IntechOpen

Current Issues in Knowledge Management

Edited by Mark Wickham

Current Issues in Knowledge Management

Edited by Mark Wickham

Published in London, United Kingdom







IntechOpen






Supporting open minds since 2005

Current Issues in Knowledge Management
http://dx.doi.org/10.5772/intechopen.77625
Edited by Mark Wickham

Contributors
Michel Grundstein, Laura Zapata, Giovanna Testa, Hadi El-Farr, Rezvan Hosseingholizadeh, Arkady Trachuk, Natalia Linder, Mark Wickham, Timothy Donnelly

First published in London, United Kingdom, 2019 by IntechOpen
IntechOpen is the global imprint of INTECHOPEN LIMITED, registered in England and Wales, registration number: 11086078, The Shard, 25th floor, 32 London Bridge Street
London, SE19SG – United Kingdom
Printed in Croatia

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Additional hard and PDF copies can be obtained from orders@intechopen.com

Current Issues in Knowledge Management
Edited by Mark Wickham
p. cm.
Print ISBN 978-1-78985-231-8
Online ISBN 978-1-78985-232-5
eBook (PDF) ISBN 978-1-78985-045-1

Meet the editor

Dr. Mark Wickham is a senior lecturer in the Tasmanian School of Business and Economics at the University of Tasmania. After working as a manager in the retail sector for 15 years, he changed to an academic career to build on his managerial and marketing experience. Since 2004, Dr. Wickham has worked in various capacities at the University of Tasmania, and has develop teaching and research interests relating to corporate social responsibility, strategic management, sustainability, and reputation management in not-for-profit industry settings. Recently, Dr. Wickham has increased his research focus on the use of the resource-based view of the firm to explore the antecedents of strategic sustainability management, of which the knowledge management concept is key.

Contents

Preface

The knowledge management concept has emerged to serve as one of the critical inputs to the strategic management process, and a common factor underpinning competitive advantage. Over the concept's development, knowledge management research has focused on the processes that enable a firm to recognize sources of data, to transform data into useful information, to disseminate the information, and to develop strategies based on its insights. More recently, the development of the concept has begun to focus on the critical antecedents that enable these knowledge management processes to be implemented more effectively and efficiently. This research book serves to highlight some of the antecedents of effective knowledge management through empirical research done by researchers all around the globe. It does so in two separate sections: the first relates to tacit knowledge management, the second relates to strategic knowledge management.

In the first section, three chapters relating to the concept of tacit knowledge management are presented; these concern the topics of managing tacit knowledge spillover effects (in a Russian context), tacit knowledge management factors and their relationship to innovative capacity (in a Mexican context), and the impact that digital technologies play in understanding how tacit knowledge needs to be generated (in a global context). In the second section, three more chapters are presented relating to the strategic management implications of knowledge management. These chapters concern the strategic processes relating to the issues surrounding knowledge sharing across organizational boundaries (e.g. to strategic partners, organization in the supply chain, government agencies, etc.), the management of knowledge in "third spaces" (e.g. virtual networks, virtual organizations, "fab-labs," etc.), and what elements constitute knowledge management inputs for best-practice sustainability strategy.

On behalf of the authors, I hope that these chapters offer some important insights into the knowledge management concept, and that their findings and insights will assist practicing managers to improve their knowledge management practices. It is also our hope that these chapters will serve as the basis for a knowledge management research agenda by academics and other professional researchers in the field.

Dr. Mark Wickham
Tasmanian School of Business and Economics,
University of Tasmania,
Australia

Section 1

Tacit Knowledge Management

Chapter 1

Knowledge Spillover Effects: Impact of Export Learning Effects on Companies' Innovative Activities

Arkady Trachuk and Natalia Linder

Abstract

The global nature of knowledge production has blurred the boundaries between many scientific and technical fields. New, enhanced processes, technologies, products, services, and business models emerge leveraging integrated solutions with different roots. The existing spillover or flow of knowledge has influenced the creation of new cross-disciplinary areas of research into this phenomenon: knowledge economics and management. This chapter explores the impact of knowledge spillover effects on companies' innovative activities and presents a classification of spillover effects based on seven attributes. The empirical analysis was conducted by using cross data of Russian industrial companies. The stratified sample comprises data for 252 high-tech industry enterprises. It is concluded that knowledge spillover effects contribute to changes in both business models of industrial enterprises and their performance. The degree of this influence directly depends on whether companies that have well-developed foreign relations possess a "critical mass" of absorption material. Knowledge spillover effects enable companies to ensure payback of investments in exports and innovations on a regular basis solely through the continuous inflow of complementary knowledge and experience from international partners. However, such openness comes along with loss of independence, the possibility of being taken over, and the need for the presence of a significant market demand.

Keywords: the flow (spillover) of knowledge, knowledge spillover effects, research and development (R&D), channels and forms of innovation "cross-flow", knowledge transfer, export sales

1. Introduction

The latest technologies and knowledge today play a huge role in the rapidly changing global economy [1, 2]. Studies that analyze how knowledge is created, accumulated, and transferred make it possible to identify and explain the performance and productivity gaps between specific enterprises, activities, industries, and even countries that have "knowledge potentials"—dynamic knowledge absorption capabilities [3].

Companies currently tend to reorient their efforts toward applied rather than fundamental research, which makes organizations dependent on the state and academic institutions [4, 5]. A similar situation, although smaller in scale and coverage, is faced by scientific organizations due to the increasing financial and political pressure on them [6, 7]. As a result, the structure of the body of knowledge is undergoing significant changes: despite the increasing number of patent applications and scientific publications, scientific activity results are mostly incremental in nature, the consequences of which are hard to predict [8]. In view of the foregoing, ensuring the flow of scientific knowledge, results, and the process of evaluating and monitoring the transfer and adaptation of accumulated experience to one's own work environment within the "triple spiral" system (various knowledge-sharing institutions, science and education) is becoming ever more critical every day [9, 10].

In this chapter, we review the knowledge flow phenomenon and the related learning spillover effects as well as their impact on companies' innovative activities.

2. Knowledge and innovation spillover effects

Knowledge is a resource, a specific asset capable of generating vast external effects (spillovers), or externalities, expressed in the accumulation of knowledge and the continuous production of new knowledge based on acquired competencies, skills, and experience [11]. On the other hand, "learning" effects are, as a rule, associated with a positive phenomenon that contributes to the enrichment of all spheres of life in society [12]. Knowledge created by one economic entity (whether an individual or an entire organization) will definitely become available to other entities over time [13]. This phenomenon can be described as knowledge transfer and knowledge spillover. For firms with an underdeveloped technological, intellectual base, the knowledge-borrowing process becomes essential for their further development [14]. Knowledge gained from the external environment will not always be able to take root in an internal differently tuned system. Effects that arise from the borrowing of experience can differ in nature and direction. In theory, there are several classifications of external knowledge effects, which are outlined in **Table 1**.

The econometric model measuring the effect of R&D investment on knowledge stock and economic growth was first introduced by [15]. Later, in 1986, [16] proved this relationship, based on the fact that the total relevant activity of other firms influencing innovation of a particular firm can be represented as a weighted sum of R&D investments, with weights proportional to the technological proximity of the firms to the one under consideration. Similar studies in terms of topics addressed can be found in works [17, 18]. Evaluation of patenting activity in neighboring regions of France and its relationship with the level of corporate and university R&D expenditures was dealt with by [19]. The paper [20] measures how the geographical distance between firms affects their participation in the Small Business Innovation Research program that awards grants. Software industry in the USA studied and proved that clustering directly affected innovative outputs and growth [21].

In 2004, [22] explored the effectiveness of various channels of R&D spillover effects at the intra-industry level through a survey of 358 Swiss R&D managers representing 127 different lines of business. This monograph, in particular, considers the following factors: R&D activity, reverse engineering (design capability), publications, patents, technical meetings/discussions, and intra-corporate communications as potential knowledge flow channels, with in-house R&D investments being named as the principal factor contributing to spillovers.

Another group of studies investigates relationships between spillover effects and innovations. Compared the geographical location of companies that published

I. Positive and negative	
Positive: improvement of a product, process, and technology by one company as a result of imitation, borrowing from another company	Negative: theft of confidential information, trade secrets, causing damage to another enterprise
II. Internal and external	
Internal: result from information, experience, and knowledge being shared between employees of the same entity or technologies, equipment, staff being shared within divisions of the same company	External: result from the company's interaction with the external environment
III. Horizontal and vertical	
Horizontal: occur between firms in similar stages of the production chain	Vertical[1]: occur between firms that have a supplier/seller-consumer relationship (strong diversification of knowledge, concentrated in complementary sectors)
IV. Direct and indirect	
Direct: knowledge not mediated by market transactions, trade; is translated into improvements in structural elements of production (material output)	Indirect (monetary): arise from dependence upon strategies and pricing policies
V. Temporary and spatial	
Temporary: have an impact on next generations, e.g., as a result of scientific and technological progress, development of alternative energy sources	Spatial: have an impact on agents operating in the same economic space
VI. Innovation and technological knowledge spillover effects	
a. External knowledge effects: transfer of knowledge beyond the intended boundary, defined range of individuals, organizations (as opposed to knowledge sharing)	
b. Innovation effects are derivatives of knowledge externalities	
c. Technological effects arise from the diffusion of technologies, with the only difference being that the diffusion takes place in an uncontrolled fashion, without any payment for technology; knowledge is transformed into one of the production factors; technologies are applied in various sectors of the economy	
VII. Marshall-Arrow-Romer (MAR), Porter, and Jacobs spillover effects	
Key attribute: firms are located close to each other (are geographically concentrated)	

Source: developed by the authors.
[1]They are divided into direct and reverse. Direct ones result from foreign investments when national firms gain access to less expensive or new intermediate resources. Reverse ones constitute effects of the dissemination of state-of-the-art technologies through the supply chain from companies with foreign capital to local, domestic suppliers.

Table 1.
Classification of knowledge spillover effects.

patents and those that cited patents in order to demonstrate the local nature of explicit knowledge spillover [23]. The importance of the impact that tacit knowledge has on innovation, which, unfortunately, is unmeasurable and hard to reach, should also be taken into consideration.

Economists have distinguished two types of knowledge spillover effects that are important in terms of growth and innovation: MAR spillovers and Jacobs spillovers.

2.1 MAR spillovers

In 1980 Alfred Marshall developed knowledge spillover theory that was further finalized by Kenneth Arrow and Paul Romer and named "MAR spillover" after its authors [24]. According to that theory, concentration of firms in one sector (industry) facilitates scientific knowledge transfer between firms encouraging growth

and innovation. Employees of different companies of the same sector (industry) exchange ideas of new products and processes. That is, the higher the concentration of employees of the same specialization on that territory, the higher the possibility of idea exchange that can further lead to innovative solutions. Frequently the latest data on technological breakthrough and know-how keeps its value for a very short period of time, spreading among the professional community afterward. That is why firms aim to locate their R&D centers close to the sources of such data determining the formation of technological clusters [25].

2.2 Jacobs spillovers

In 1969 Jane Jacobs developed another knowledge spillover effect theory [26]. Jacobs believes that knowledge spillover effects are connected with differentiation of industries on the territory. In her opinion, concentration of different industries in one place stimulates innovation by uniting people having different knowledge and professional experience, forming the ground for idea exchange from different perspectives. Also reasoning on the competition, Jacobs claims that developed markets with a large number of players are the most positive environment for innovation. At the same time, high monopolization level restrains innovations from emergence [26].

Jacobs inter-sectoral effects occur between companies belonging to different sectors: knowledge flows occur between complementary sectors of industry or suppliers and customers [27]. It is not clustering but the diversity of industries that triggers mutual, cross-enriching spillovers: movement, flow of ideas, techniques, tools to other industries lead to their different, completely new application, and, accordingly, to a different result, end product [28].

Table 2 below provides a systematization of knowledge spillover effects based on "location within/outside the industry," where the horizontal axis displays two main types of market structures by a degree of competition (competitive and monopolistic environment), while the vertical axis shows industry-specific characteristics of the geographical concentration of firms (cluster type, diversified industry base).

The abovementioned theories of dynamic spillover effects formulate a kind of a hypothesis on the nature of a diversified and concentrated industry base and which of the industries is more likely to experience the flow of knowledge and the fastest growth.

The role of exports as a factor driving growth in general and productivity in particular was empirically proven quite a long time ago using aggregated cross-country and cross-industry data in time (macro level) [29]. And it was just recently that researchers decided to test longitudinal data at the inter-company level (micro and meso level) by reviewing the difference in productivity and efficiency between exporting companies and their opposites—companies that only operate in the domestic market [13].

One of the most well-known, frequently cited papers investigating this phenomenon at the macro level is [30]. The paper is based on 45 econometric models built

	Competitive environment	**Monopolistic environment**
Technological cluster	Porter effects	MAR effects
Diversity of industries	Jacobs effects	—

Source: developed by the authors.

Table 2.
Classification of knowledge spillover effects by industry geographical concentration.

from data of companies representing 33 countries, published between 1995 and 2004. The conclusion is formed from two key statements: (1) exporting companies appear to be more efficient and innovative than non-exporting companies and (2) as a result of a "self-selection" process, more productive firms are prone to enter export markets, while export activities do not necessarily lead to improvements in effectiveness.

The first fact finds its confirmation in the papers [31, 32] arguing that it is the expansion of the company's footprint and sales market that encourages managers to introduce innovations and various improvements resulting from an increase in efficiency and sustainable growth. The second fact is presented at the theoretical and empirical level in [33]: innovation activity and research create a competitive advantage for a company, which leads to productivity growth that increases the likelihood of becoming an exporter and gaining a foothold not only in the national but also in the international market. An intuitive suggestion regarding a relationship between innovations and exports has been confirmed by experts at various times; however, the relationship between these processes is ambiguous and should be researched in more detail using various industries, companies, and scientific institutions.

The "self-selection" effect is analyzed in [34] on the basis of register data with the addition of customs statistics. Previous experience in a foreign market is a key to success in the future. Globalization leads to an increase in innovation activity, as shown in the papers [35, 36]. [37] test the hypotheses regarding innovation incentives for processing enterprises when entering a foreign market at macro and micro levels (panel data for 2005 and 2009 obtained during two surveys).

Studies that address the question whether exports influence growth or growth are influenced by exports actually appeared in 1995 when Bernard and Jensen [38] published a number of articles that turned how things were viewed upside down. The same phenomenon was addressed in papers by [39, 40]. They used a vast sample of data obtained from surveys represented by US official statistics to explore the effectiveness of firms across all industrial sectors from a different perspective, depending on whether they were engaged in exports.

3. Development of the research model and hypotheses

More contemporary empirical studies using variations of the approach were employed by [38], but, unlike them, focusing on one particular industry is also of interest for studying the similarities and differences between exporting and non-exporting companies [41, 42]. [32] studied differences between firms based on another fact: whether firms engaged in exports enter developed or developing countries. In developing countries, foreign companies earn more substantial profits than national markets, with an opposite effect observed in developed countries.

Thus, our first hypothesis has been formulated.

H1: Innovation-active firms more often become exporters compared with firms that do not engage in active innovation.

