities are lacking.

4.2.7 Assessment of specific alliance

As described in Section 4.2.2, the alliance formation committee listed in Table 17 successfully reached a consensus on the purpose and values of the alliance, an outline of the foreseen working relationship and the summary vision and mission statements (see Appendix C). As also described in Section 4.2.2, the alliance formation committee decided together to create an MVP to validate the alliance's first hypothesised strategic objective that that Org. DE latest

technology is highly attractive for customers of two particular market sectors and that a joint sales approach is effective for winning new business.

To announce the formation of the alliance, marketing activities such as internal and customer communications, press releases, website updates and joint trade fair events were organised (see Appendix D - RASI matrix). To prepare for the development of the upcoming MVP as well as for future joint projects, activities such as technical training events, joint customer visits, intra-team on-site visits and inter-team strategy meetings were also organised (see Appendix D - RASI matrix).

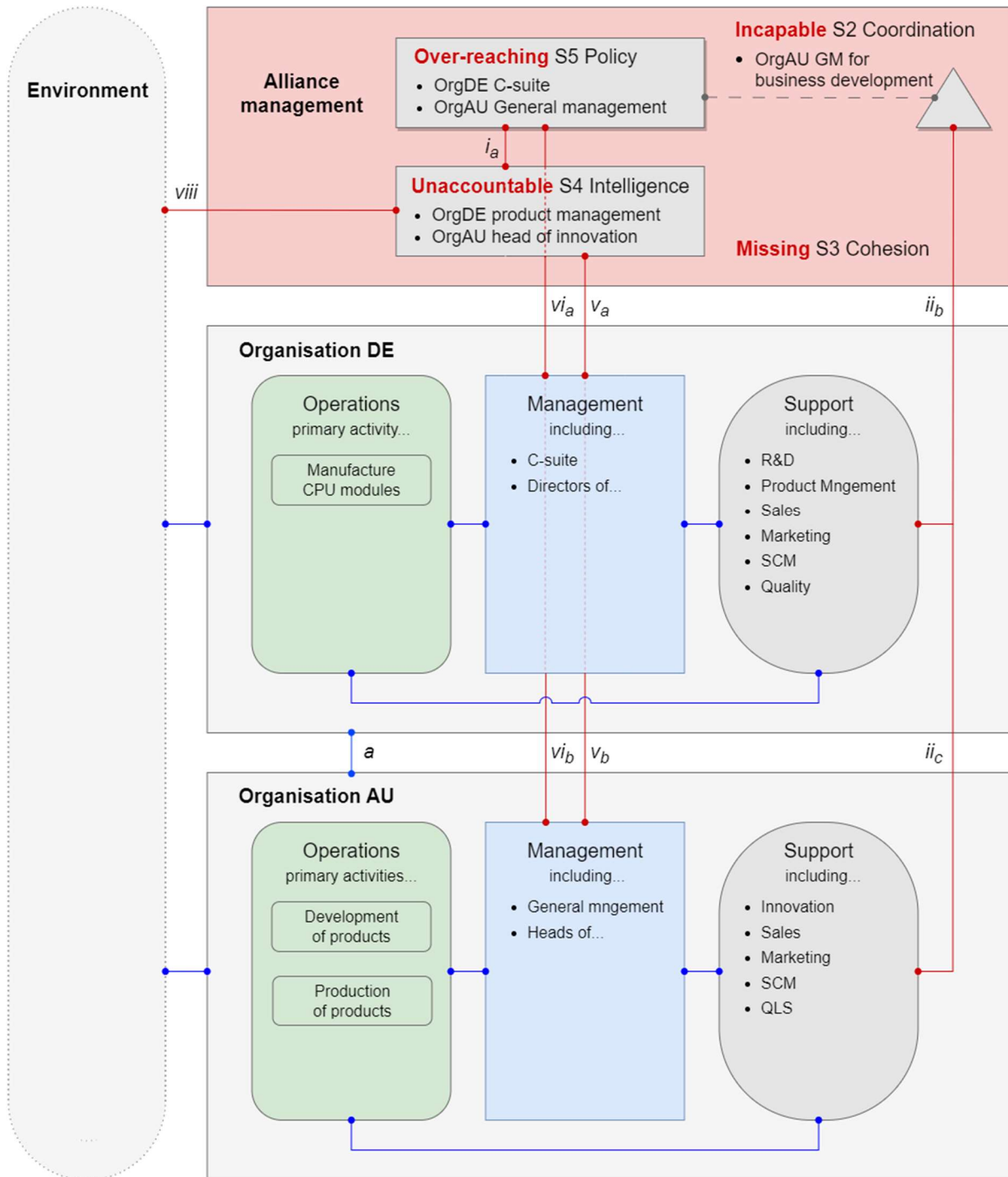
Overall, hundreds of hours of effort was spent by stakeholders, outside of the alliance formation committee itself, over the duration of more than one year before it finally became clear that both organisations actually had significantly different views of the intended purpose of the MVP and with diverging objectives, joint activities slowly ground to a halt. According to stakeholders actively involved in the alliance formation, the relationship between organisations is still good. But there is little doubt that not successfully achieving the first joint objective set out by the alliance management committee has caused frustration and impacted the initial enthusiasm and momentum of alliance formation activities.

In VSM terms, it is permitted and even necessary that two independent organisations, as two primary activities within the alliance, produce different purposes and the failure to reach a single joint strategic objective does not mean that the alliance cannot enjoy future successful collaborations. So perhaps the question is not why did the alliance not achieve the strategic objective that it initially set out (because by now that is pretty clear) but rather why did it take so long and require so much effort to recognise that it was in fact not an appropriate strategic objective?

The previous Section 4.2.1 and Sections 4.2.3 to 4.2.6 demonstrated how the VSM model and application framework have been used as a visual aid and structured checklist to provoke questions about whether the necessary management conditions are in place to support a synergistic and viable alliance. As identified by the application framework and now illustrated by Figure 37, the alliance management has demonstrated by its actions and interactions that it currently does not possess the necessary and sufficient conditions for a synergistic and long-term viable alliance. Despite the fact that the senior management stakeholders of the alliance formation committee were more than willing, capable, and empowered to bring about the realisation of a joint strategic objective, it appears that in the excitement of the alliance potential, assumptions were made and certain basic checks and balances have been overlooked or mishandled.