The second hypothesis is devoted to the role of learning by exporting: exporting companies are more efficient than companies that are only present in the national market. [43]. Flows of knowledge between international foreign buyers, suppliers, and competitors help novice exporters improve their activities (higher postentry performance), adopt positive business experience, promote products and services faster, implement technological innovations to keep the acquired niche, and expand the zone of influence [42]. In addition, firms that enter foreign markets face more intense and fierce competition and must develop faster to survive in the future.

Export orientation and innovation are alternative, competing investment projects. Perhaps, firms that have already entered a foreign market do not need additional investments in innovation development, since they are anyway borrowing the best, new things from abroad. To answer this question, the second hypothesis has been formulated.

H2: Exporting companies are more likely to implement innovations (including organizational innovations) than firms oriented toward the local market (a positive learning effect of international interaction). Export activities, however, are not a linchpin of growth in the company's productivity.

The abovementioned hypotheses serve as a proof of the existence of a two-way link between export activities and innovation and effectiveness [13]. As a result of implementing innovations, stronger, more durable companies start to export (are self-selected in an attempt to expand abroad), which makes them even more competitive and productive through learning by exporting. Some researchers have proven [21] that companies' export orientation still leads to productivity growth even where there is a "self-selection" effect.

4. Research methodology

To answer the questions posed, we used econometric modelling based on data obtained by interviewing, consolidating information on companies from different databases, and carrying out statistical monitoring in order to test the hypotheses. The empirical analysis was based on cross data of Russian industrial companies. The stratified sample is represented by 252 Russian high-tech industry enterprises.

The limitations of the sample are that it is incomplete (the sample can be expanded during a more detailed research in the future) and biased toward companies located in Russia's largest cities because respondent companies were more readily available and had their own capabilities to produce and export high-tech innovations.

The tools used in this work make it possible to interpret exports of products, services, and technologies in terms of whether exports actually exist (export activities are carried out), scale (share of exports or, more precisely, of "foreign sales" in the firm's total sales), structure (technological services, finished products), and destination of exports (CIS and non-CIS countries; accordingly, CIS countries with a market similar to the Russian market and all other countries).

Learning-by-exporting effects were evaluated using information on different indicators of the levels of export activities, companies' efficiency and productivity (with the indicator being financial reporting metrics), and technological, product, organizational, and management innovations, including R&D expenditures. The principal body of data was taken from the Russian statistical database and questionnaires posted on the website of the analytical portal TAdviser (URL: http://www.tadviser.ru/index.php/Компании).

Apart from exports, there are other factors influencing innovational learning processes and development. In particular, "the industry to which an enterprise belongs and its size may affect propensity to innovate and implement new management technologies" [27]. An enterprise's innovation activity may be also associated with the age of the firm and characteristics of its owner (affiliation with a foreign holding company) [17, 20, 28]. A list of dependent variables and regressors is presented in **Table 3**.

If learning spillover effects are present in exports, then what is their nature? Perhaps, these are just some regularities; is the one who enters a foreign market (as a result of self-selection) originally more productive, organized, or more prone to innovation? To empirically evaluate the impact of these effects on productivity,

Model number	Designation of dependent variable	Dependent variables = indicators of companies' innovation behavior
Y_1	RD_cost	Existence of R&D expenditures (takes values 1 or 0 for each period)
Y_2	NewTech	New technology implementation (takes values 1 or 0 for each period)
Y_3	NewProduct	Release of a new product, service (takes values 1 or 0 for each period)
Y_4	Marketing	Existence of marketing innovation expenditures (takes values 1 or 0 for each period)
Y_5	Exp	Increase in the share of foreign sales (takes value 1 in case of an increase in the share of exports or 0 in case of its decrease for each period)
Predictors		
Size		The firm's size (logarithm of the number of employees)
Age		The company's age (1, established before 2003; 2, after 2003)
Foreign		Availability of an international office and/or parent company abroad (1, otherwise 0—a purely Russian company)
Region		1, the company is located in the capital (Moscow, St. Petersburg, Moscow or Leningrad Region); 0, the company is located in a region
Exp_period		Classification of the organization into one of the four groups (1, firms that exported their products in 2015–2017; 2, "new exporters" that did not have exports in 2015, but had exports in 2017; 3, "former exporters" that have left export markets; 4, firms that did not have exports in both periods of observation)
Exp_status		Type of the company's principal sales market: 1—local (market with a certain range of buyers in a part of the city, region, etc.) 2—national (Russia and CIS countries) 3—international

Table 3.
Indicators of dependent variables and predictors

we constructed the following regression model based on an analysis of works that focus on exploring the phenomenon of external knowledge effects and the question regarding their existence as such:

$$\ln y_i^t = b_1 + \sum_{j=1}^{4} b_{j+1} Exp\_period_j + \sum_{j=1}^{3} b_{j+1} Exp\_status_j + b_8 Foreign_{1,0} + b_9 Size_j + \sum_{k=1}^{3} b_{k+9} Age_k + \sum_{l=1}^{2} b_l Sector_l \quad (1)$$

We will use a common probit regression examining the dependencies of the value of the respective indicator in 2017 from its value in 2015, export status, and other characteristics of the organization to assess dummy variables (the variables are presented in

Table 3). To eliminate the endogeneity problems "associated with the different direction of the cause-and-effect relationships between the size indicators and property parameters, the values of these predictors in the model are taken for the previous period" [27].

An attempt to use a linear regression to predict innovation activity of enterprises after entry into a foreign market does not make sense, as the linear form values are on a continuous quantitative scale, while the variable is measured discreetly [44]. Therefore, it is recommended that special regression models be constructed to investigate dependencies between binary variables (innovation indicators) and quantitative data (in our case, regressors).

There are two approaches that allow to construct such models. The first one involves building a linear probability model (using robust standard errors), which will not be used by us, while the second one involves building nonlinear models (logit and probit) [37]. These models capture dependencies between a variable and a data set as well as the probability that the i^{th} value of a binary variable is equal to 1 if a certain condition is met [32].

The probit model differs from the logit model only in that the normal distribution density function is used instead of derivative logistic curve. In the other respects, probit and logit analyses are similar.

Their idea is that the likelihood function is maximized—there is a probability that what is present in our sample will be obtained randomly. In practice this means that we no longer pay attention to the sums of squares of the residuals and are interested in the behavior of the likelihood function.

We performed the required analysis of the collected data for 252 Russian companies, different in terms of affiliation with a variable, to construct a model.

In our sample, 55% of the respondents are located in the capital and in the Moscow Region (128 companies in the two capitals, Moscow and St. Petersburg, and nine companies in the Moscow Region).

	2003	**2017**	**Panel**
Characteristics of the selection of firms in the sector (%)			
High-technology industries	4.6	28.9	25.4
Middle-technology industries	45.7	34.9	44.9
Low-technology industries	49.7	36.2	29.7
Total	100	100	100
Average headcount characteristics of companies (%)			
100–199	5.4	2.7	3.0
200–499	7.9	6.2	7.1
500–999	7.6	13.4	9.7
1000–4999	52.4	47.9	51.7
5000–9999	16.3	15.5	16.1
10,000 and more	10.4	14.3	12.4
Total	100	100	100
Foreign proprietary ownership characteristics of companies (%)			
Share of exporting companies with foreign ownership	34.2	49.8	54.2
Share of non-exporting companies with foreign ownership	7.1	22.4	16.5

Table 4.
Descriptive statistics of inspected firms in the analyzed timeframe of 2003–2017, % of respondents.

Most of the surveyed respondents (31%) worked in companies established before 1999; about 20% of the firms were established during 1999–2003, 2004–2008, or 2009–2013 (about 65% during 1999–2013), and just 5% of the respondents were young novice exporters.

Exporting and non-exporting companies' characteristics are in **Table 4**.

To build probit models, we divided the companies into those established before and after 2003 (54.6 and 45.4%, respectively).

We take 2017 as the "start of exports" for the purpose of dividing new and traditional exporting firms, while "former exporters" are understood to mean all those who left foreign markets in any year within the period under review.

The export status, or the type of the principal sales market for Russian industrial companies (just as the other regressors), is fixed at the 2015 level to eliminate the endogeneity of factors, as the percentage of presence in international markets is higher in 2016–2017 at about 22%.

As regards the distribution of companies by the share of exports in total revenue, the picture in 2017 was as follows: 43% of the firms had a relative share of exports of <0.10, 13% between 0.11 and 0.25, and 22% over 0.75. Thus, about one-fifth of all surveyed firms mainly generated revenue from exports.

5. Research results

Table 5 presents the results of the calculation of the relationship between the innovation behavior indicators and the export status of industrial companies.

The hypotheses put forward by us on the selectivity of enterprises ("self-selection" for foreign markets), the existence of learning-by-exporting effects, and the influence of the duration of exports on the enhancement of learning spillover effects were confirmed (the first hypothesis—partially).

Thus, "new" exporting companies, unlike "permanent" exporters, do not have a visible relationship between implementation of new products, technologies, and the start of exports (the significance of the coefficients was not confirmed, Ƀ < p, and Ha is not rejected, where Ƀ is the level of significance, Ha is the hypothesis on the absence of dependencies, or Ƀ_*i* = 0). The coefficients themselves and the probabilities of the innovation behavior under study being exhibited are much lower than for similar traditional exporters. This can be explained by the fact that R&D investments which might have been initiated after or at the time of entry into foreign markets have not yet yielded results. That said, the status of "traditional" exporters increases the likelihood of investments in advanced research and development by 38%. We believe that this statement is also true vice versa.

For all innovation behavior indicators out of the five indicators considered for a group of traditional exporters, the sign in the models estimating regressor dependencies for a past period (2015) considered by us is positive, and the statistical significance (at the level of 1, 5 and 10%) was proven, indicating that stable export activities serve as an incentive for industrial companies to apply new technological, process, and marketing innovations, which previously were not included in the firm's plans, much more often compared to non-exporting firms.

Our research shows that the impact of external knowledge effects on the productivity of industrial companies depends on the geographical destination of exports: (a) markets in CIS countries plus Russia itself and (b) markets in non-CIS countries. In the case of exports abroad (primarily to West Europe and America), knowledge effects have a significant positive impact on Russian industrial companies, which begin to develop state-of-the-art technologies and increase R&D and marketing expenditures to boost sales of products and services and increase the

	$Y_{1\,(R\&D)}$	$Y_{2(New\_Tech)}$	$Y_{3(New\_Prod)}$	$Y_{4(Exp)}$	$Y_{5(Marketing)}$
Const	0.416 (1106)	0.392 (0.209)	0.254 (0.022)	0.169 (0.138)	0.675 (0.563)
Previous	0.264 (0.119)	**0.269 (0.147)	*0.105 (0.046)	**0.214 (0.184)	*0.851 (0.771)
Exp_period1	***0.381 (0.305)	**0.182 (0.049)	*0.081 (0.051)	**0.241 (0.231)	*0.085 (0.071)
Exp_period2	*0.361 (0.302)	0.159 (0.123)	0.172 (0.125)	0.012 (0.004)	*−0.113 (0.093)
Exp_period3	0.124 (0.001)	−0.331 (0.210)	−0.319 (0.238)	Dropped	−0.378 (0.267)
Exp_status1	0.016 (0.004)	**−0.302 (0.193)	−0.351 (0.268)	0.016 (0.007)	−0.461 (0.386)
Exp_status2	0.081 (0.017)	−0.041 (0.019)	−0.134 (0.089)	0.029 (0.019)	0.018 (0.009)
Exp_status3	0.256 (0.119)	0.087 (0.052)	Dropped	0.068 (0.033)	0.225 (0.193)
Size	0.252 (0.227)	0.338 (0.211)	*0.226 (0.173)	−0.006 (0.003)	*0.163 (0.134)
Age	−0.206 (0.102)	0.356 (0.245)	Dropped	−0.059 (0.031)	0.118 (0.109)
Region	*0.109 (0.081)	*0.282 (0.169)	0.174 (0.134)	0.057 (0.098)	*0.028 (0.005)
Foreign	0.015 (0.006)	−0.289 (0.192)	0.073 (0.019)	0.134 (0.042)	−0.153 (0.097)
Ind1	*0.561 (0.368)	**0.374 (0.371)	0.269 (0.156)	0.247 (0.237)	*0.239 (0.194)
Ind2	−0.379 (0.302)	0.082 (0.061)	0.014 (0.007)	0.178 (0.160)	0.128 (0.106)
Ind3	Dropped	Dropped	0.005 (0.000)	Dropped	−0.167 (0.143)
Ind4	−0.289 (0.141)	−1.441 (0.046)	−0.018 (0.012)	0.153 (0.127)	0.007 (0.001)
Ind5	0.102 (0.045)	*−0.876 (0.782)	0.008 (0.002)	0.019 (0.025)	0.137 (0.066)
Ind6	Dropped	Dropped	Dropped	Dropped	Dropped
Ind7	−0.488 (0.279)	−0.656 (0.739)	−0.497 (0.362)	−0.041 (0.022)	−0.443 (0.368)
Ind8	−0.081 (0.005)	−0.089 (0.495)	−0.021 (0.007)	0.032 (0.018)	−0.344 (0.289)
Ind9	−0.479 (0.056)	0.121 (0.797)	0.015 (0.004)	0.051 (0.022)	−1.884 (0.974)
Ind10	**0.193 (0.095)	*0.522 (0.524)	0.134 (0.086)	0.177 (0.151)	−0.132 (0.069)
McFadden R-squared	0.221	0.229	0.189	0.271	0.261

Source: constructed by the authors.
Note: Standard errors were calculated from the Hessian.
****Significance at the level of 1%.*
***Significance at the level of 5%.*
**Significance at the level of 10%.*

Table 5.
Results of the regression analysis of seven models measuring the relationship between the innovation behavior indicators and various criteria of the export status of industrial companies.

share of the international market. The dependence of spillover effects and innovation activity, efficiency across the high-tech industry, is quite high. It should be emphasized that learning requires special efforts, the ability to assimilate knowledge, and time, and therefore learning effects do not manifest themselves immediately, and they become visible only with a certain time lag.

According to the performed calculations, investments of industrial companies in R&D, marketing, and release of new products are more characteristic for metropolitan companies (at a significance level of 1%). The relationship between the availability of an international office and introduction of innovations, on the contrary, was not proven. The companies' size (based on the logarithm of the number of employees) only had an impact on the production of new technologies: if a company

Minimum possible value = 1.0 **Values > 10.0 may indicate multicollinearity**	
Age	1.561
Size	1.293
Foreign	1.274
Region	1.149
Exp_period *i*	$6 < x_i < 7$
Exp_status *i*	$1.5 < x_i < 3$
Sector *i*	$1 < x_i < 2.5$

Note: VIF(j) = 1/(1–R(j)^2), where R(j) is the multiple correlation coefficient between variable j and other independent variables. As all values of the coefficients are <10, the models do not exhibit a strong correlation between the explanatory variables.

Table 6.
Analysis of the multicollinearity of indicators.

belongs to medium-sized enterprises (101–250 people) or is larger, the probability of inventing innovations is increased by 22% (at a significance level of 1%).

It can also be concluded that the impact of learning spillover effects of knowledge is manifested in industrial companies as a result of a change in their innovation behavior: the longer a company operates in foreign markets, i.e., the longer the learning process, the flow of knowledge, the more pronounced the transformation of the firm's innovation behavior (changes in business processes, renewal of company staff, increase in the creativity and skills of employees, changes in the business model and other indicators).