Figure 37 describes the VSM S5 policy role as 'over-reaching', the S4 intelligence role as 'unaccountable', the S3 cohesion role as 'missing', and the S2 coordination role as 'incapable'.

From the application of the framework in Sections 4.2.3 to 4.2.6, it may already be apparent why these labels have been chosen to describe the status of the VSM S5-S2 roles but this is now laid out in the following summary assessment.



i Command channel (only purpose!)
ii Coordination channel

v Inter-Intelligence (inter level) channel
vi Inter-Policy (inter level) channel

viii Environment channel
a Operational linkages

Figure 37: VSM of specific business alliance after analysis – currently not a viable system!

Source: Self-created.

As outlined in Section 4.2.2, the joint innovation team presented a brainstorm of possible ideas from certain typical categories of a business model (offering, target group and channels) and the alliance formation committee together reached a consensus on which elements to formulate an MVP. However, as noted in Section 4.2.3, the basis for the MVP was one of convenience and there no evidence of effort spent on the preparation of an alliance business model concept or any solid market research. The former exercise forces the alignment stakeholders on the focus and scope of the joint business model innovation which is helpful for planning the MVP implementation. The latter provides indicatory input or at least raises additional relevant market questions that help to guide the definition of the MVP design. As seen from Table 20 however, neither of these responsibilities were considered as necessary by the alliance formation committee.

This means that the VSM S4 role has immediately been restricted in its role to produce appropriate strategic objectives in response to environment perturbations based on a model of the alliance and its ability to deal with those perturbations. The joint c-suite team, as part of the alliance management committee, inadvertently dictated the strategic objective (which according to the VSM they are entitled to do on the command line i_a) but without recognising that that objective was subtly misaligned within the c-suite team. It is for this reason that the VSM S5 role has been described as over-reaching. As the expression goes, ‘the devil is in the detail’ of which the VSM S5 role may not and should not have to know – this is why the VSM should contain balanced S4 and S3 roles so that S5 only needs to absorb residual variety.

As also outlined in Section 4.2.2, the joint innovation team was assigned the responsibility to create the MVP to validate the alliance’s hypothesised strategic objective. In fact, the MVP consisted of two main aspects namely, a physical product called ICE requiring mainly development resources and secondly, a joint sales team enabled with relevant ICE knowledge requiring the joint collaboration of multiple disciplines. While the joint innovation team is an integral part of both aspects and well placed to manage the overall MVP implementation, remember that the alliance formation committee agreed that Org. AU GM for business development would be responsible for maintaining the overview of alliance-wide activities and supporting the alignment of inter-team activities (another example of VSM S5 over-reaching). This means that the joint innovation team were not assigned with the clear authority to manage resources needed for the implementation of the MVP (after all, alignment of activities would be done by a member of the c-suite with a clear authority to do so).

So, the joint innovation team did not feel compelled to prepare a plan and budget for the MVP and they were not requested to do so. The exercise of preparing a plan forces the express consideration of objectives to be achieved and the activities needed to achieve those objectives. However, as seen from Table 20, this responsibility was not considered by the alliance formation committee meaning that the VSM S4 role had effectively no accountability

since there is no negotiated, agreed basis upon which to gauge progress and recognise budget excesses (including timeline). This meant that it took a long time for the large number of stakeholders as a whole to truly recognise that the MVP was not proceeding in the straightforward manner assumed.

Meanwhile, the Org. AU GM for business development who had taken responsibility for maintaining the overview of alliance-wide activities and supporting the alignment of inter-team activities simply did not have the requisite variety to recognise the complexity of the task. As Beer put it, “the lethal variety attenuator is sheer ignorance” (Beer, 1985, p. 25) and so the GM for business development saw no need to prepare a plan assuming that everyone knew exactly what needed to be done to achieve the seemingly simple objective. This is not a reflection on capabilities or good intentions of the GM but in VSM terms, it is a misassignment of the VSM S2 coordination role for which the assignee is not equipped (see Table 20, Note 1.8 and 1.2). It is for this reason that the VSM S2 role has been described as incapable.

As mentioned, the physical MVP ICE product to be developed mainly required resources from the joint development team. The joint development team consisting of the Org. AU head of product development (a primary activity of Org. AU and so well supported by structured requirements engineering processes and dedicated project management) and the Org. DE director of R&D duly provided resources to participate in technical concept planning workshops driven by the innovation team. As noted in Section 4.2.3, Note 1.7, the joint development team would have been well suited to fill the VSM S3 role as the grounded operational counterpart to the VSM S4 innovative role. Indeed, as reported by involved stakeholders, the development team did act as important sparing partners for the innovation team. However, officially and as seen from Table 20, VSM S3 responsibilities of determining operational objectives and planning and managing operational activities were not requested by the alliance formation committee.

This means that the joint development team did not feel compelled to attempt to prepare operational objectives or a development plan for the ICE product understandably waiting for the innovation team, who had been assigned responsibility for the overall MVP, to provide more clear requirements. The allocation of the S3 role would normally oblige S3 to escalate issues blocking their function of producing purpose (via the command line i_b or algedonic signal vii of Figure 35). In this case, however, this mechanism and the complete VSM S3 role is completely missing.

Stakeholders involved in the formation of the alliance have reflected that in hindsight, it is clear that Org. DE selling standard CPU modules will naturally have overlapping but different views to Org. AU selling customised systems for an own product (even if it is just an MVP) to be used to enable sales of their core products/services. And of course, there is still optimism that

one false start does not mean that the alliance cannot enjoy future shared success with specific customer projects. However, the false start did come at a significant cost in all respects (financial, time, resources, market credibility, stakeholder motivation) and naturally has raised some concerns and uncertainty of the pairing. Therefore, senior management would be well advised to reflect on lessons learned so as to not repeat mistakes going forward.