The study has shown that the duration and destination of exports significantly influence organizations' innovative activities, but innovations do now always encourage managers of industrial companies to start exporting.

It should be noted that we also attempted to build linear probability models. We considered a large number of variations of factors that could influence innovation behavior. However, the same variables proved to be significant as in the probit model analysis. We also considered variants with logarithms of multiple status variables, the period of exports, and specialization, which changed the situation slightly. The number of correctly predicted cases was about 196–209 (77.6–82.9%). The R-squared in all models fluctuated around 0.20, which is not high enough to confirm the hypotheses put forward by us.

When constructing models, we also tested variables for multicollinearity by the inflation factor method (**Table 6**).

6. Conclusions

The study carried out by us was aimed at exploring the impact of knowledge spillover effects on the innovative activity of industrial companies in Russia. Special attention was paid to which characteristics of a company contributed to knowledge accumulation and stimulated an increase in innovation activity.

The obtained results allow drawing conclusions about the positive impact of knowledge spillover effects stemming from the companies' export activities. "New" exporting companies, unlike "permanent" exporters, do not have visible links between implementation of new products, technologies, and the start of exports. The coefficients themselves and the probabilities of the innovation behavior under

study being exhibited are much lower than for similar traditional exporters. This can be explained by the fact that R&D investments that might have been initiated after or at the time of entry in a foreign market have not yet yielded results. The status of "traditional" exporters increases the probability of investments in advanced research and development by 38%.

We obtained evidence that exporting firms increasingly begin to introduce technological, process and marketing innovations, which previously were not included in the firm's plans, much more frequently compared to non-exporting firms.

It should be emphasized that the impact of external knowledge effects on the productivity of industrial companies depends on the geographical destination of exports: thus, companies exporting to CIS countries operate in the domestic market. Therefore, the effects of learning by exporting to CIS countries are much weaker, whereas for companies exporting to non-CIS countries, learning is much more characteristic. This conclusion is in line with the study [15], which shows that productivity growth is more characteristic for firms operating in industrially developed countries.

Another conclusion is that investments in R&D, marketing, and release of new products are more characteristic for companies located in metropolitan regions (at a significance level of 1%).

It should be noted that we did not find any significant dependence between the availability of an international office and implementation of innovations. This fact is in line with other studies showing that competition conditions are more significant for the firms' innovation behavior than the form of ownership. The companies' size (based on the logarithm of the number of employees) only had an impact on the production of new technologies: if a company belongs to medium-sized enterprises or is larger, the probability of inventing innovations increases by 22% (at the significance level of 1%).

The derived conclusions are generally in line with most of advanced foreign works on the topic in question.

Thus, the impact of learning spillover effects of knowledge is manifested in organizations as a result of a change in their innovation behavior: the longer a company operates in foreign markets, i.e., the longer the learning process, the flow of knowledge, the more pronounced the transformation of the firm's innovation behavior (changes in business processes, increase in the creativity and skills of employees (IT specialists), a change in the business model, and other indicators). Knowledge spillover effects enable companies to ensure payback of investments in exports and innovations on a regular basis solely through the continuous inflow of complementary knowledge and experience from international partners. However, in some cases such openness can increase the risk of loss of independence and the possibility of being taken over.

Our study has a number of limitations. Overcoming these limitations predetermines the direction of its further development. The survey sample was conditioned by the possibility of collecting data; therefore, the model should be tested additionally on a larger sample embracing more Russian regions. Some indicators in the model can be reformulated; new factors, whose analysis would make it possible to increase the model's explanatory power, can be incorporated in the model.

Conflict of interest

There is no conflict of interest.

Author details

Arkady Trachuk* and Natalia Linder
Department of Management, Financial University under the Government of the Russian Federation, Moscow, Russia

*Address all correspondence to: atrachuk@fa.ru

References

[1] Abramovitz M. Catching-up, forging ahead, and falling behind. The Journal of Economic History. 1986;**46**(2):385-406

[2] Trachuk AV. Innovation as a condition of long-term stability of the Russian industry. Strategic Decisions and Risk Management. 2012;**6**:66-71. (in Russ.). DOI: 10.17747/2078-8886-2012-6-66-71

[3] Crespo N, Fontoura MP. Determinant factors of FDI spillovers—What do we really know? World Development. 2007;**35**(3):410-425. DOI: 10.1016/j.worlddev.2006.04.001

[4] Tarasov IV, Popov NA. Industry 4.0: Production factories transformation. Strategic Decisions and Risk Management. 2018;**3**:38-53. (in Russ.). DOI: 10.17747/2078-8886-2018-3-38-53

[5] Lisovsky AL. Optimization business processes for transition to a sustainable development In the conditions of the fourth industrial revolution. Strategic Decisions and Risk Management. 2018;**4**:10-19. (in Russ.). DOI: 10.17747/2078-8886-2018-4-10-19

[6] Aghion P, Leah B, Caroline H, Jerome V. The Causal Impact of Education on Economic Growth: Evidence from U.S. Working paper. 2009

[7] Hausman N. University Innovation, Local Economic Growth, and Entrepreneurship. Harvard University Working Paper. 15 September 2011

[8] Hashiguchi Y, Tanaka K. Agglomeration and firm-level productivity: A Bayesian spatial approach. Papers in Regional Science. 2015;**94**:S95-S114. DOI: 10.1111/pirs.12147

[9] Wei X, Wang H. Research on productivity and spillover effect of high-tech industry in China-empirical analysis based on provincial panel data. Technical Economics and Management Research. 2017;**4**:116-121

[10] Zhang Y, Zhao F. Research on the impact of international technology spillovers and absorptive capacity on independent innovation in high-tech industries. Financial Research. 2017;**43**(3):94-106

[11] Corredoira RA, Rosenkopf L. Should auld acquaintance be forgot? The reverse transfer of knowledge through mobility ties. Strategic Management Journal. 2010;**31**(2): 159-181. DOI: 10.1002/smj.803

[12] Nicoletti G, Scarpetta S. Regulation, productivity and growth: OECD evidence. Economic Policy. 2003;**36**:9-72. DOI: 10.1111/1468-0327.00102

[13] Cerchione R, Esposito E. Using knowledge management systems: A taxonomy of SME strategies. International Journal of Information Management, Part B. 2017;**37**(1):1551-1562. DOI: 10.1016/j.ijinfomgt.2016.10.007

[14] Trachuk AV. Innovations as a condition of long-term stability of the Russian industry. Efficient Anti-crisis Management. 2012;**6**(75):66-71

[15] Griliches Z. The Search for R&D spillovers. Working Paper No 3768 (Reprint No r1758). November. NBER; 1992

[16] Jaffe A. Technological opportunity and spillovers from R&D: Evidence from firms' patents, profits and market value. American Economic Review. 1986;**76**(5):984-1001

[17] Arnold JM, Hussinger K. Export behavior and firm productivity in German manufacturing. A firm-level

analysis. Review of World Economics. 2005;**141**(2):219-243

[18] Singh L. Domestic and international knowledge spillovers in manufacturing industries in South Korea. Economic and Political Weekly. 2004;**34**(5):498-505

[19] Malerba F, Mancusi ML, Montobbio F. Innovation and knowledge spillovers: Evidence from European data. In: Paper presented at the AEA 2004 Annual Meeting, 3-5 January, San Diego, CA. 2004. DOI: 10.1007/s10290-013-0167-0

[20] Kesidou E, Szirmai A. Local knowledge spillovers, innovation and economic performance in developing countries empirical evidence from the Uruguay software cluster, Maastricht (Netherlands). 2007. DOI: 10.1080/09578810802060769

[21] Breschi S, Lissoni F. Knowledge spillovers and local innovation systems. A critical survey. Liuc Papers No 84. Serie Economia Impresa. 2001;**27**:1-30

[22] Keller W. International technology diffusion. Journal of Economic Literature. 2004;**XLII**(Septem ber):752-782

[23] Wagner J. Exports and productivity: A survey of the evidence from firm-level data. The World Economy. 2007;**30**(1):60-82

[24] Romer PM. Growth based on increasing returns due to specialization. The American Economic Review. 1987;**77**(2):56-62

[25] Arrow KJ. The economic implications of learning by doing. Review of Economic Studies. 1962;**29**(3):155-173. DOI: 10.2307/2295952

[26] Jacobs J. The Economy of Cities. London: Jonathan Cape; 1969

[27] Antonelli C, Crespi F, Mongeau Ospina CA, Scellato G. Knowledge composition, Jacobs externalities and innovation performance. European Regions Regional Studies. 2017;**51**(11):1708-1720

[28] Yamada E, Kawakami T. Distribution of industrial growth in Nagoya metropolitan area, Japan: An exploratory analysis using geographical and technological proximities. Regional Studies. 2016;**50**(11):1876-1888. DOI: 10.1080/00343404.2015.1072273

[29] Aarstad J, Kvitastein OA, Jakobsen S-E. Related and unrelated variety as regional drivers of enterprise productivity and innovation: A multilevel study. Research Policy. 2016;**45**(4):844-856. DOI: 10.1016/j. respol.2016.01.013

[30] Narula R, Marin A. FDI spillovers, Absorptive Capacities and Human Capital Development: Evidence from Argentina. MERIT-Infonomics Research Memorandum Series, 2003-2016. Maastricht. 2003

[31] Fariñas JC, Martín-Marcos A. Exporting and economic performance: Firm-level evidence of Spanish manufacturing. The World Economy. 2007;**30**(4):618-646

[32] Damijan J, Polanec S, Prasnikar J. Self-selection, export market heterogeneity and productivity improvements: Firm level evidence from Slovenia. LICOS Discussion Papers. LICOS Centre for Institutions and Economic Performance, Leuven; 2004

[33] Trachuk A, Linder N. Learning-by-exporting effects on innovative performance: Empiric study results. Knowledge Management Research and Practice. 2018;**16**(2):220-234

[34] Wilhelmsson F, Kozlov K. Exports and productivity of Russian firms: In

search of causality. Economic Change. 2007;**40**:361-385

[35] Fallah H, Ibrahim S. Knowledge spillover and innovation in technological clusters. Journal of International Association for Management of Technology (IAMOT). 2004:1-4. Available from: http://www.personal.stevens.edu

[36] Carlino GA. Knowledge spillovers: Cities' role in the new economy. Business Review (Federal Reserve Bank of Philadelphia). 2001;(Q4):17-26

[37] Golikova VV, Gonchar KR, Kuznetsov BV. Empirical evidence of the learning effects of exports. WP1 Preprint. Moscow: National Research Institute (HSE); 2011

[38] Bernard AB, Jensen JB. Exceptional exporter performance: Cause, effect, or both? Journal of International Economics. 1999;**47**(1):1-25

[39] Cassiman B, Golovko E, Martinez-Ros E. Innovation, exports and productivity. International Journal of Industrial Organization. 2010;**28**(4):372-376

[40] Johansson B, Lööf H. Innovation activities explained by firm attributes and location. Economics of Innovation and New Technology. 2008;**17**(6):533-552

[41] Arnold JM, Hussinger K. Export behavior and firm productivity in German manufacturing. A firm-level analysis. Review of World Economics. 2005;**141**(2):219-243

[42] Leahy D, Neary JP. Absorptive capacity, R&D spillovers and public policy. International Journal of Industrial Organization. 2007;**25**(5):1089-1108

[43] Altuzarra A, Bustillo R, Rodríguez C. Understanding export market success: Evidence from manufacturing firms. Open Economies Review. 2016;**27**(1):161-181. DOI: 10.1007/s11079-015-9368-6

[44] Cassiman B, Golovko E. Innovation and internationalization through exports. Journal of International Business Studies. 2011;**42**(1):56-75. DOI: 10.1057/jibs.2010.36

Chapter 2

Knowledge Generation to Foster Innovation in Mexico: How Human Capital Matters

Laura Zapata-Cantú

Abstract

The aim of this chapter is to identify those individual skills and organizational factors (OF) that facilitate knowledge generation in firms operating in Mexico. The innovative capacity of organizations depends on how successful they are in the generation of knowledge and how organizational culture, management support, motivation, and personal skills support this process. To validate this phenomenon, a quantitative explanatory study was designed. Data collection was carried out through a questionnaire applied to 211 collaborators who work for firms located in Mexico. Concerning external knowledge acquisition (EKA), for Mexican and foreign firms, only individual skills such as professional qualification, personal motivation, and opportunity to learn are significant compared to internal knowledge creation (IKC) in which organizational factors such as organizational culture, management style, and commitment to learn are predominant. In addition, for knowledge creation in Mexican firms, individual skills are relevant but not for foreign ones. This result could assume that foreign firms in Mexico create their own knowledge based on headquarters' institutionalized processes.

Keywords: knowledge generation, external knowledge acquisition, internal knowledge creation, innovativeness, organizational factors, human capital skills

1. Introduction

Recently, innovation scholars found that in order to innovate, knowledge from a variety of external sources (e.g., suppliers, customers, universities, competitors, and consultants) must be meticulously embedded in a firm's organization and technical systems for better exploitation [1–3].

Organizations are not just knowledge warehouses; their knowledge base can be generated within a social framework, inside and outside organizations' boundaries, improving their existing processes and products and/or services. To generate new knowledge, organizations undertake specific activities and initiatives which involve external acquisitions of knowledge, and the company interacts with other organizations [4–6] and internally creates this intangible resource through the dynamic interaction between individuals and/or between individuals and their environment. In both cases, their success is highly dependent upon the organization's culture and management style.

Knowledge generation is mainly an institutionalized activity, so each organization must be able to establish its own creative routines and human interventions to make this process possible and to be a learning-oriented institution where having a shared vision and a commitment to learning and open-mindedness are key drivers [7]. The challenge is to build systems that collect the learning processes acquired during projects and ongoing activities, capture that knowledge in a database or document, and spread it throughout the entire organization [8, 9]; and that will be useful for innovation strategies. In this sense, there are many studies discussing how knowledge generation is positively related to innovation and performance [10–12]; but the impact of individual skills and organizational factors to generate knowledge is still unexplored [7, 13].

The present research was conducted in Mexico, where innovation capability could accelerate the country's productivity and economic growth to as much as 4% per year over the next 10 years [14]. According to the Global Competitiveness Index in which Mexico is ranked 51 out of 137 countries [15], even when Mexico presented some progress, it has a relatively slower rate than other countries. In this context, our study suggests that the challenge for Mexican firms is that for a dynamic economy where organizations can take full advantage of opportunities to grow and compete more effectively, it requires the foundation of a strong business environment [16] and organizational leverages where knowledge generation could be a pillar to grow and survive rather than to keep competing on a lower cost basis.

The aim of the chapter is to identify the individual skills and organizational factors that support external and internal knowledge generation and show to what extent and in what way these factors differ from those in Mexican and foreign firms with operations in Mexico. This research analyzes a database generated through a survey of knowledge generation activities and how its innovation capability impacts firms operating in Mexico. This chapter is structured as follows: Section 2 exposes the development of a conceptual framework related to knowledge generation, both external acquisition and internal creation, and how this process is supported by individual skills and organizational factors, Section 3 presents the methods used to conduct the empirical study, Section 4 discusses the results, and Section 5 finalizes the research with conclusions and limitations and describes further lines of research.