4.2.8 Assessment of framework

In this overall Section 4.2, then general alliance management VSM model and application framework put forward by this research have been used as a checklist/diagnostic tool to determine if conditions necessary for a viable alliance may be missing (according to VSM) from the alliance management. As demonstrated, the tool has indeed identified absent or incomplete roles, actions and interactions within the alliance management of the specific application that has helped to explain the alliance's failure to reach its first seemingly straightforward strategic objective. The value of the VSM model in this exercise is that it has provided a visual aid and language to facilitate clear discussion and diagnosis of the specific alliance. As Espejo & Gill (2011) put it, VSM "is above all a thinking framework which helps people to share a common language and model of their organization to manage more effectively its complexity and aid debate and adjustment" (p. 3). The value of the application framework in this exercise is that it has provided a structured step-by-step approach to ensuring that all roles, activities, and interfaces of VSM have been considered in the diagnosis.

Is it possible that the research is biased and that the VSM model and application framework have been made to fit the diagnosis of the specific alliance in retrospect? Well, the VSM model and application framework have indeed been used to diagnose the specific alliance, with the help of involved stakeholders, in retrospect. However, the VSM does not produce some complex or subjective formula to be interpreted by management. Rather it stipulates basic conditions that must be present like purpose, objectives, accountability, escalation signals and so on - and so does not allow much room for bias. The application did nothing more than use the framework in a relatively objective manner to check for these basic conditions in the specific alliance management together with involved stakeholders and report the findings.

It is interesting to observe that, despite VSM prescribing basic conditions that would normally be considered entirely obvious to any one individual of the alliance formation committee, it has been exactly some of these conditions that have been overlooked by the alliance formation committee as a whole. Perhaps it is not *despite* but rather *because* conditions are obvious that they were overlooked - everyone assumed them as a given and an unnecessary check. This indicates that the VSM model and application framework could serve equally well as an organisational planning tool at the start of an application as it has shown to be a useful diagnostic tool later in an application.

5 Conclusions

The following section of this concluding chapter looks back over the complete thesis summarising the development of the central theme and key takeaways of the research. The subsequent section then reflects if the research displays the criteria of a quality business science research namely, dependability, credibility, and transferability. It also reflects on the research relevance, originality and value of contribution to practitioners and academics as well as the research limitations and recommendations for further research.

5.1 Research summary

The motivation and focus of this research have been outlined in Section 1.1 and are summarised by Figure 1. As discussed, the research is motivated by the challenges facing organisations competing in an ever-increasing knowledge-based economy arguing that organisations operate in a VUCA environment, with a shortage of knowledge workers, grappling with the often-abstract paradigm that is knowledge management (KM) and trying to leverage intangible assets (tacit knowledge embodied in knowledge workers) to achieve a sustainable competitive advantage. While the formation of organisation alliances that are capable of generating new knowledge (synergistic knowledge alliances) offers a strategy for shared market advantage, the management of alliances also poses additional challenges in stimulating and maintaining the appropriate cross-boundary relationships needed for effective knowledge generation. The viable system model (VSM) is said to be one of the most powerful organisational tools for understanding the necessary and sufficient conditions for an organisation in dealing with complexity, maintaining synergy of its primary activities, and adapting to a changing environment so that it can remain long-term viable. This research therefore decided to focus on how VSM might be used as a tool by the management of an alliance to determine the conditions to achieve synergy of its constituent organisations and how the core elements of KM could be viewed by management as being integrally linked to those conditions.

In Section 1.2, the above research focus has been framed in the form of the research question: *how can the VSM be utilised, in the context of a synergistic knowledge alliance, to define necessary alliance management functions and relationships, the knowledge required by that management to fulfill those functions, and the processes that need to be in place to manage that knowledge?* And the following research objectives were defined in order to achieve the goal of answering this question:

- Objective 1: Construct a VSM of a business alliance and link the VSM with the core elements of KM theory in an intuitive manner.

- Objective 2: Construct an application framework to support the design of the alliance management functions and interfaces, the knowledge required by management to fulfill those functions, and the processes that need to be in place to manage that knowledge.
- Objective 3: Refine the theoretical model and application framework together with practitioners that are actively involved in the organisation of a newly formed international alliance with the target of improving its general practability for business applications.
- Objective 4: Apply the refined model and application framework to that same specific alliance in order to observe and record its usage.
- Objective 5: Review and compile a reflective assessment of the usage of the model and framework in the practical application together with alliance stakeholders.

The design of the research to achieve these objectives has been described in Chapter 2. Formally, the research strategy has been defined as an action research and the research philosophy as one of pragmatism. As discussed, and summarised by Figure 4, the research has been divided into four phases (tool construction, refinement, application, and evaluation) with the researcher working closely with practitioners actively involved in the formation of a new alliance to bring about continuous incremental improvements in the VSM model and application framework being researched and developed.

The theoretical foundation for the core elements of KM employed by this research has been introduced in Section 3.1. Most notably, a literature research of the extremely vast topic of KM has allowed the introduction of the following terminology and concepts:

- Knowledge can be treated as a resource with a variety of attributes and with the potential of being a source of sustained competitive advantage should its attributes satisfy the four VRIN criteria (see Figure 6).
- A knowledge episode is defined as a knowledge resource instance with a set of attributes that is encountered by a knowledge processor (an individual/collective) that processes and in doing so enriches the knowledge resource in some way thus elevating its position on the knowledge ladder (see Figure 8 and Figure 7).
- The introduction of the knowledge episode with its simple input, action, output unit building block then allowed the researcher to make a logical connection to a functional definition for the concept of knowledge proposed by Achterbergh & Vriens (2002) which is that knowledge is that which is needed “for the assessment of signals and for the performance of actions” (p. 226).

- KM literature does not provide a consistent definition for the quantity, naming and description for a core set of knowledge processes. Referencing well-cited literature, Section 3.1.2 argued that the five core knowledge processes of identification, generation, application, retention and sharing (see Table 5) are sufficient for capturing the variety of activities that are central to all KM activities.
- Finally, Section 3.1.3 highlighted the critical role played by an organisation's management leadership in formulating a clear strategy and promoting a culture that is conducive to KM. A clear, unambiguous, and consistent management statement of the organisation's purpose, scope, and values as well as its specific short-term operational and long-term strategic objectives enables knowledge processors to self-determine if encountered knowledge resources are relevant for the organisation and how they should be processed appropriately for the benefit of the organisation. The willingness of knowledge processors to do so however (and their attitudes to KM), is then hugely influenced by the organisational culture cultivated by the leadership style and must not be underestimated.

The theoretical foundation for the VSM has been introduced in Section 3.2. Beer is seen as the father of management cybernetics and the inventor of VSM and so this research has taken the approach of meticulously dissecting the details of his seminal work referring to more modern literature when required for further clarification of concepts. The following key concepts of the VSM have been presented:

- In systems thinking terms, an organisation is a set of interconnected members that form relationships based on a shared sense of the organisation's purpose, and that this configuration of 'interconnected nodes' establishes the behavioural identity of the organisation that distinguishes it from other organisations.
- The number of all possible behavioural distinctions of an organisation is referred to as the organisation's variety and in order for that organisation to be viable in the environment in which it exists then its variety must match the complexity of the environment (the number of states of the environment that are relevant to the organisation).
- Management then, can be seen as the task of designing effective attenuators and amplifiers to balance complexity between the environment and the organisation at a minimum cost to the organisation. This lead the researcher to recognise that KM (management of knowledge processors and knowledge resources) to generate the knowledge needed to achieve objectives is essentially complexity management.
- The VSM structure of an organisation consists of recursive layers of primary activities, each producing an aspect of the organisation's stated purpose and each being an

autonomous unit permitted and capable of self-organisation and self-regulation (see Figure 14).

- Each recursive layer of primary activities successively absorbs aspects of environment complexity (complexity unfolding) leaving senior management to cope with only a residual variety. In other words, the recursive system of devolved power means that complexity is evenly distributed throughout the entire diversity of the organisation increasing its capacity for knowledge generation (needed for problem solving, decision making, innovation, and so on).
- Section 3.2.2 explained how management ensures the cohesion of all primary activities (each seeking its own individual viability). This is achieved through controlling command channels (see Figure 15) and anti-oscillatory coordination channels (see Figure 16) as well as through its variety generating audit channels (see Figure 18). The fact that this mechanism exists at every level of recursion of an organisation that is structured according to the VSM, means that synergy between all primary activities and cohesion of the organisation as a whole is ensured.
- Complexity unfolding and collective cohesion are still not sufficient to ensure the viability of the organisation. In order for an organisation to remain viable in an environment which is constantly changing it must also be able to detect and respond appropriately to disruptions in the environment. Section 3.2.3 explained the functions and interactions of a VSM management metasystem necessary to implement such an adaption mechanism (see Figure 19) that exists at every layer of recursion. Key functions include: maintaining a model of the organisation and environment, proposing strategic objectives for adaption, balancing proposals against feasible operational plans, and guidance of actions by the organisation's stated purpose, scope and values.
- Finally, Section 3.2.4 presented the complete detailed, labelled VSM (see Figure 21) and summarised key takeaways and conventions adopted by the research. It is worth highlighting that the research recognised the general Model of Systemic Control (from the St. Gallen management concept toolset) and adopted the intuitive naming of normative, strategic, and operative management from the MSC for the S5 policy, S4 intelligence and S3 cohesion management functions of the VSM. It is further worth noting a point of originality that the model specifically includes a visual representation for the support functions (e.g. sale, marketing, regulatory affairs, HR, etc.) of an organisation. While the inclusion of an unconnected circle may not appear significant, decisions of centralised/decentralised support functions impact the organisational trade-off between autonomy of primary activities and cohesion of the collective and this researcher views the

visual representation to serve as a useful mental container as well as organisational task reminder for practitioners.

The theoretical foundation, Chapter 3, concluded with Section 3.3 finding that, while a large volume of VSM related literature exists and many successful applications have been reported, academics have well recognised that few applications provide actual insights of hands-on usage. Furthermore, a literature review has determined that only a small portion of VSM literature relates to KM, most of which then only discusses the potential of VSM in the domain of KM without establishing a framework or demonstrating an application, and none of which consider the application of alliance management. Achterbergh & Vriens “Managing viable knowledge” (2002) has been identified as an academic paper that provided a concept for linking the core elements of KM to the VSM and then elaborated this link as a framework. However, as demonstrated, while Achterbergh & Vriens (2002) well-cited research provides a good point of departure for this research, many questions and challenges still remain for the practitioner. It is therefore concluded that there is gap in academic research that merits further investigation (see Figure 25).

Based on the solid theoretical foundation of Chapter 3 and collaborative refinements with practitioners actively involved in the organisation of a newly formed alliance, Section 4.1 presented the following artifacts that fulfill the first three objectives of this research:

- The general model for the VSM of a business alliance focusing on the management functions of the alliance that has been put forward by this research is presented in Figure 27. As discussed, the model does not consider the VSM of each individual organisation in detail since, being viable businesses, it has been assumed that they contain the necessary and sufficient VSM systems S5 to S1 whether or not this is explicitly recognised by the organisations in VSM terms.
- The model that has been put forward by this research to link the core elements of KM theory with the VSM are represented by Figure 28 and Figure 29. Although extended in a number of aspects, the main underlying principles for this model are based on Achterbergh & Vriens (2002) (see adopted principles in Section 3.3.1). A key difference not utilised by Achterbergh & Vriens (2002) however, is the representation of a VSM role as a set of knowledge episodes with the VSM role corresponding to the knowledge processor and the interfaces to the VSM role corresponding to the knowledge resources received/transmitted by the knowledge processor.

The visual representation of a VSM role (to be clear, this means every role in the VSM of an organisation) as a set of knowledge episodes is significant. It forces the express recognition that KM is an integral part of every interaction that takes place and every action

performed, that according to the VSM are necessary and altogether are sufficient for viability. This means that KM cannot be considered as some abstract topic or unnecessary overhead – it is entirely necessary, practical and forms a natural course of events during design of action/interaction processes. In other words, a viable organisation is constantly doing KM whether it is recognised as such or not. The VSM, by defining necessary and sufficient actions and interactions for its VSM roles, therefore provides a focus for relevant knowledge and a tool for structured knowledge management.