2. Conceptual background and hypotheses

All successful organizations create and use knowledge as a fundamental tool for interacting with their environments, absorbing information, making informed decisions, and carrying out actions based on the combination of this knowledge and organizational experiences, values, and rules [1, 12, 17]. All of these are activities that make up the knowledge generation process in organizations [18]. The present study posits that knowledge generation requires individual skills and organizational factors that enable external acquisition and internal creation of knowledge.

2.1 External knowledge acquisition

Often, organizations do not have all necessary resources, so they have to acquire beyond organizational limits [19]. Thus, acquiring external resources plays a critical role in determining the performance implications of knowledge creation capabilities [20]. Engaging with market-based partners such as customers and suppliers can help to better specify the market requirement for innovative goods, services, or processes and to spread the costs and risks of the innovative capability [21].

Acquisition of external knowledge implies that an organization interacts with other organizations such as suppliers and customers [4, 6], has strategic alliances, and prefers that its collaborators attend courses and seminars [5]. When companies internalize knowledge gained through external sources, the incorporation or internalization of these individual learnings is necessary to strengthen absorptive capacity of the knowledge base at the organizational level. In contrast, the acquisition of external knowledge can deprive the organization of the opportunity to learn and build its own knowledge. When an organization chooses this option, it is because it does not have the dynamic capabilities for rapid creation, either because such knowledge is often highly tacit or because the creative process takes time and has a high opportunity cost. This opportunity cost is especially high when the company operates in an environment of rapid change [18].

Although individuals may have differing cognitive abilities and processing speeds, the outcome of any individual learning for the organization is dependent on the organizational context where the learning occurs [22]. Another value is open-mindedness to assimilate new knowledge and to adapt to new ways to do things. In that sense, knowledge generation is highly dependent upon the organization's culture and management style. In fact, a culture that promotes intensive communication, accepts new ideas, and is prepared to explore new processes and activities favors the generation of knowledge [23].

Hypothesis 1: Organizational factors such as organizational culture, management style, commitment to learn, and open-mindedness have a positive impact on external knowledge acquisition.

The literature also shows that employees are qualified to handle technical requirements needed to process and integrate new knowledge [7]. They are able to align and combine market knowledge and customers' needs to the organization's strategic goals. Additionally, to develop professional skills, the collaborators' capability to combine external knowledge into internal process is supported by their ability to understand, interact, and recognize other people's abilities and needs [24]. Moreover, their opinions and suggestions are taken into account, which facilitates new knowledge generation.

Hypothesis 2: Individual skills such as professional skills, personal skills, personal motivation, and opportunity to learn have a positive influence on external knowledge acquisition.

2.2 Internal knowledge creation

Companies as social organizations are specialized in creating and transforming knowledge [25], based on the assumption that knowledge cannot exist without human subjectivities and the context that surrounds humans [19]. The creation of internal knowledge is understood as a process that increases knowledge in organizations created by specific individuals and as part of the knowledge network of the company [18]. Knowledge is created through the dynamic interaction between individuals and/or between individuals and their environment, rather than an individual working alone [23]. That is, an organization cannot create knowledge without individuals who generate it, while the business must provide the right environment for individuals to create knowledge [6]. The knowledge created within the organization is especially valuable because it tends to be unique, specifically with a large tacit component. This is what makes it more difficult to be imitated by competitors, which is a strategic advantage for the organization.

Organizational culture is the most significant element that supports knowledge generation: employees are motivated to improve or find new ways of doing their activities. In contrast, management style, personal motivation, and opportunity to

learn are the organizational elements that support this process for manufacturing firms. In these types of organizations, the top management team is aware of how knowledge generation is relevant, providing time and space to seek new ways of doing things and to increase employees' knowledge through learning in action. A learning-oriented culture, along with other factors, promotes receptivity to new ideas and innovation as part of an organization's culture [26].

In terms of knowledge exchange, the interaction among organizational members facilitates dissemination of explicit and tacit knowledge. When the frequency of knowledge exchange within an organization is high, the organizational members have more opportunities to access and acquire knowledge that is different from their own. This will trigger more novel ideas [25]. Moreover, knowledge exchange, as has been discussed, can induce organizational members to combine their existing knowledge with acquired knowledge or recombine their existing knowledge in better ways. For instance, the results of an exploratory study in Mexican firms show that the internal creation of knowledge occurs primarily in meetings that occur within the organization followed by employee self-directed learning [27]. Based on these arguments, Hypothesis 3 is proposed:

Hypothesis 3: Organizational factors such as organizational culture, management style, commitment to learn, and open-mindedness positively impact internal knowledge creation.

To recognize and evaluate the organization's relevant and new knowledge, employees need to hold some prior knowledge base [24]. This expertise and know-how enables employees to recognize the value of new knowledge, and it is helpful to communicate and be cooperative in sharing new knowledge [7]. Social interaction develops the ability for people to exchange and acquire knowledge that is tacit in nature. In the notion of exchange, the assumption that individuals hold different levels and types of knowledge and will engage in teamwork and communication to learn from one another seems to be implicit [28].

Moreover, the dynamic environment in which organizations work currently provides motivation for employees to create new knowledge and the opportunity to learn. Employees feel they can learn from the work they perform and the experience gained in applying their knowledge. The literature shows that employee motivation is essential to create new knowledge and the opportunity to learn about issues of interest motivates employees to seek new ways of doing things, leading to innovation [28]. In addition to that, professional qualifications allow exploration and exploitation of new ways of doing things, and social skills promote cooperation and social interaction among employees, influencing the knowledge creation process inside the firm. This leads to the final hypothesis.

Hypothesis 4: Individual skills such as professional skills, social skills, personal motivation, and the opportunity to learn have a positive influence on internal knowledge creation.

3. Methods

3.1 Sample profile and data collection

The data to identify the relationships between variables was obtained through a questionnaire designed in Qualtrics, a software which allows participants to answer the questionnaire online. The sample comprised 211 collaborators from Mexican and foreign firms operating in Mexico. **Table 1** presents the profile of the respondents. An e-mail was sent to invite organizations to participate in the study, and only 35 firms agreed to participate from May to August 2017.

Demographic characteristics	**(%)**
Firm	
Nationality	
Foreign	42
Mexican	58
Sector	
Manufacturing	49.1
Service	51.9
Size	
Small (0–49 employees)	15.0
Medium (50–249 employees)	11.1
Large (>249 employees)	73.9
Participants	
Position	
General manager	21.4
Department director	49.8
Project leader	28.8

Table 1.
Profile of the respondents.

Collecting potentially different opinions of various members of each firm concerning the phenomenon under study was especially interesting because individual skills are key variables. In each company, the distribution of questionnaires was carried out to employees at multiple hierarchical levels and functional departments. Knowledge generation is not exclusive to a specific organizational level or department; the occurrence of a key informant bias should be avoided by using a multiple informant approach. The questionnaire was designed in Qualtrics to facilitate its completion. An e-mail was sent to those collaborators who were interested in participating. The final sample includes 211 collaborators, implying between 6 and 7 questionnaires per firm. **Table 1** lists the respondent and company characteristics, including firm size, sector, and collaborator's position.

A total of 58% of participant firms are Mexican, and 42% are foreign firms operating in Mexico. 49.1% of the participant firms operate in the manufacturing sector, and 51.9% are service firms. Fifteen percent of the firms are small, 11.1% are medium sized, and 73.9% are large. Respondents are mostly in leadership positions or at the top level in their companies (71.2%).

3.2 Measures

For the present study, a questionnaire was designed making use of constructs identified in previous studies related to knowledge generation: external acquisition and internal creation, organizational factors, and individual skills [29]. These constructs were operationalized with different dimensions adapted from those studies and modified for use in the present research. All constructs and dimensions were measured using multiple items and a five-point, Likert scale (ranging from 1 = strongly disagree to 5 = strongly agree). **Table 2** shows a list that includes each construct together with its related dimension and items as well as the studies from which the constructs were derived.

Construct	Dimension/variables	Indicators/items
External knowledge acquisition [23]	External knowledge acquisition activities	KG1—Customer experience is important for the improvement of our activities KG2—It has collaborative agreements with other companies to offer better services to our customers KG3—Information systems are often acquired to support the activities and business processes KG4—Attendance at refresher courses is encouraged among employees
Internal knowledge creation [23]	Internal knowledge creation activities	KG5—It has a library and/or literature to support the development and execution of priority activities KG6—Our organization encourages employee self-directed learning KG7—Attendance at refresher courses is encouraged among employees KG8—Meetings are held to solve problems or to seek solutions or improvements to an ongoing activity or process
Knowledge generation organizational factors [7, 23]	Organizational culture	OR1—The work environment makes it easy to approach the senior management as well as the rest of the members of the company OR2—The senior management can be easily approached to give them points of view on an activity and/or process OR3—An atmosphere of frankness and trust prevails in the organization.
	Management style	MS1—Awareness of the relevance of knowledge generation MS2—Facilitation of knowledge generation by holding meetings that foment the creation of new ways of doing things MS3—Encouragement of the development of employees' initiative and creativity
	Commitment to learning	CL1—Managers basically agree that our organization's ability to learn is the key to our competitive advantage CL2—The basic values include learning as key to improvement CL3—The sense around here is that employee learning is an investment, not an expense CL4—Learning is seen as a key commodity necessary to guarantee organizational survival
	Open-mindedness	OM1—We are not afraid to reflect critically on the shared assumptions we have made about the way we do business OM2—We place a high value on open-mindedness OM3—Managers encourage employees to think "outside of the box" OM4—Original ideas are highly valued

Construct	Dimension/variables	Indicators/items
Knowledge generation individual skills [7, 23]	Professional skills	Collaborators: PS1—Possess excellent market knowledge PS2—Possess excellent company knowledge (e.g., product range) PS3—Possess excellent knowledge about our strategic goals (e.g., business objectives) PS4—Possess excellent skills in analyzing information gained from single customers with regard to its utility for our company PS5—Possess excellent skills in evaluating information gained from single customers with regard to its utility for our company PS6—Possess excellent skills in preparing and documenting information gained from single customers with regard to future purpose
	Social skills	SS1—Is fully able to put themselves in the position of other people SS2—Is fully able to understand the behavior of other people SS3—Is easily able to recognize and understand the demands and needs of other people SS4—Is able to recognize conflicts on time
	Personal motivation	PM1—Employees' opinions or suggestions are taken into account PM2—The activities carried out in the company allow employees to seek new ways of doing things PM3—Employees like what they do
	Learning opportunity	LO1—The activities carried out within the company provide an opportunity for increasing employees' knowledge LO2—The activities carried out within the company allow employees to learn how to use new tools LO3—The activities carried out within the company allow employees to learn new ways of doing things

Table 2.
Constructs and items.

4. Results and discussion

To test the hypotheses, partial least squares (PLS) analysis using the SmartPLS 3.0 was performed [30, 31]. The PLS is suitable for early-stage research model construction allowing the interaction between the theory and the empirical data and the small sample condition [32]. In addition, it allows us to test the causal relationships between constructs that feature multiple measurement items [32]. The authors will build a two-stage model to test the measurement model to perform construct, discriminant, and convergent validity and confirm the structural model to test the hypotheses through the significance of the path coefficients.

4.1 Analysis of the measurement model

The measurement model was assessed using a bootstrapping procedure to minimize the standard errors. **Table 3** shows the results of construct reliability based on Cronbach's alpha, and the discriminant and convergent validity to measure average variance was extracted. The reliability of the scale is acceptable because the composite reliability coefficient exceeds 0.7 [33]. In terms of the average variance extracted, all constructs exceed the suggested value of 0.5 [34], indicating that the measure has adequate convergent validity. When the respective average variance extracted is larger than the squared correlation between two constructs, discriminate validity is demonstrated.

4.2 Structural model

The first step was to obtain the goodness of fit of the model hypothesized in **Figure 1**. The normed fit index (NFI: Mexican = 0.874; foreign = 0.876) and the root mean of the index's squared residual (RMSR: Mexican = 0.070; RMSR foreign = 0.62) are within acceptable ranges and correspond to a satisfactory adjustment [35]. This implies a substantial amount of variance in the model [34] and a fit to the model. The second step was to examine the significance of each hypothesized path.

We draw on the significance of the variable's relationship, a t-value higher than 1.96 and a p-value lower than 0.05 and on the effect size (F^2) of a predictable variable on a dependent variable; values of 0.15 can be viewed as a medium effect and 0.02 as a small effect. All hypotheses are significant except Hypothesis 1. **Table 4** shows the results of the measurement model analysis and the hypothesis evaluation, and **Figure 1** illustrates the results of parameter estimation and the structural model.

Regarding Hypothesis 1, this study evaluated the effects of organizational factors on external knowledge acquisition activities, but there is no evidence to support this for both Mexican and foreign firms. This result suggests that organizations have to promote activities or even institutionalize practices in order to generate knowledge from external sources, which favors the opportunity to learn and differentiate themselves. It is also possible that organizations under study do not have dynamic capabilities such as absorptive capacity to respond quickly to their environment with their own knowledge [6].

Variable		Reliability Cronbach's alpha	Average variance extracted	Discriminant dimension	Validity correlation
External knowledge acquisition	Mexican	0.733	0.735	HC-EKA	0.638
	Foreign	0.709		HC-EKA	0.695
Internal knowledge creation	Mexican	0.755	0.750	OF-IKC	0.672
	Foreign	0.745		OF-IKC	0.798
Organizational factors	Mexican	0.887	0.749	OF-EKA	0.638
	Foreign	0.878	0.731	OF-EKA	0.653
Human capital (IS)	Mexican	0.848	0.687	HC-IKC	0.683
	Foreign	0.860	0.746	HC-IKC	0.740

Table 3.
Results of reliability and validity.

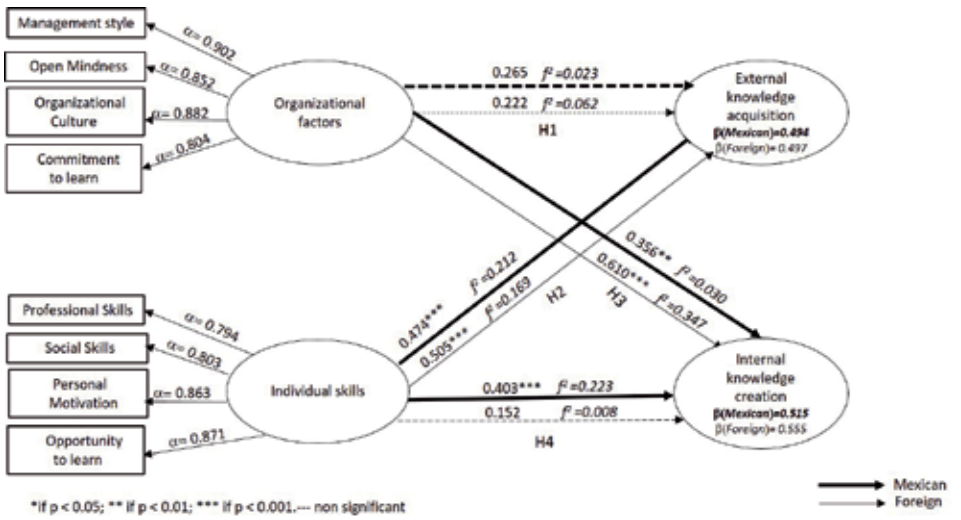


Figure 1.
Results of PLS estimation.