- Sections 4.1.3 to 4.1.6 then compiled 'job descriptions' for the responsibilities, interfaces, scope of interactions, and required competencies for each role of the alliance management (normative management, strategic management, operative management and coordination function). Compiled tables have been supplemented by explanatory diagrams, and prompts for the knowledge process types expected to take place at each stage (input, action, output) of role interactions have also been provided. A literature review has not identified any sources that have previously attempted to compile the above set of related parameters in such a complete, concise, and practical manner in the novel format of job descriptions.
- Finally, the application framework that has been put forward by this research is provided in Table 16 and is summarised by flowchart Figure 34. The framework continues the novel HR theme of job descriptions by dividing the application into the logical phases of recruitment, onboarding, and development (of interfaces and then activities). It has been designed to provide practitioners with a tangible step-by-step approach to putting in place an alliance management that is supported by appropriate knowledge processes. It is supported by the VSM model shown in Figure 27, utilising the VSM job descriptions of Sections 4.1.3 - 4.1.6 and the knowledge processes summarised by Figure 29.

Finally, Section 4.2 applied the general alliance management VSM model and application framework of Section 4.1 to the specific case of the newly formed real-world international business alliance in order to fulfill the final two objectives of this research. As has been seen, the simple checklist structure of the application framework, which was reviewed together with practitioners actively involved in the alliance formation, could easily identify absent and incomplete roles, actions, and interactions within the alliance management. This has helped to demonstrate how the application framework and VSM model can be used to diagnose and most importantly to articulate and visualise (see Figure 37) the alliance's failure to reach its first seemingly straightforward strategic objective as well as why it took such a long time and so much effort to do so. As reflected in Section 4.2.8, given the basic and yet essential management conditions prescribed by the VSM model and application framework put forward by this research, this toolset could serve equally well as an organisational planning tool at the start of an application as it has shown to be a useful diagnostic tool later on in an application.

5.2 Implications & further research

The question that has been posed by this research and the objectives that have been set to provide an answer to the question have involved linking together the extremely vast topics of KM and the VSM. In order to do so, this researcher has set out a clear research design plan (Chapter 2) and undertaken a systematic and rigorous research of both topics (Chapter 3). The researcher has used well-cited, credible literature and has compiled relevant aspects that are linked together in a clear and continuous logical progression in order to demonstrate a reliability and dependability of the research.

Besides the value to practitioners provided by a solid theoretical foundation to both KM and the VSM, the research also displays originality and novelty to benefit practitioners and that contributes to the existing body of academic research including:

- A general model for the VSM of a business alliance focusing on the management functions of the alliance that utilises the intuitive management naming convention of the general Model of Systemic Control and that visually represents the organisations' support functions (see Figure 21).
- A visual model that links the core elements of KM theory with the VSM (Figure 28 and Figure 29). Again, the model is strongly based on principles adopted from Achterbergh & Vriens (2002). However, firstly those principles are dissected and then extended and secondly and uniquely, a VSM is represented as set of knowledge episodes allowing a more intuitive visual representation of the link between KM and the VSM.
- Complete, concise and practical descriptions for the functions, relationships and expected knowledge processes for each VSM role prepared as a set of job descriptions outlining responsibilities, interfaces, scope of interactions, and required competencies (see Sections 4.1.3 to 4.1.6).
- A phased application framework that continues the novel HR theme by seeing the phases as the HR stages of recruitment, onboarding, and development (Table 16 and Figure 34). And that provides a concrete step-by-step approach to implementing the necessary and sufficient conditions for the management of an alliance that is supported by appropriate knowledge processes.

The credibility of the research findings have been validated to some degree by the application of the above toolset to a newly formed international business alliance. Section 4.2 has demonstrated straightforward usage of the toolset and its effectiveness in diagnosing, articulating and visualising (see Figure 37) absent and incomplete roles, actions, and interactions within the alliance management.

Additionally, the real-world insights, artifacts and reflections generated by the application herein exactly addresses the general academic call for shared insights of VSM applications thus contributing to positively to academic research.

The build up of the general alliance management VSM model and application framework (Section 4.1), the application of this toolset (Section 4.2) including the eventual reflection of the toolset usage (Section 4.2.8) have helped to demonstrate that the conditions for viability stipulated by the VSM are far from complex and in fact, one could even dare say, are rather obvious. It is therefore the hope of this researcher that this research has allowed practitioners to recognise the generalisability and transferability of the toolset to similar alliance formation applications (no matter the exact format of their manifestation) - and so encouraging its usage right from the outset for organisational planning purposes, and not only at a later stage for diagnostic purposes (as has been the case here).

The alignment of the short cross-sectional research period (active collaboration took place between February and May 2023) with the development state of the specific alliance during that time has meant that the application framework has not been utilised from the outset of the alliance formation as an organisational planning tool and also that it has not been used to its full extent to support the development of knowledge processes for the alliance management. Therefore, while the credibility and generalisability of the framework may be recognisably feasible, strictly speaking it means that it has not been fully validated and tested for general robustness. And so, future research should attempt to use a longitudinal research time horizon as well as testing multiple alliance formations in order to address this limitation of this current research.

This research has provided a clear motivation, focus and research gap for a topic of relevance to International Management and Leadership programme at the University of Applied Science Vorarlberg. The research has been conducted according to an planned research design considering all aspects of a formal business science research methodology. The reliability of the research has been demonstrated by the use of well-cited relevant literature and the researcher has carefully introduced and linked theories to form a dependable theoretical foundation. The researcher has demonstrated a structured, methodical approach but also creativity in the development of a general alliance management VSM model and application framework. Finally, the research has produced real-world insights for a specific business application allowing the reader to judge the credibility and generalisability of the developed toolset. Overall, this research offers value to practitioners by providing a solid theoretical background as well as a useful and practical toolset and offers value to academics by elaborating the theoretical link between KM and VSM as well as providing insights and reflections of a VSM-based tool application.

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Appendices

Appendix A - Beer's viable system model

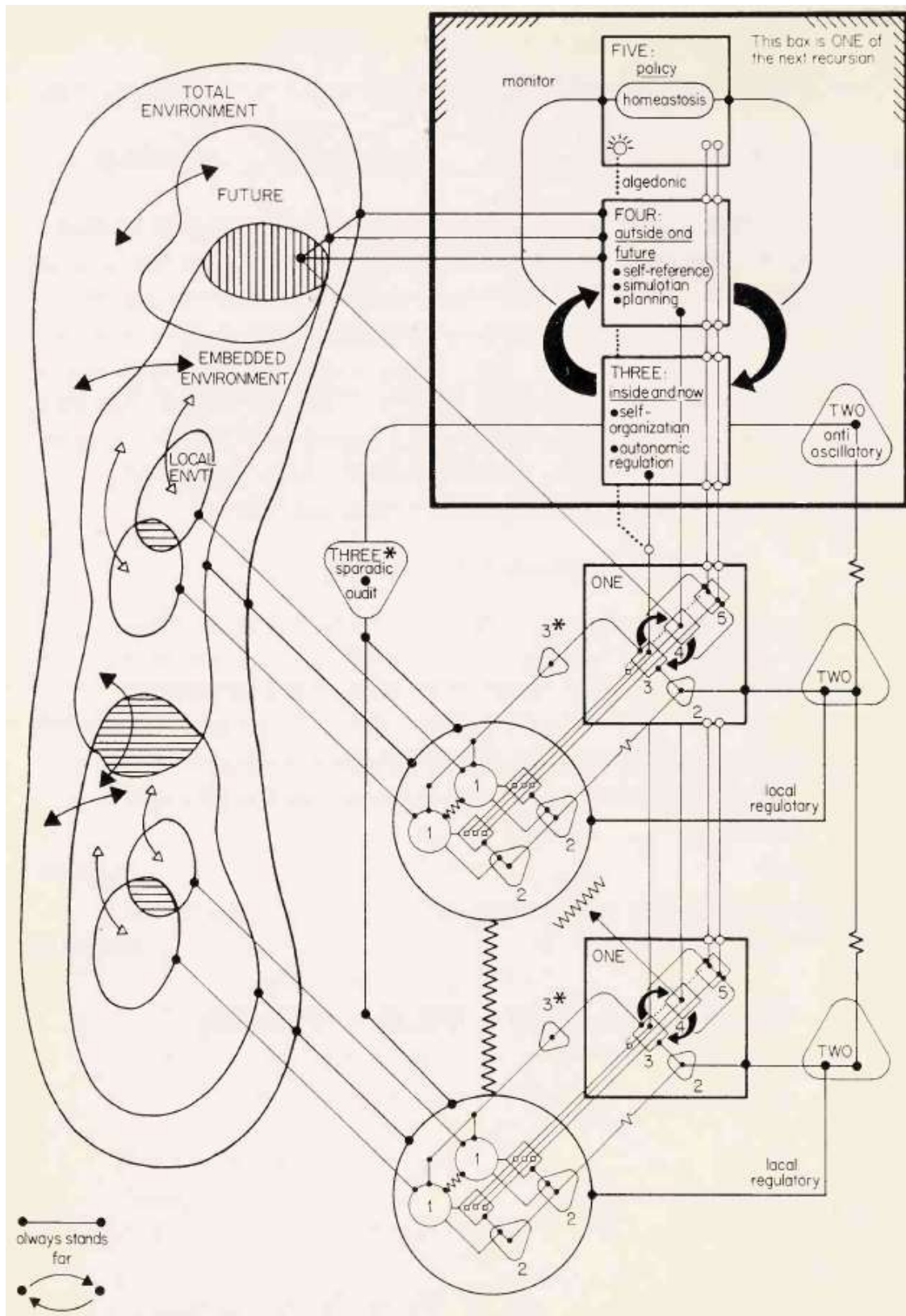


Figure 38: Beer's viable system model
 Source: (Beer, 1985, p. 136).