	Mexican				Foreign				
Variable/ path	**Parameter estimate**	**t-value**	**p-value**	**F^2**	**Parameter estimate**	**t-value**	**p-value**	**F^2**	**Hypothesis**
H1: Org. factors—external knowledge	0.265	1.699	0.089	0.053	0.222	1.513	0.130	0.027	Rejected
H2: Ind. skills—external knowledge	0.474	3.317	0.001	0.171	0.506	3.364	0.000	0.141	Supported
H3: Org. factors—internal knowledge	0.356	3.097	0.002	0.100	0.610	4.009	0.000	0.231	Supported
H4: Ind. skills—internal knowledge	0.403	3.628	0.000	0.129	0.152	0.924	0.359	0.014	Partially supported

Table 4.
Results of measurement model.

Hypothesis 2 confirmed, for both Mexican (B = 0.474) and foreign (B = 0.506) firms, to a slight extent that individual skills have positive causal relationship when external knowledge acquisition is a latent variable. Organizations operating in Mexico acquire external knowledge by individuals not by organizational factors per se. Activities such as being aware and informed of customer experience and needs, collaborative agreements with suppliers or other companies, and attendance of courses or seminars give Mexican firms the opportunity to generate knowledge [23], through collaborators' skills. This result also addressed on individuals' learning outcomes is promoted by the organizational context [22]. This suggests that what collaborators are able to do is significant because of the organizational support

they have. Individuals not only know what to do but also know how and when to apply that knowledge to achieve organizational goals. Specific attention is required for collaborators in order to generate knowledge externally because they build the blocks of all knowledge-based organizational and social development [36].

Regarding Hypothesis 3, results show that internal knowledge creation is explained by organizational factors for both Mexican firms (B = 0.356) and foreign firms (B = 0.610), having a higher impact in foreign firms operating in Mexico. For internal knowledge creation activities, organizational factors predominate over individual skills. This is similar to that "an organization cannot create knowledge without individuals who generate it, while the business must provide the right environment for individuals to create knowledge" [25]. The relevant point here is how management style and organizational culture promote thinking differently and facilitate and encourage learning new things and thinking "out of the box" [7].

Hypothesis 4 is partially supported by a coefficient of 0.403 for Mexican firms compared to foreign firms, without a significant coefficient. This points out that Mexican firms create knowledge inside the organization supported by organization factors as well as individual skills compared to foreign firms in Mexico which create knowledge only by organizational factors. It could be addressed to Mexican firms to support their knowledge generation on collaborators skills. Collaborators could be motivated to learn by themselves because they have the opportunity to do so, but that is not enough to create new knowledge that results in organizational innovation. Our research also addressed the aspect of firms' need to empower their people to create and support the development of their knowledge generation competence [7].

5. Conclusions

In this study, the authors built and validated a model that identified which organizational factors and individual skills influence knowledge generation, external acquisition, and internal creation of knowledge. Given the reality that today's economy is largely knowledge-based, there is a substantial need for companies to favor the generation of knowledge. The knowledge generated within the organization is especially valuable because it tends to be unique and specific and have a large tacit component. This is what makes it more difficult to be imitated by competitors, which is a strategic advantage for the company.

Organizations must be able to identify both external and internal knowledge generation activities. The challenge is to build systems that collect the new knowledge acquired during projects and ongoing activities with external partners and, once that value is created inside organization, to capture that knowledge in a database or document and then to spread it throughout the entire organization to be useful for innovation strategies.

Regarding managerial implications, managers have to be able to identify what particular external and internal activities support the knowledge generation process in their organization and what organizational elements and individual skills are crucial. For strategy and growth purposes, organizations are not necessarily locked into internally controlled skills and resources but may draw upon external knowledge (e.g., customers) as sources of new ideas and problem-solving capabilities and for flexibility in the assimilation of new skills and resources [37]. The present study results suggest that a learning-oriented organization is key to generate knowledge to foster innovation. The results also imply that more relevant than the identification of external and internal activities to generate knowledge is the need to develop strategic initiatives that systematically promote this process, with a highly involvement of collaborators.

Meetings to solve problems and seek solutions or improvements on an ongoing activity or process, attendance at courses or seminars, and the development of appropriate literature to support the development and execution of priority tasks are activities that allow to the generation of knowledge inside firms. This is possible when organizations believe in learning processes and invest in them.

Regarding public policy implications, the results point out the shortcomings of the educational system will take many years. The average Mexican formal education has only 9 years and few opportunities to get on-the-job training in globally competitive businesses. However, in the short term, Mexico can focus on developing professional skills by upgrading their vocational education, aligning the curricula with employer needs, developing more employer-sponsored training programs, creating rapid training courses, and improving the labor-market matching mechanisms.

Organizations have to include both knowledge generation processes, internal creation and external acquisition, in their strategic planning initiatives. It is new knowledge combined with existent knowledge that will make it possible for organizations to survive in dynamic and uncertain environments.

The main limitations of the study are that only Mexican firms have been analyzed and it is not possible to generalize the results to other contexts. Additionally, we have not identified whether organizations participating in the study are Mexican-born or global enterprises operating in Mexico. It could be significant to analyze whether multinationals from other countries operating in Mexico are more committed to learning to innovate than Mexican-born firms and how different their knowledge generation activities are.

Future research efforts should also address the way in which generation of knowledge in organizations operating in dynamic environments provides a competitive advantage. We believe that the analysis of our model in other settings may raise the identification of other determinants that facilitate the generation of knowledge and contribute to the achievement of a competitive advantage under the study environment itself.

Author details

Laura Zapata-Cantú
EGADE Business School, Tecnológico de Monterrey, San Pedro Garza García, Mexico

*Address all correspondence to: laura.zapata@tec.mx

References

[1] Un CA, Asakawa K. Types of R&D collaborations and process innovation: The benefit of collaborating upstream in the knowledge chain. Journal of Product Innovation Management. 2015;**32**(1):138-153. DOI: 10.1111/jpim.12229

[2] Trantopoulos K, von Krogh G, Wallin MW, Woerter M. External knowledge and information technology: Implications for process innovation performance. MIS Quarterly. 2017;**41**(1):287-300. DOI: 10.25300/misq/2017/41.1.15

[3] Segarra-Ciprés M, Bou-Llusar JC. External knowledge search for innovation: The role of firms' innovation strategy and industry context. Journal of Knowledge Management. 2018;**22**(2):280-298. DOI: 10.1108/jkm-03-2017-0090

[4] Nonaka I. A dynamic theory of organizational knowledge creation. Organization Science. 1994;**5**(1):14-37. DOI: 10.1287/orsc.5.1.14

[5] Inkpen A. Creating knowledge through collaboration. California Management Review. 1996;**39**(1): 123-140. DOI: 10.2307/41165879

[6] Nonaka I, Toyama R, Nagata A. A firm as a knowledge-creating entity: A new perspective on the theory of the firm. Industrial and Corporate Change. 2000;**9**(1):1-20. DOI: 10.1093/icc/9.1.1

[7] Griese I, Pick D, Kleinaltenkamp M. Antecedents of knowledge generation competence and its impact on innovativeness. Journal of Business and Industrial Marketing. 2012;**27**(6):468-485. DOI: 10.1108/08858621211251479

[8] Argote L, Spektor EM. Organizational learning research: Past, present and future. Management Learning. 2011;**42**(4):439-446. DOI: 10.1177/1350507611408217

[9] Grant RM. Shifts in the world economy: The drivers of knowledge management. In: Despres C, Chauvel D, editors. Knowledge Horizons: The Present and the Promise of Knowledge Management. Boston, MA: Butterworth-Heinemann; 2000. pp. 27-53. DOI: 10.1016/b978-0-7506-7247-4.50005-7

[10] Soo C, Devinney T, Midgley D, Deering A. Knowledge management: Philosophy, process and pitfalls. California Management Review. 2002;**44**(4):129-150. DOI: 10.2307/41166146

[11] Lee H, Choi B. Knowledge management enablers, processes, and organizational performance: An integrative view and empirical examination. Journal of Management Information Systems. 2003;**20**(1):179-228. DOI: 10.1080/07421222.2003.11045756

[12] Zelaya-Zamora J, Senoo D. Synthesizing seeming incompatibilities to foster knowledge creation and innovation. Journal of Knowledge Management. 2013;**17**(1):106-122. DOI: 10.1108/r13673271311300822

[13] Forés B, Camisón C. Does incremental and radical innovation performance depend on different types of knowledge accumulation capabilities and organizational size? Journal of Business Research. 2016;**69**(2):831-848. DOI: 10.1016/j.jbusres.2015.07.006

[14] Deloitte. Competitiveness: Catching the Next Wave Mexico. London, United Kingdom: Deloitte Touche Tohmatsu Limited; 2015. Available from: https://www2.deloitte.com/global/en/

pages/about-deloitte/articles/mexico-competitiveness-report.html [Accessed: March 11, 2019]

[15] Schwab K. The Global Competitiveness Report 2017-2018. World Economic Forum. 2017. Available from: https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018 [Accessed: March 11, 2019]

[16] McKinsey. A Tale of Two Mexicos: Growth and Prosperity in a Two-Speed Economy. New York: The McKinsey Global Institute; 2014. Available from: https://www.mckinsey.com/featured-insights/americas/a-tale-of-two-mexicos [Accessed: March 11, 2019]

[17] Teece DJ, Pisano G, Shuen A. Dynamic capabilities and strategic management. Strategic Management Journal. 1997;**18**(7):509-533. DOI: 10.1002/(sici)1097-0266(199708)18:7<509::aid-smj882>3.0.co;2-z

[18] Nonaka I, Toyama R. The theory for the knowledge-creating firm: Subjectivity, objectivity and synthesis. Industrial and Corporate Change. 2005;**14**(3):419-436. DOI: 10.1093/icc/dth058

[19] Pisano G. Profiting from innovation and the intellectual property revolution. Research Policy. 2006;**35**(8):1122-1130. DOI: 10.1016/j.respol.2006.09.008

[20] Su Z, Peng MW, Xie E. A strategy tripod perspective on knowledge creation capability. British Journal of Management. 2016;**27**(1):58-76. DOI: 10.1111/1467-8551.12097

[21] Mina A, Bascavusoglu-Moreau E, Hughes A. Open service innovation and the firm's search for external knowledge. Research Policy. 2014;**43**(5):853-866. DOI: 10.1016/j.respol.2013.07.004

[22] Sun PYT, Anderson MH. An examination of the relationship between absorptive capacity and organizational learning, and a proposed integration. International Journal of Management Reviews. 2010;**12**(2):130-150. DOI: 10.1111/j.1468-2370.2008.00256.x

[23] Zapata L, Rialp J, Rialp A. Generation and transfer of knowledge in IT-related SMEs. Journal of Knowledge Management. 2009;**13**(5):243-256. DOI: 10.1108/13673270910988088

[24] Cohen WM, Levinthal DA. Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly. 1990;**35**(1):128-152. DOI: 10.2307/2393553

[25] Nonaka I, Takeuchi N. The Knowledge Creating Company. New York, NY: Oxford University Press; 1995. DOI: 10.5465/ame.1995.9509210310

[26] Mahmoud MA, Blankson C, Owusu-Frimpong N, Nwankwo S, Trang TP. Market orientation, learning orientation and business performance: The mediating role of innovation. The International Journal of Bank Marketing. 2016;**34**(5). DOI: 10.1108/ijbm-04-2015-0057

[27] Zapata L, Pineda JL. Customer as external source of knowledge to foster innovation. In: Kaufmann H, editor. Handbook of Research on Managing and Influencing Consumer Behavior. Hershey, PA: IGI Global; 2015. pp. 552-563. DOI: 10.4018/978-1-4666-6547-7.ch024

[28] Crossan MM, Lane HW, White RE. An organizational learning framework: From intuition to institution. Academy of Management Review. 1999;**24**(3):522-537. DOI: 10.5465/amr.1999.2202135

[29] Zeller RA, Carmines EG. Measurement in the Social Sciences: The Link Between Theory and Data. London, United Kingdom: Cambridge University Press; 1980. DOI: 10.1017/s0003055400191506

[30] Simonin BL. Ambiguity and the process of knowledge transfer in strategic alliances. Strategic Management Journal. 1999;**20**(7):595-623. DOI: 10.1002/(sici)1097-0266(199907)20:7<595::aid-smj47>3.3.co;2-x

[31] Yli-Renko H, Autio E, Sapienza HJ. Social capital, knowledge acquisition, and technology-based firms. Strategic Management Journal. 2001;**22**:587-613. DOI: 10.1002/smj.183

[32] Chin WW, Marcolin BL, Newsted PR. A partial least squares latent variable modeling approach for measuring interaction effects: Results from a Monte Carlo simulation study and an electronic-mail emotion/adoption study. Information Systems Research. 2003;**14**(2):189-217. DOI: 10.1287/isre.14.2.189.16018

[33] Peterson RA. A meta-analysis of Cronbach's coefficient alpha. Journal of Consumer Research. 1994;**21**(2): 381-391. DOI: 10.1086/209405

[34] Bagozzi RP, Yi Y. On the evaluation of structural equation models. Journal of the Academy of Marketing Science. 1988;**16**(1):74-94. DOI: 10.1177/009207038801600107

[35] Tabachnick BG, Fidell LS. Using Multivariate Analysis. 3rd ed. New York: Harper Collins College Publishers; 1996. DOI: 10.1177/014662168400800113

[36] Shujahat M, Sousa MJ, Hussain S, Nawaz F, Wang M, Umer M. Translating the impact of knowledge management processes into knowledge-based innovation: The neglected and mediating role of knowledge-worker productivity. Journal of Business Research. 2019;**94**:442-450. DOI: 10.1016/j.jbusres.2017.11.001

[37] Zander I, Zander U. The inside track: On the important (But neglected) role of customers in the resource-based view of strategy and firm growth. Journal of Management Studies. 2005;**42**(8):1519-1548. DOI: 10.1111/j.1467-6486.2005.00555.x

Chapter 3

Toward Management Based on Knowledge

Michel Grundstein

Abstract

In a world overwhelmed with pervasive digital technologies, the organization is transformed and becomes a socio-technical system which is constantly renewed. Organization needs specific skills, adapted to the values and to the cultures peculiar to each location. The cooperation and the mobility become a shape of inescapable work which rests on a permanent personal and collective learning. Beyond the information handled in the digital information systems, the role of the tacit knowledge, which is in each individual's head, cannot be ignored. A constructivist attitude replaces a determinist attitude strongly deep-rooted in our educational modes. The managers have to pass from a posture of authority and of control to a posture of incitation, of support, and of accompaniment. The notions that are introduced in this chapter result from a managerial and socio-technical vision of knowledge management. They arouse essential reflections to develop a mode of management adapted to the digital transformation of the organizations called management based on knowledge.