Appendix B – Business model template

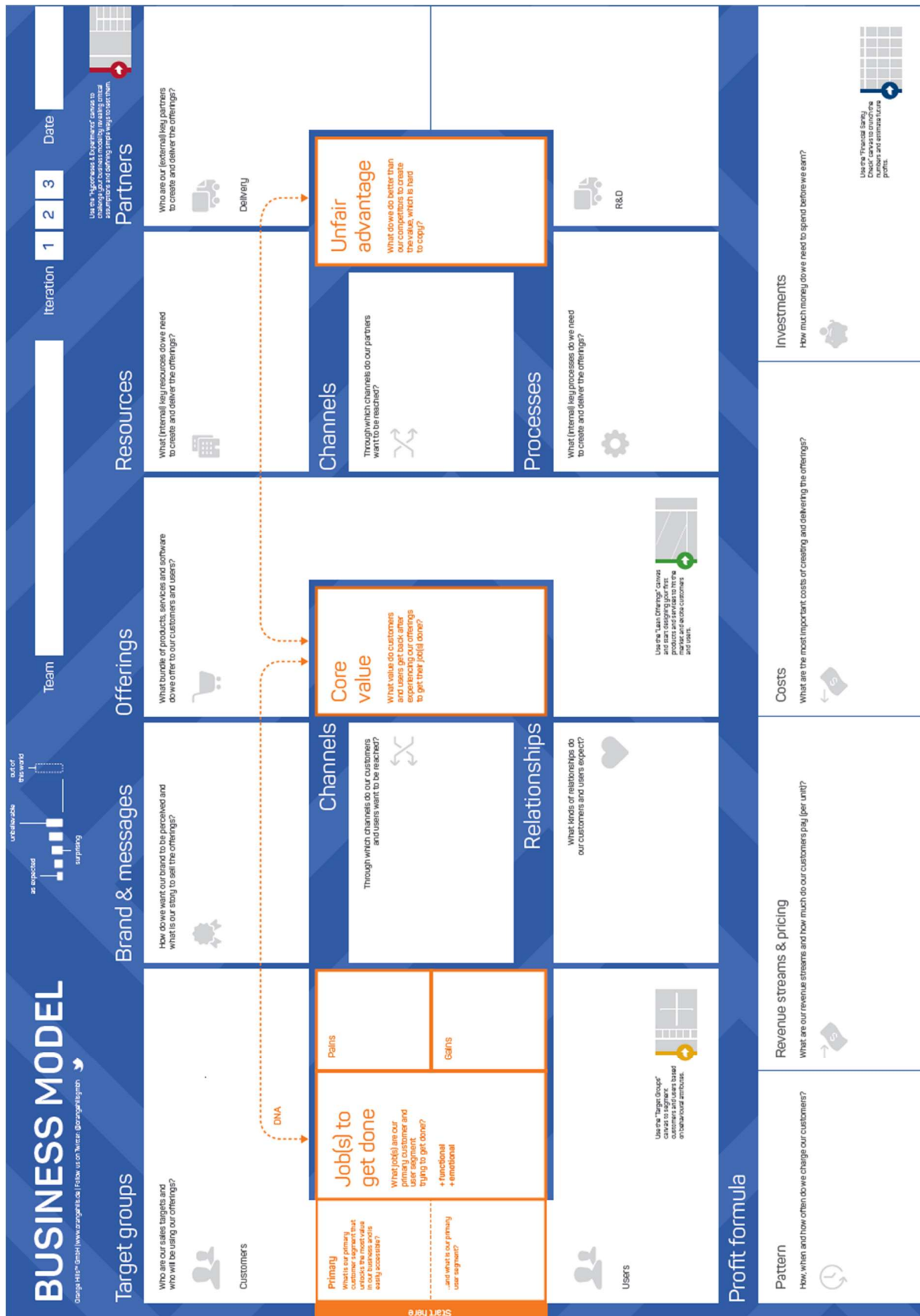


Figure 39: Illustrates the content of a typical business model template.

Source: Orange Hills GmbH (<https://businessdesign.org/knowledge-base/business-model/>).

Appendix C – Specific alliance statements of intent

Alliance – Purpose and values

- This framework for corporate entrepreneurship involves developing and implementing joint growth strategies by creating innovative solutions within a creative community of like-minded individuals.
- Current business topics such as digitalization, AI, and data are the focus of joint project and business model development.
- Shared revenues through transparent business models, including margin calculation and distribution, are a key element.
- Complementary skills of partners bring added value to customers and competitive advantages.
- It is a place for forward-thinking individuals to work across companies on innovations, services, and knowledge exchange.
- Common values include sustainable digitalization, with a dynamic network that is utilized and expanded.

Table 24: Specific alliance statement of purpose and values.

Source: Specific alliance artifact. Sensitive text has been intentionally altered or redacted.

Alliance – Outline of relationship

- Through this strengthened collaboration, both parties aim to implement a growth strategy that will result in increased revenue for both companies.
- They plan to market hardware-software combinations from their respective product portfolios as a "system" offering.
- This system business will be exclusively handled by Org. AU, particularly as a system integrator in the "██████" and "██████" industries. In the first step, customers in the EMEA market will be targeted.
- Specifically, Org. DE will present the partnership with Org. AU to its customers, generating additional business for both companies. Org. AU will officially act as a system integrator, using Org. DE hardware for this purpose.
- To implement this system, both partners agree on a competitive pricing model that avoids margin stacking, with each partner receiving a margin based on their value-add.

- Regular consultations, technology roadmaps, and employee training at Org. AU are also planned. Org. DE will provide technical support (FAE) to Org. AU in the system business, particularly in acquiring new customers.
- The partners will enter into appropriate agreements for customer/project protection and lead-sharing.
- Mutual transparency will also be established in the system business, enabling a transparent margin model.

Table 25: Specific alliance outline of foreseen relationship.

Source: Specific alliance artifact. Sensitive text has been intentionally altered or redacted.

Alliance vision

We are convinced that the collaboration between Org. DE and Org. AU can offer mutual customers new added value. The combined expertise of both companies enables you to obtain modular system solutions from a single source. Joint strategic efforts and intensive networking in marketing and on an operational level generate sustainable increases in market share. Both partners benefit from each other as a multiplier.

Table 26: Specific alliance vision statement.

Source: Specific alliance artifact. Sensitive text has been intentionally altered or redacted.

Alliance mission

Open and transparent networking, as well as a joint approach in order acquisition and fulfillment, are the top priority between the value partners Org. DE and Org. AU. The companies aim and should learn from each other and together realize the existing potentials in the markets of medical technology and cybersecurity. For these markets, Org. AU relies on Org. DE as its exclusive module partner, and in turn, Org. DE relies on Org. AU as its exclusive system integrator.

Table 27: Specific alliance mission statement.

Source: Specific alliance artifact. Sensitive text has been intentionally altered or redacted.

Appendix D – Specific alliance RASI matrix

RASI Matrix	C-suite	Development	Production	QLS	SCM	Innovation	Sales	Marketing
Responsible Who is responsible for performing the task decided upon by the group?	Org. DE CEO	Org. DE director of R&D	Org. DE director of global operations	Org. DE director of quality & compliance	Org. DE director of sourcing & SCM	Org. DE director of product management	Org. DE director of sales	Org. DE director of marketing
	Org. DE CSO	Org. AU head of development	Org. AU head of production	Org. AU head of quality and PLM	Org. AU head of strategic purchasing	Org. AU head of innovation	Org. AU head of sales	Org. AU head of marketing
	Org. AU GM for business development							
	Org. DE COO and CTO							
Accountable Who is accountable for ensuring the task completion?	Org. DE CEO	Org. DE director of R&D	Org. DE director of global operations	Org. DE director of quality & compliance	Org. DE director of sourcing & SCM	Org. DE director of product management	Org. DE director of sales	Org. DE director of marketing
	Org. DE CSO	Org. AU head of development	Org. AU head of production	Org. AU head of quality and PLM	Org. AU head of strategic purchasing	Org. AU head of innovation	Org. AU head of sales	Org. AU head of marketing
	Org. AU GM for business development							
	Org. DE COO and CTO							
Support Who is consulted during the task if needed?	Org. DE director of R&D	Org. DE COO and CTO	Org. DE COO and CTO	Org. DE COO and CTO	Org. DE COO and CTO	Org. DE COO and CTO	Org. DE CEO	Org. DE CEO
	Org. AU head of development	Org. AU GM for operations	Org. AU GM for operations	Org. AU GM for operations	Org. AU GM for operations	Org. DE CSO	Org. DE CSO	Org. DE CSO
	Org. DE director of global operations	Org. DE director of product management	Org. DE director of R&D	Org. DE director of R&D	Org. DE director of global operations	Org. AU GM for business development	Org. AU GM for business development	Org. AU GM for business development
	Org. AU head of production	Org. AU head of innovation	Org. AU head of development	Org. AU head of development	Org. AU head of production	Org. DE director of R&D	Org. DE director of product management	Org. DE director of sales
	Org. DE director of product management	Org. DE director of quality & compliance	Org. DE director of sourcing & SCM			Org. AU head of development	Org. AU head of innovation	Org. AU head of sales
	Org. AU head of innovation	Org. AU head of quality and PLM	Org. AU head of strategic purchasing			Org. DE director of sales	Org. DE director of quality & compliance	
	Org. DE director of sales					Org. AU head of sales	Org. AU head of quality and PLM	
	Org. AU head of sales							
	Org. DE director of marketing							
	Org. AU head of marketing							
	Org. DE director of sourcing & SCM							
	Org. AU head of strategic purchasing							
	Org. DE director of quality & compliance							
Org. AU head of quality and PLM								
Informated Who will be informed about the results of the task?	We all inform each other & regularly							

C-suite team member
 Development team member
 Innovation team member

Figure 40: Specific alliance formation committee RASI matrix – illustrates stakeholders.