Keywords: management based on knowledge (MBK), cognitivist perspective, constructivist perspective, knowledge management (KM)

1. Introduction

In a world disrupted by the omnipresence of digital technologies,[1] the hierarchical organization closed on its local borders has evolved into an extended, borderless, open, and adaptive organization under the control of an unpredictable environment that creates uncertainty and doubt. Organization encounters fundamental problems of information exchange and knowledge sharing between: on the one hand, its formal entities spread throughout the world (functions, business units, projects), and, on the other hand, her members carry values and cultures diversified according to their local sites. Regardless of their roles and hierarchical positions, actors are faced with new situations that increase their scope for initiatives and responsibilities, and they become decision-makers.

This chapter presents basic concepts derived from our industrial experience and our university research. These concepts constitute the roots of our vision of managerial and socio-technical approach of knowledge management (KM) that we transpose to the concept of "management based on knowledge (MBK)," described

[1] The term "digital," used in this chapter, refers to digital information systems characterized by the contributions of Web 2.0, reinforced in particular by Big Data, analytics, machine learning and deep learning technologies, and physical tools such as smartphones and tablets, equipped with SIM cards giving access to 4D, which have become essential prostheses for the human being in his personal and professional life.

in this chapter. That supplies a set of elements which raise awareness of crucial problems linked to the digital transformation of the organizations and transcend traditional solutions.

In Section 2, the chapter describes the background theories and assumptions. We introduce a reflection on knowledge within organization considered from two perspectives: a cognitivist perspective and a constructivist perspective. We state three interlinked fundamental postulates that constitute the basis of our approach of knowledge management; we present our vision of KM that we call "managerial and socio-technical" approach to KM. In Section 3, the chapter provides a discussion about KM, and we identify two main approaches underlying KM: a technological approach and a managerial and sociological approach. Then, in Section 4, the chapter introduces the socio-technical approach to the organization and the concept of organization's information and knowledge system (OIKS/SICO). Finally, in Section 5, the chapter presents the management based on knowledge with regard to the problem of capitalization on knowledge within organizations. This vision is a transposition of our approach to knowledge management.

2. Background theories and assumptions

2.1 Research motivations, method, and objectives

In this chapter, the basic concepts presented are derived from our industrial experience and university researches. As an operational manager responsible for the deployment of innovative technologies (including computer-aided design and knowledge-based systems) in a large industrial company—at a time when these technologies had just been developed in universities and laboratories—we developed empirical models with a socio-technical vision of organizations. These models have been used as references to generate the organizational learning process that induced organizational members to appropriate and use these technologies.

Later on, we became associate researcher in the domain of knowledge management, and we highlighted the lack of KM models with a socio-technical perspective. As the project's manager, we practiced a constructivist approach underlying the creation and use of knowledge. The interactions of these dual trajectories are at the root of a useful reflection on the establishment of the concept of "management based on knowledge," transposed from our "managerial and socio-technical" approach of knowledge management.

In addition, this reflection is based on (1) few books posing the fundamentals of knowledge management [1–9], (2) the work of the European Committee for Standardization (CEN) KM working group [10], and (3) the thesis conducted at LAMSADE[2] [11–16].

We wish that this chapter should be useful for all stakeholders of the digital transformation processes within organizations.

2.2 Knowledge within organizations considered from two perspectives

Our research has led us to identify two major approaches to knowledge management in organizations: a technological approach and a managerial and sociological approach. These approaches are significant for the fundamental conceptual distinction of two world visions: the cognitive perspective and the constructivist

[2] Laboratoire d'Analyze et Modélisation de Systèmes pour l'Aide à la Décision, Université Paris-Dauphine, PSL Research University, CNRS UMR (7243), LAMSADE 75016, Paris, France.

perspective, highlighted by [4]. Thereafter, we agree with their analysis and paraphrase, in large part, what they say, which describes two ways of approaching the concept of knowledge in organizations.

2.2.1 Cognitivist perspective (representationism)

The cognitive perspective is the best established and best known. It began in the early 1950s with considerable advances in computer science, systems theory, psychology, and neuroscience. The cognitive sciences provided important insights into the physical structure of the brain and the functioning of cognitive processes. Formal models of the cognitive system as an information processing machine and logical reasoning were developed. Knowledge was envisaged as representations of the world consisting of a number of objects and events, and the key task of the brain (or any other cognitive system) was to represent or model them as accurately as possible. Knowledge was universal; two cognitive systems were to lead to the same representation of the same object or event. For cognitivists, knowledge was explicit, capable of being encoded and stored, and easily communicable to others.

Moreover [17], specified that from a cognitive perspective, two major hypotheses concerning knowledge can be identified:

- Knowledge is seen as a representation of a pre-defined world. This implies that reality, whether objects, events, or states, lies outside the subject of knowledge and is given objectively for everyone.

- Knowledge can be seen as information processing and rule-based symbol manipulation.

2.2.2 Constructivist perspective (anti-representationism)

Resting on new contributions of the neurobiology, the cognitive sciences, and the philosophy, the constructivist point of view envisages the cognition as an act of construction or creation rather than an act of representation [4]. The prospect anti-représentationniste of Von Krogh and Johan Roos leans in particular on the model "autopoïèse" created by [18], two Chilean biologists, who suggested that the cognition was a creative act of production of the world. Because knowledge lives in ourselves and is closely linked to our senses and our previous experiences, we are brought to create the unique world to ourselves. So, knowledge is not universal, and the constructivist carries only not much attention to comparisons between different models. The constructivist approach considers that the cognitive system works when knowledge allows effective actions. For certain constructivists knowledge is explicit, but others can be tacit, strongly personal, not easy to express, and consequently little easy to share with others [4].

These two perspectives influenced the theories and the practices of the management. However, the interest of the constructivist studies is that they consider as well the tacit aspects that the explicit aspects of knowledge. The main features of these two perspectives, enriched by [19], are summarized in **Table 1**.

2.3 Three fundamental postulates

Our observations and experiments within the industry led us to set forth three postulates about knowledge within organizations: (i) knowledge is not an object, (ii) knowledge is linked to the action, and (iii) organization's knowledge includes two main categories of knowledge. We define these postulates hereafter.

The cognitivist perspective of knowledge within organizations (representationism)	The constructivist perspective of knowledge within organizations (anti-representationism)
• Knowledge is seen as a representation of a pre-defined world. This implies that reality, whether objects, events, or states, lies outside the subject of knowledge and is given objectively for everyone • Knowledge is universal: two cognitive systems should lead to the same representation of the same object or event • Cognition (the ability to know) is seen as information processing and rule-based symbol manipulation • The cognitive approach considers that the key task of the brain (or any other cognitive system) is to represent or model reality as accurately as possible • For cognitivists, knowledge is explicit, can be encoded and stored, and is easily transmitted to others	• Knowledge resides in ourselves. It is closely linked to our senses and past experiences • Knowledge is not universal; we are driven to create the one world for ourselves • Cognition (the ability to know) is considered an act of construction or creation rather than an act of representation • The constructivist approach considers the cognitive system to work when knowledge enables effective actions • For constructivists some knowledge is explicit, but others may be tacit, highly personal, not easily expressed, and therefore difficult to share with others. Tacit knowledge involves talents, dexterity, and skills characterized by perception and intuition

Table 1.
Knowledge within organizations from two perspectives.

2.3.1 First postulate: knowledge is not an object

This postulate is based on the theories of [20] concerning organizational learning. Drawing on the concepts of "tacit knowledge" and "sense-giving" and "sense-reading" studied by [21, 22], he observed that "Although terms 'datum', 'information', and 'knowledge' are often used interchangeably, there exists a clear distinction among them. When datum is sense-given through interpretative framework, it becomes information, and when information is sense-read through interpretative framework, it becomes knowledge" (p. 88).

The sense-giving and sense-reading processes are defined by [22]: "Both the way we endow our own utterance with Meaning and our attribution of Meaning to the Utterances of others are acts of Tacit Knowing. They represent sense-giving and sense-reading within the structure of Tacit Knowing" (p. 301).

Tsuchiya added the concept of "interpretative framework," which from our perspective can be considered a mental model as defined by [23]: "Mental models are personal, internal representations of external reality that people use to Interact with the world around them. They are constructed by individuals based on their unique life experiences, perceptions, and understandings of world. Mental models are used to reason and make decisions and can be the basis of individual behaviors. They provide the mechanism through which new information is filtered and stored." In short, tacit knowledge that resides in our brain results from the sense given, through our interpretative frameworks, to data that we perceive among the information transmitted to us.

Tsuchiya [20] emphasizes how organizational knowledge is created through dialog and highlighted that "commensurability" of the interpretative frameworks of the organization's members is indispensable for an organization to create organizational knowledge for decision and action. Here, commensurability is the common space of the whole interpretative frameworks of each member. Let us quote Tsuchiya: "It is important to clearly distinguish between sharing information and sharing knowledge. Information becomes knowledge only when it is sense-read

through the interpretative framework of the receiver. Any information inconsistent with his interpretative framework is not perceived in most cases. Therefore, commensurability of interpretative frameworks of members is indispensable for individual knowledge to be shared" (p. 89).

Therefore, we postulate that knowledge is not an object processed independently of the person who has to act. This individual knowledge is tacit knowledge, self-explanatory or not, and can be later transformed into collective knowledge, as it is shared with other people. Tacit knowledge involves talents, dexterity, and capacities characterized by the perception and the intuition.

Consequently, formalized and codified knowledge that are independent from individual, are not more than information. We call it "information source of knowledge for someone." Furthermore, taking back [24], we must discern the knowledge of knower and the codification of that knowledge (p. 295).

The *conditions and limits under which knowledge can be thought of as an object* and therefore can be managed as information as follows: Knowledge is explicit, stable and well defined, recognized by a specific homogeneous population. Knowledge is "apparently" independent of people and situations. Knowledge is dissociated from action and can be thought of as an object.

Exception cases: Knowledge is highly complex and/or has a very high degree of specialization.

2.3.2 Second postulate: knowledge is linked to the action

Within organizations, activities contributing to value-added processes and support processes, defined by [25], use and create knowledge. So, the organizations' knowledge is depending of the context and the situation that allow using and creating this knowledge. Moreover, knowledge is partially characterized by the aim of these activities. In particular, the role of the stakeholder, involved with these activities, must be taken into account. Therefore, knowledge is linked to their decisions, their actions, and their relationships with the surrounding systems (people and artifacts).

2.3.3 Third postulate: knowledge used and created in organizations includes two main categories of knowledge

Within an organization, knowledge consists of, on the one hand, explicit knowledge comprising all tangible elements (we call it "know-how") and, on the other hand, tacit knowledge defined by [21], which comprises intangible elements (we call it "skills"). The tangible elements take the shape of formalized knowledge in a physical format (databases, procedures, plans, models, algorithms, and analysis and synthesis documents) or are embedded in automated management systems (conception and production systems) and in products. The intangible elements are inherent to the individuals, either as collective knowledge ("routines"—the logic of individual or collective actions defined by [26]) or as personal knowledge: skills, tricks, trade secrets, knowledge of history and decision-making contexts, and environmental knowledge (customers, competitors, technologies, socioeconomic influences) (see **Table 2**).

2.4 Our vision of knowledge management

Relying to the three postulates mentioned overhead, it appears that KM addresses activities, which utilize and create knowledge more than knowledge

Know-how *(Explicit knowledge)* **Tangible elements**	**Skills** *(Tacit knowledge embodied by individuals)* **Intangible elements**	
Collective knowledge *Knowledge that can be though as objects*	Collective knowledge *Routines*	Personal knowledge *Private knowledge*
Knowledge that is formalized within documents and/or codified into data bases	*Knowledge that is incorporated within models and regular and predictable behaviors*	*People's abilities* *Professional knack* *Knowledge of company history and decisional contexts* *Knowledge of the environment (customers, competitors, technologies) and socioeconomic factors*
Information source of knowledge for someone ©Michel Grundstein	Defensive routines *Knowledge that are obstacles to change* Constructive routines *Knowledge that favors innovation and change*	Specific knowledge belonging to each individual *Knowledge that is a volatile intangible resource, which depends on the continuity of the presence of employees in the company*

Table 2.
The two main categories of organization's knowledge.

itself. With regard to this question, since 2001, our group of research[3] has adopted a managerial and socio-technical approach to KM defined as follows [27]:

KM is the management of the activities and the processes that enhance the utilization and the creation of knowledge within an organization, according to two strongly interlinked goals, and their underlying economic and strategic dimensions, organizational dimensions, socio-cultural dimensions, and technological dimensions: (i) a patrimony goal, and (ii) a sustainable innovation goal (p. 980).

The *patrimony goal* has to do with the preservation of knowledge, their reuse, and their actualization; it is a static goal. The *sustainable innovation goal* is more dynamic. It is concerned with organizational learning that is creation and integration of knowledge at the organizational level. This definition of KM, by focusing on managerial and organizational problems linked to socio-technical environment and organization's value-added processes, highlights the economic and strategic dimension of KM. It leads to integrate the whole dimensions that should be involved in the management based on knowledge within organizations. In doing so, it induces a well-balanced technological, organizational, and socio-technical management based on knowledge strategy that mutualizes and structures the various themes discussed in this chapter.

3. Distinguishing two main approaches underlying knowledge management

In this section we will refer to our research that leads to distinguishing two main approaches underlying KM: (i) a technological approach that answers a demand of solutions based on the technologies of information, communication, and artificial intelligence and (ii) a managerial and sociological approach, which is people-focused and integrates knowledge as resources contributing to the implementation of the strategic vision of the organization.

[3] SIGECAD Research Group is created in 1998, in which domain topics are information system, knowledge management, and decision aid.

Snowden [28] consolidates our research when writing about developing practices of knowledge management (pp. 241–242). He identifies two different approaches to KM: (1) an approach that arises from information management where knowledge is seen as a thing or entity that can be managed and distributed through advanced use of technology and (2) an approach that sees the problem from a sociological vision where knowledge is seen as human capability to act.

3.1 Technological approach of knowledge management

Taking into account our researches and observations, we can say that technological approach of KM is the most widespread. Considered from the point of view of the information system, knowledge is implicitly treated as an object independently of the person who creates and uses it. It is a positivist approach that can be considered according to the cognitivist perspective of knowledge within organizations. In this perspective, knowledge exists as a "truth" that can be stored and transmitted.

Typically, the positivist approach considers knowledge independently of its links to the action and context of its implementation. As a result, it neglects the role of tacit knowledge. The same phenomenon is analyzed by [21] who states: The fact that we can possess knowledge that is unspoken is of course a common-place and so is the fact that we must know something yet unspoken before we can express it in words. It has been taken for granted in the philosophical analysis of language in earlier centuries, but modern positivism has tried to ignore it, on the ground that tacit knowledge was not accessible to objective observation (p. 306).

In the technological approach, the KM refers to information systems and databases. Emphasis is placed on the quality of the IT system to create and preserve knowledge in order to create value. Most often, the goal is oriented by the notion of knowledge management system (KMS). For instance, let us quote the definition [29]: "Knowledge management systems refer to a class of information systems applied to managing organizational knowledge. That is, they are IT-based systems developed to support and enhance the organizational processes of knowledge creation, storage, retrieval, transfer, and application."

Moreover, although authors are careful to propose a definition to distinguish between data, information, and knowledge concepts, when applications are addressed in terms of computer systems, these three concepts are rapidly declining in terms of data processing: knowledge being only a form of enriched data. This leads to the characterization and organization of knowledge according to a hierarchical vision of objects. Thus, the authors who join this perspective are mainly interested in the content of the knowledge of the organization. They focus on building and managing knowledge stocks.

3.2 Managerial and sociological approach of knowledge management

3.2.1 Current of economic and managerial research influence

The emergence of the managerial and sociological approach of knowledge management comes, according to [11], in three phases:

First phase: a change of paradigm of the corporate strategy called "the approach based on the resources," to which Edith Penrose strongly contributed. She was the first one to begin this change of paradigm in 1959, with the publication of her book entitled "*The theory of the growth of the firm*" [30]. She explains in this work that the company undergoes a loss of capital when a capable employee, who is an employee whose services interfere in the process of production, leaves the firm. By conferring on the knowledge an economic value, in the same way as any other

material resource being a part of the capital, Edith Penrose opened the way to a new economic theory which has to place the knowledge in the center of the process of creation of the wealth.

Second phase: a new vision of the company, through the notions of directory of knowledge and of organizational routines expressed by [31]. In their work *An Evolutionary Theory of Economic Change*, the authors define the notion of skill as a capacity to coordinate a sequence of behavior to reach goals in a given context. Besides, they define the notion of organizational routine as a predictable and regular behavioral plan. These routines are the siege of the knowledge of the organization, because beyond any formalization, the best way of storing the knowledge of the organization lies in the exercise of these. So, all the routines of an organization constitute its directory of knowledge [30].

Third phase: an organizational change taking care of the problem of capitalization of the knowledge of the company [1, 31, 32]. Concretely, the company has to learn to establish connections between her members. This means connecting people whose cooperation will generate new and useful knowledge for themselves and for the company. These connections can take place as well at the individual level as at the level of a team or at the level of the whole organization.

3.2.2 Managerial and sociological approach of knowledge management

Thiétard [33] proposes the following definition of management: "Management can be defined as the way to conduct, direct, structure and develop an organization. It touches on all the organizational and decision-making aspects of how she works. Management is less concerned with the procedures to be applied, whether they are accounting, legal or social procedures, than the animation of groups of men and women who must work together for the purpose of a finalized collective action" (p. 1).

Thus, the diversity of situations, the complexity of problems, and the multiplicity of actors concerned by the KM should be studied. We can say that managerial and sociological approach of the KM emphasizes the link between learning and action and the constraints of the social system which requires giving meaning to working hours. This last point of view is based on the theory of needs and motivations pointed out by [34–38] and in particular on a pyramid hierarchy of motivations determining the human behavior proposed by the American psychologist Abraham Harold Maslow (1908–1970), who distinguishes five levels of need [37], notably level 5, the need to use and to develop one's abilities, to flourish in one's work.

Consequently, each employee must have a sense of belonging to the company; he must be integrated into a network of people and have good relations with others; he must be respected and recognized; he must take pleasure in the accomplishment of his work. The KM must provide the means to be autonomous and to develop its own potential.

3.3 International standard ISO 30401:2018

Finally, we introduce the last International Standard ISO 30401:2018 (November 2018) [39] entitled "Knowledge Management Systems Requirements." This document sets out the requirements for the knowledge management systems of organizations, leading to the successful implementation of knowledge management. However, the document preserves a certain latitude in the application of these requirements, which allows each organization to comply with them in accordance with characteristics and needs.

In the introduction of this standard, knowledge management is envisaged in the following way: Knowledge management is a discipline focused on the ways in

which organizations create and use knowledge. Knowledge management has no recognized single definition and no international standard predates this management system standard. There are many known barriers to successful knowledge management. Similarly, there are many confusions with other disciplines such as information management and many widespread misconceptions about how to achieve knowledge management [39], for example, the misconception that simple acquisition of technological means can be enough. From our point of view, this standard should be very useful for a management based on knowledge operation.

3.4 Outcomes

At the end of this section devoted to KM, it appears that this discipline has followed developments strongly rooted in two contradictory and complementary paradigms: the positivist paradigm and the constructivist paradigm. Although not always leading to expected results, the KM positivist paradigm remains the implicit paradigm most recognized by KM researchers and practitioners.

From our point of view, this paradigm needs to be expanded to a more general point of view based on a constructivist paradigm. We refer to this approach as "the managerial and socio-technical approach to KM" (Section 2.4). This perspective brings together the elements on which the "management based on knowledge" is founded.

4. Organization's information and knowledge system

In this section, opting for a socio-technical approach to the organization, we introduce the concept of "organization's information and knowledge system."

4.1 Socio-technical approach to the organization

The socio-technical approach of organization is to consider the organization as a system consisting of a social system interacting with a technical system [40]. The following reflections are essentially based on the book *Knowledge Management in the Sociotechnical World*. Coakes [40] states that the term "socio-technical" is commonly used in systems studies, particularly in the design of organizations. Based on numerous writings, some dating back to 1920, she says that the best incarnation of this paradigm is found in the work of Fred Emery and Eric Trist at the Tavistock Institute, London, and in the study of Trist and Bamford (1951) in which the researchers identified the need for a socio-technical approach to develop a social system appropriate for the establishment of a new technical system. Elayne Coakes defines the term "socio-technical" as "The study of the relationships and interrelationships between the social and technical parts of any system" (p. 5). Thus, this term describes a broader view of the role of technology in an organization: "technology should be considered, discussed and developed not only as a technical artifact but in the light of the social environment in which it is exploited" (p. 4). She suggests that "Knowledge management from a socio-technical perspective requires managing the organization through continuous change and a continuous learning process supported by appropriate technologies" (p. 10). In addition, [41] consider that "adopting a socio-technical perspective avoids a purely technological approach to information systems" (p. 27).

Thus, an information and knowledge system of an organization could be considered as a subset of the organization in which the technical system would be the digital information system (DIS). This system interacts with the members of

the organization considered both as users and as components of the system. This system is described in the following subsection. We refer to it by the expression "the organization's information and knowledge system".

4.2 Organization's information and knowledge system

4.2.1 Description of the organization's information and knowledge system[4]

Figure 1 represents the organization's information and knowledge system. This system is a local subset of the organization's socio-technical system (individuals interacting between themselves, with machines, and with the system itself).

The organization's information and knowledge system consists of:

- A digital information system, an artifact based on information, communication, and artificial intelligence technologies (including Web 2.0 and Big Data applications) that ensure the consistency of the different DIS specific to the socio-technical subsets of the organization [16] (p. 202).

- An information system (IS), constituted by individuals who, in a given context, are processors of data to which they give a sense under the shape of information. This information, depending of the case, are transmitted, stored, processed, and diffused by them or by the DIS.

- A knowledge system (KS), consisting of the tacit knowledge embodied by the individuals and the explicit knowledge formalized and encoded on any form of media (document, video, photo, digitized or not). Under certain conditions (Section 2.3.1), digitized knowledge may be transmitted, stored, processed, and disseminated by the DIS. In that case, knowledge is no more than information. We refer to them by the expression "information source of knowledge for someone."

Information systems and knowledge systems are based on digital information systems. The latter constitutes, on the one hand, the source and support of the company's decision-making and management processes and, on the other hand, the structuring base of the companies in which they are designed and deployed. The DIS is the artificial system (artifacts) designed from information, communication, and artificial intelligence technologies. Considering the possibilities provided by artificial intelligence, in particular "deep learning" technologies, "several interactions must be considered: a "Man to Man" interaction; a "Man to Machine" interaction; and a "Machine to Machine" interaction." [16].

We insist on the importance to integrate the individual as a user and a component of the system. In their study on the design of knowledge management collaborative systems (CKMS), Chua and Brennan [42] reinforce our point of view. These authors point out that "One of the most important components of CKMS is the knowledge workers, who are also the users of the system, and the Workspaces they are associated with" (p. 172).

4.2.2 Impact of individual's culture on the organization's information and knowledge system

We think that the individual's culture is one of the bases on which employees' interpretative frameworks are deeply rooted. As employees' interpretative

[4] SICO in french: Système d'Information et de Connaissance de l'Oganisation.

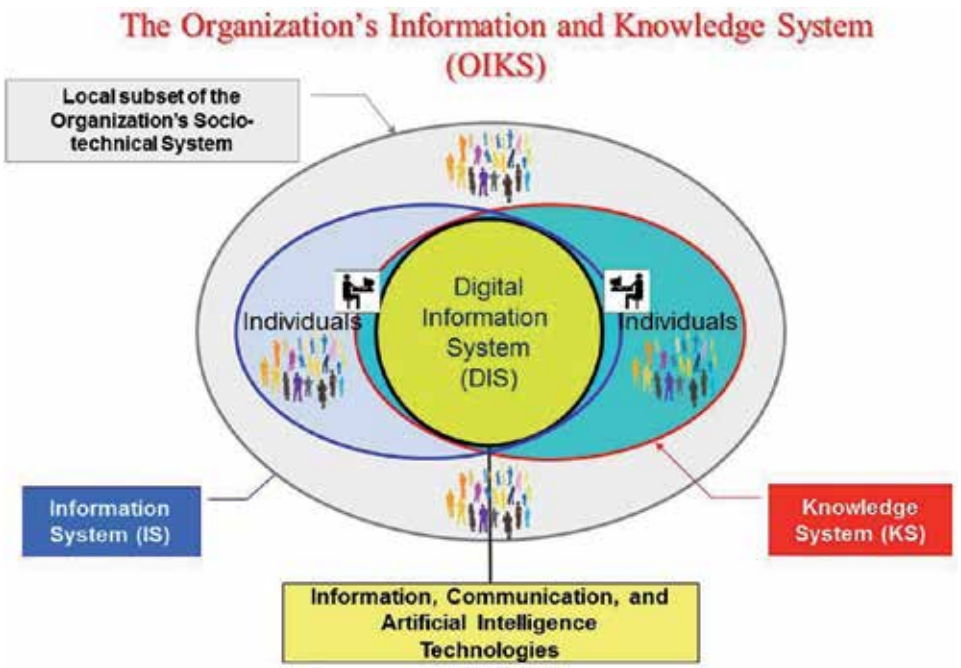


Figure 1.
The organization's information and knowledge system (OIKS/SICO).

frameworks are transducers that give sense to information and codified knowledge, individual's culture is a key factor to enable employees to make sense to information that they access from the digital information systems and so internalize it and transform it into action. Consequently, we stress the role of cultural factors every time social interactions and sharing of information and knowledge are essential to enable efficiency in an intercultural world.

In their research, [43] state that "one of the main difficulties in the analysis of culture and its impact on KM initiatives is to separate the business from the national culture" (p. 233). They focused on five national cultural dimensions, which are power distance, tolerance of ambiguity, individualism/collectivism, time orientation, and doing/thinking (pp. 241–242). These indicators provide empirical evidence that they have an impact on the individual's cognitive abilities and so develop different interpretative frameworks. Accordingly, when considering the knowledge worker as a user and a component of the organization's information and knowledge system, we suggest regarding these indicators as criteria to develop a cultural analysis study in order to conceive, realize, and implement collaborative information systems.

5. From capitalization on organization's knowledge to management based on knowledge within organizations

In this section, looking to the capitalization on knowledge problem within organizations, we position our vision of the management based on knowledge.

The concept of "capitalization on organization's knowledge" was first expressed back in 1990 in a large French company. The object was to preserve and obtain greater value from the know-how and the skills acquired in the field of knowledge engineering, in extension of the company's deployment into applied artificial intelligence and knowledge-based systems.

5.1 Capitalization on knowledge problem within organizations[5]

In what follows, we propose to define the problem of capitalization on knowledge within organizations, irrespectively of the different currents of influence that contributed to the emergence and propagation of the concepts of "capitalization of knowledge" and "knowledge management." So, we define the concept of capitalization on knowledge as follows [44]: "Capitalization on knowledge within the organization means considering some knowledge used and produced by the organization as a storehouse of riches and drawing from these riches interest that contributes to increasing the organization's capital" (p. 141).

Several problems co-exist. These problems constitute a general problem focused on crucial knowledge. They are recurring problems with which the company was always confronted. We classified them into four categories and their interactions, which are represented in **Figure 2**: Locate crucial knowledge, preserve crucial knowledge, enhance crucial knowledge, and actualize crucial knowledge.

5.2 Concept of "crucial knowledge"

In this subsection, we suggest the following definition of "crucial knowledge." Crucial knowledge is knowledge that, regardless of its nature, is tacit (embodied within the head of a person or embedded in an artifact) and explicit (incorporated into a document or another physical support):

1. Contributes to the added value and performance of organizational and production processes or to the innovation of products and services or to the maintenance and improvement of a competitive position.

2. Is vulnerable, that is, rare, specific and unique, inaccessible, poorly distributed, inimitable, and difficult to transmit.

3. Has a high cost and/or high acquisition time.

4. Can cause an unacceptable risk for the strategy and life durability of the firm, by weakening its core competencies, endangering the performances of its business units, and reducing its market share, in case of possible loss.

Crucial knowledge supplies essential resources that are used by value-added processes activities of an organization. Value-added processes are derived from the value chain described by Porter [25] who identifies nine value-added activities that he classifies into two main categories. The "primary activities" are (1) inbound logistics, (2) operations, (3) outbound logistics, (4) marketing and sales, and (5) services. The "support activities" are (1) business infrastructure, (2) human resource management, (3) technological development, and (4) supplies. In this way,

[5] The expression "capitalization of knowledge" is strongly influenced by knowledge engineering in the early 1990s. We transformed it in 1993 following our meeting with Professor Shigehisa Tsuchiya [20]. Until that time we were talking about "capitalization of knowledge," and we changed to the expression "capitalization on knowledge." In fact, the technological approach to the knowledge engineering considers knowledge as an object, which is a reality external to the individual in the form of concrete and perceptible things. This is implicitly inferred by the expression "capitalization of knowledge." Subject to conditions specified in Section 2.3.1, we changed the paradigm considering that in organizations, knowledge created and used is above all a knowledge related to action that is specific to people and cannot be thought of as an object, hence the expression "capitalization on knowledge."

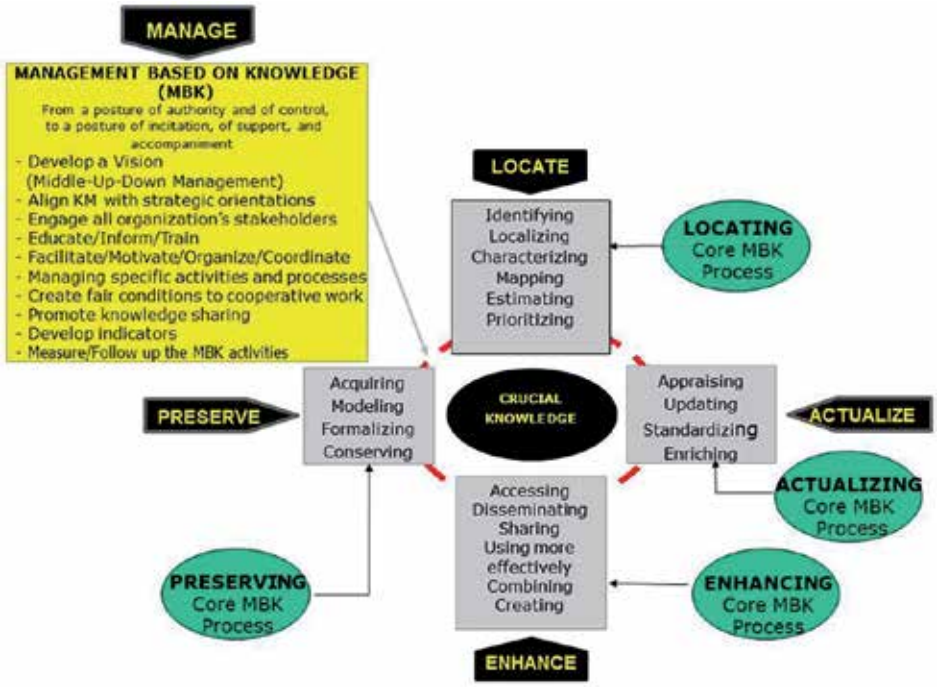


Figure 2.
Management based on knowledge: the core MBK processes.

value-added processes represent the organizational context for which knowledge is essential factors of performance.