Source: Specific alliance artifact. Sensitive text has been intentionally altered.

#	C-suite	#	Development
1	Alliance management task: Vision / Mission Creation of vision and mission v2.0 based on workshop inputs	1	Regular meetings Organise regular development management meetings
2	Internal communication Preparation of statements for shareholders and staff	2	Technology knowledge exchange Organise tech-workshops and trainings for development teams
3	Pricing Definition Pricing - Calculation Basis	3	On-site visits Organise on-site visits with development teams (getting to know)
4	Customer visits Planning of "high-level" customer visits		
5	Controlling teams Maintain overview and alignment of teams. Organise meetings, dates, contents etc.		
#	Marketing	#	Production
1	Organise trade fairs Joint appearance at trade fairs	1	-
2	Internal communication Preparation of internal communication on the partnership		
3	Org. DE Homepage Org. AU as system integrator		
4	Org. AU Homepage Integrate Org. DE modules		
5	Press conference Preparation of the joint press conference		
#	Innovation	#	QLS
1	Ideation Product / service strategy according to roadmap, identification of future topics, setting priorities	1	Align quality topics in product development Sample Q-planning, sample control plan, P-FMEA, QA coordination
2	MVP based on latest roadmap technology Find sweet spots - direction of solutions, "agile" systems	2	Align QLS in customer contracts Complaint handling, change management, product documentation, traceability, liability, insurance
3	Tech Summit Organise / conduct Technology Summit for alliance stakeholders	3	Alignment typical complaints & RMAs Complaint & RMA, analyses and investigations, logistics
		4	Align Product file & LCM Change management bill of material, material number logic incl. index, releases and approvals
		5	Enable sales task: QLS topics for sales Compile quality & regulatory affairs topics for sales
#	Sales	#	SCM
1	Get Together Getting to know one another, products, opplist, pricing...	1	Align Product costing Material price and total cost of ownership
2	Project reviews Start of project reviews from February	2	Align Supplier portfolio comparison Comparison supplier portfolio / manufacturer
3	Education and training needs Compile education and training needs by March	3	Align Packaging & Logistics Packaging and logistics -> sustainability / shuttle packaging
4	FAE support Determine Field Application Engineer support for joint visits	4	Align delivery models Buffer warehouse, consignment warehouse, ...
5	Demo units and future needs of customer Determine units needed to support joint customer visits by March. Determine customers needs for future products.	5	Negotiating power Align potential to increase of negotiation power with suppliers
6	Price list Create a price list in SAP and own book price by April	6	Shared component selection Discuss feasibility of early shared component selection
7	Global account strategy (OEM price list), com-only support (responsible + margins)	7	Supplier contracts Align regarding preparation of necessary contracts

Figure 41: Specific alliance formation committee RASI matrix – illustrates starting activities.

Source: Specific alliance artifact. Sensitive text has been intentionally altered.

Appendix E – Specific alliance collaboration tool

The screenshot shows a Confluence page for 'Industrial Computer Enabler (ICE) Programm'. The page layout includes a top navigation bar with 'Home', 'Recent', 'Spaces', 'Teams', 'Apps', and 'Templates'. The main content area is divided into two columns. The left column contains a list of items, including 'ICE Besprechungen und Workshops', '12th Generation generic Platforms &...', 'ICE-FOUR - [redacted]', 'ICE-THREE - [redacted]', and 'ICE-TWO - [redacted]'. The right column contains a detailed description of the program's goals, a section titled 'Why - Warum machen wir das?', and a section titled 'Hypothesen/Vorgaben aus der Geschäftsstrategie:'. An illustration of an ice cream sundae is positioned at the top right of the main content area.

Industrial Computer Enabler (ICE) Programm

Created by [redacted] | Last updated: Aug 24, 2022 • 2 min read • 20 people viewed

Ziel dieses Programmes ist [redacted]

Lösung seine "Needs" bietet Diese Basis ist der "Köcher" um Kunden zu interessieren und für neue Services und Produkte (bzw. Produktgenerationen) zu inspirieren.

Why - Warum machen wir das?:

- Um [redacted] der Salesextension zu erreichen
- Anwender die Chance zu geben etwas auszuprobieren um den Mehrwert zu entdecken

Hypothesen/Vorgaben aus der Geschäftsstrategie:

- Die Stärke unseres Angebots liegt in der Skalierbarkeit der Lösung
- Den Mehrwert ziehen unsere Kunden aus der Konsolidierung ihrer Systeme. Dies wird durch kundenspezifische Anpassungen erreicht.
- Wir als SIE wollen nicht in einen Preiskampf mit großen Mitbewerbern treten, da wir nicht mit der AddedValue-Chain von Herstellern, die ihre eigenen Mainboards entwickeln und fertigen, konkurrieren können.
- Aufgrund der Value-Partnerschaft mit [redacted] sind die Produkte von [redacted] preislich interessanter als deren Mitbewerber und deswegen in [redacted]

Den Kunden zu interessieren und zu locken

Figure 42: Collaboration tool, *Confluence*, used to document specific alliance MVP development. Source: Specific alliance artifact. Sensitive text has been intentionally redacted.

Statement of Affirmation

I hereby declare that all parts of this thesis were exclusively prepared by me, without using resources other than those stated above. The thoughts taken directly or indirectly from external sources are appropriately annotated.

This thesis or parts of it were not previously submitted to any other academic institution and have not yet been published.

Dornbirn, 7th, July 2023

Robert von Offenberg Sweeney