5.3 Core MBK processes to capitalize on company's knowledge

The core MBK processes answer the problem of capitalization on company's knowledge. Thus, we have identified four core MBK processes corresponding to the resolution of the categories of problems: locating core MBK process, preserving core MBK process, enhancing core MBK process, and actualizing core MBK process. Each of these core processes contains sub-processes designed to solve all the problems involved. These sub-processes are integrated into the overall management based on knowledge processes implemented in the organization.

We describe these processes below.

The following description of the core MBK processes is not necessarily cyclical in nature. Each category contains, in itself, a set of problems that can be addressed in a different order depending on the situation and context of each organization.

- The ***locating,*** *core MBK process*, deals with the location of crucial knowledge, that is, knowledge (explicit or tacit) essential for decision-making processes and for the progress of the value-added processes. It is necessary to identify it, to locate it, to characterize it, to make cartographies of it, to estimate its economic value, and to classify it. One can mention our approach named GAMETH® [45] (pp. 271–285), specifically aimed to support this process.

- The ***preserving,*** *core MBK process*, deals with the preservation of know-how and skills: when knowledge can be explicit, it is necessary to acquire it with the bearers of knowledge, to represent it, to formalize it, and to conserve it. This leads to knowledge engineering activities notably described in Schreiber et al.

[48]. When formalizing knowledge is not feasible, then interactions of people through social networks, communities of practice, or other types of networks implemented, and the transfer of master-apprentice-type knowledge should be encouraged.

- The ***enhancing,*** *core MBK process*, deals with the added-value of know-how and skills: it is necessary to make them accessible according to certain rules of confidentiality and safety, to disseminate them, to share them, to use them more effectively, to combine them, and to create new knowledge. Here is the link with innovation processes.

- The ***actualizing,*** *core MBK process*, deals with the actualization of know-how and skills: it is necessary to appraise them, to update them, to standardize them, and to enrich them according to the returns of experiments, the creation of new knowledge, and the contribution of external knowledge. Here is the link with business intelligence processes.

5.4 Positioning management based on knowledge within organizations

When considering the capitalization on knowledge problem within organizations, we do raise the problem that concerns interactions between the core MBK processes mentioned above and the management process for knowledge creation and use. This problem is linked to our vision of the managerial and socio-technical approach of KM that, from our point of view, is adapted to the digital transformation of the organizations. Indeed, this transformation leads to replace a determinist attitude strongly deep-rooted in our education, by a constructivist attitude that characterizes our approach of KM. We call it "management based on knowledge" problem (**Figure 2**).

Thereby, managers have to pass from a posture of authority and of control to a posture of incitation of support and accompaniment. We have to:

- Develop a vision like the middle-up-down management suggested by [1] (pp. 124–159).

- Align the MBK with strategic orientations of the organization.

- Engage all organization's stakeholders.

- Educate/inform/train the members of the organization.

- Facilitate/motivate/organize/coordinate concerned employees.

- Manage specific activities and processes.

- Create fair conditions to cooperative work.

- Promote knowledge sharing.

- Develop indicators.

- Measure and follow up The MBK activities.

Our vision of KM, defined in Section 2.4, induces a well-balanced, technological, organizational, and socio-technical management based on knowledge strategy that

mutualizes and structures the various themes discussed in this chapter. It should result in a MBK that takes into account the individuals and which has to allow them to be autonomous and to achieve their potentialities. Thus, the MBK fosters a "people-focused KM" as proposed by [9] who states: "our emphasis is on people and their behaviors and roles in enterprise operations" (p. XXV). MBK rests on the *general system theory* first established by [46] who cares very much on the humanist approach. It is inspired by the work of [47] who focused on complexity.

5.5 MBK guiding principles

The MBK guiding principles should bring a vision aligned with the enterprise's strategic orientations and should suggest a MBK governance principles by analogy with COBIT® 5 [48].

In particular, MBK indicators must be established. Numerous publications and books relate to that subject. From our viewpoint, two main categories of indicators should be constructed in order to monitor a MBK initiative: (1) a category of indicators that focuses on the impacts of the initiative favoring enhancement of intellectual capital and (2) a category of indicators that insures monitoring and coordination of MBK activities, measuring the results, and insuring the relevance of the initiative. Furthermore, we can add a category of indicators focused on knowledge itself. For instance, indicators of knowledge complexity are presented in **Table 3**.

In addition, we should find a way to get a good articulation between the Deming's cycle and the organizational learning. **Figure 3** shows this articulation. Firstly, we refer to the PDCA cycle of activities—plan, do, check, and act [49]. This cycle, first advocated by Deming (1992) is well known as the *Deming's cycle* by quality management practitioners. The PDCA cycle has inspired the ISO 9004 (2000) [50] quality standards in order to get a continuous process improvement of the quality management system.

Secondly, we refer to the *single-loop learning* and *double-loop learning* defined in the Argyris and Schön's organizational learning theory [51]. Thus, we point out the key contribution of Knowledge Management to *Change 2* defined by [52]. **Figure 3** shows the articulation between Deming's cycle and organizational learning.

Indicators	Objective
Nature of knowledge	Distinguish between declaratory knowledge (knowing what) and procedural knowledge (knowing how)
Quality of knowledge	Characterize specialized knowledge that relates to narrow areas with precise limitations (e.g., knowledge acquired in a scientific discipline) and commonsense knowledge (knowledge that is generally used and used unconsciously)
Depth of knowledge	Determine the surface knowledge that is implemented by experts in tasks within their field (knowledge that allows them to associate with a known situation the appropriate actions, without having to "go down" to the level of a causal model) and deep knowledge (those of laws and principles, implemented by novices or by experts confronted with unknown cases)
Extent of knowledge	Characterize specialized knowledge that relates to narrow areas with precise limitations (e.g., knowledge acquired in a scientific discipline) and commonsense knowledge (knowledge that is generally used and used unconsciously)
Stability of knowledge	Distinguishing static knowledge (those that do not depend on time at least in sufficiently long intervals) and dynamic knowledge (those which concern evolutionary processes and are accompanied by a temporal modality)

Table 3.
Indicators of knowledge complexity.

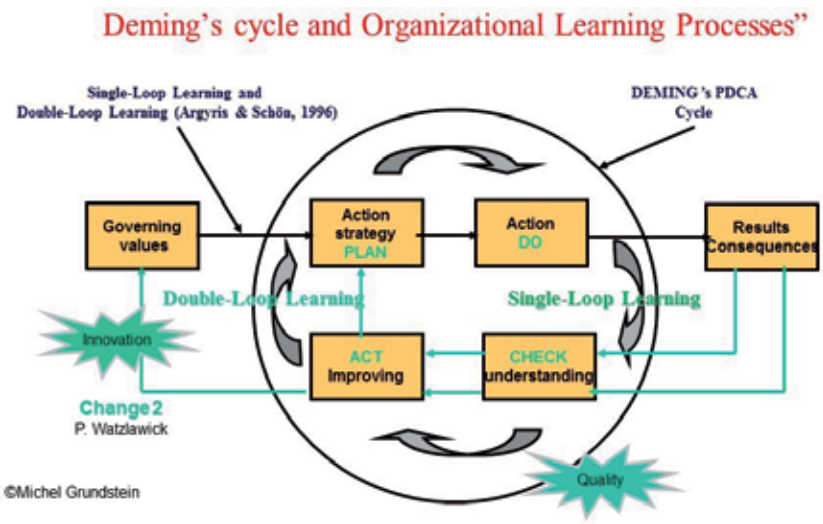


Figure 3.
Deming's cycle and organizational learning articulation.

We note that single-loop learning generates a cycle identical to the PDCA cycle. These two cycles, which are indispensable from the point of view of quality, are not favorable to innovation. The MBK-specific management principles should lead to a balanced dialogical between the two learning processes defined by Argyris and Schön. A balance leads to quality without prejudice to innovation.

6. Conclusions and perspectives

In a world disrupted by the omnipresence of digital technologies, organizations have become complex socio-technical systems in perpetual mutation. Cooperation and mobility become an essential form of work which requires that decision-makers have specific individual and collective skills, adapted to the values and cultures of each geographical location. Organizations become aware of the need for continuous personal and collective learning and of the contribution of each, especially of the crucial impact of their tacit knowledge.

In this paper, we provided theoretical and practical reflections and outcomes from our industrial experience and our researches. Thus, we have transferred our managerial and socio-technical approach of knowledge management to our concept of management based on knowledge as a managerial function. It consists in animating, organizing, coordinating, and monitor activities and processes to enhance the use and the creation of knowledge within an organization. That is done according to a well-balanced perspective of the knowledge within organization: a cognitivist perspective and a constructivist perspective. We identified two main approaches underlying KM: a technological approach and a managerial and sociological approach. We described the three fundamental postulates that are the basis of our own approach called "managerial and socio-technical" approach to knowledge management. We introduced the concept of organization's information and knowledge system. We positioned our concept of the management based on knowledge with regard to the problem of capitalization on knowledge within organizations. Finally, we suggested MBK guiding principles and indicators on knowledge complexity.

In this paper, we state that knowledge is not manageable as if it was data or information. Consequently, faced with digital transformation, one should be aware

of limitations of "Big Data" and the associated techniques. Effectively, these technologies might suggest that digital information systems provide access to the tacit knowledge crucial for decision-making and action. However, taking into account the elements brought in this chapter, we argue that digital information systems provide only information whose data are filtered by the decision-makers' interpretative frameworks and then interpreted with their own tacit knowledge in order to give them meaning. Moreover, we should consider that data are gathered and processed by algorithms, themselves, influenced by the interpretative frameworks and tacit knowledge of their designers. So, considering the information received by the user, though originated from the formalized and encoded knowledge of the experts, there is no evidence that the user's tacit knowledge that results from this process is identical to that of the experts who produced it. That presents the risk of misunderstanding and can lead to irrelevant decisions and actions.

From our point of view, researchers in the analytics and digital field should pay attention to the possible consequences of their work according to the domain and the context of their applications. To this end we could develop research on the rules insuring the relevance of information and enabling measuring the impact of algorithms with regard to their domains of applications. This raises the problem of ethic and responsibility of algorithms in the organizations' socio-technical systems.

To conclude, this chapter retraces and completes our road toward management based on knowledge. We hope that it would generate fruitful reflections to those who will be called to contribute to the digital transformation of the organizations: professionals, researchers, and students.

Author details

Michel Grundstein
LAMSADE, Paris Dauphine University, France

*Address all correspondence to: michel.grundstein@yahoo.fr

References

[1] Nonaka I, Takeuchi H. The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. New York: Oxford University Press; 1995. Edition en langue française (traduction de Marc Ingham): La connaissance créatrice. La dynamique de l'organisation apprenante. De Boeck Université S.A.; 1997

[2] Leonard-Barton D. Wellsprings of Knowledge. Building and Sustaining the Sources of Innovation. Boston, Massachusetts: Harvard Business School Press; 1995

[3] Davenport TH, Prusak L. Working Knowledge: How Organizations Manage What They Know. Boston, Massachusetts: Harvard Business School Press; 1998. pp. 2-6, 145-153

[4] Von Krogh G, Roos J, editors. Managing Knowledge: Perspectives on Cooperation and Competition. London: Sage Publications; 1996

[5] Liebowitz J. Preface. In: Liebowitz J, editor. Knowledge Management Handbook. Boca Raton Florida: CRC Press LLC; 1999

[6] Morey D, Maybury M, Thuraisingham B. Knowledge Management, Classic and Contemporary Works. Cambridge, Massachusetts: The MIT Press; 2000

[7] Despres C, Chauvel D. Knowledge Horizons. The Present and the Promise of Knowledge Management. Woburrn, MA: Butterworth-Heinemann; 2000

[8] Wiig KM. Knowledge Work in the Corporation, IAKE'92 Tutorial, Third Annual Symposium of the International Association of Knowledge Engineers; 16-19 November 1992; Washington DC; 1992

[9] Wiig K. People-Focused Knowledge Management. How Effective Decision-Making Leads to Corporate Success. Burlington, MA: Elsevier Butterworth-Heinemann; 2004

[10] CEN-1. Knowledge Management Framework. In: European Guide to Good Practice in Knowledge Management (Part 1). Brussels: European Committee for Standardization, CWA 14924-1:2004 (E). Retrieved September 4, 2017, (version française) from: http://users.skynet.be/cimi/CWA%2014924-1%20Structure%20KM.pdf

[11] Pachulski A. Le repérage des connaissances cruciales pour l'organisation: Concepts, méthode et outils [Thèse de Doctorat, soutenue le 19 décembre 2001]. Paris, France: Université Paris-Dauphine; 2001

[12] Saad I. Une contribution méthodologique pour l'aide à l'identification et l'évaluation des connaissances nécessitant une opération de capitalisation [Thèse de Doctorat, soutenue le 27 juin 2005]. Paris, France: Université Paris-Dauphine; 2005

[13] Ravononarimanga-Raherimandimby H. Outiller le partage des informations scientifiques de base sur l'environnement en entreprise, développement et implantation d'un prototype d'outil de représentation des notions environnementales chez Electicité de France (EDF) [Thèse de Doctorat, soutenue le 7 août 2006]. Paris, France : Université Paris-Dauphine; 2006

[14] Doan QM. Préservation des connaissances dans les petites et moyennes entreprises vietnamiennes: Modèle et processus [Thèse de Doctorat, soutenue le 20 juin 2012]. Paris, France: Université Paris-Dauphine; 2012

[15] Arduin PE. Vers une métrique de la commensurabilité des schémas d'interprétation [Thèse soutenue le

26 septembre 2013]. Paris, France: Université Paris-Dauphine; 2013

[16] Atif L. P©, Une approche Collaborative d'Analyse des Besoins et des Exigences Dirigée par les Problèmes: Le Cas de Developpementt d'une Application Analytics RH [Thèse soutenue le 7 juillet 2017]. Paris, France: Université Paris-Dauphine; 2017

[17] Varela FJ. Whence perceptual meaning? A cartography of currents ideas. In: Varela FJ, Dupuy JP, editors. Understanding Origins: Contemporary View of the Origin of Life, Mind, and Society. Dordrecht: Kluwer; 1992. pp. 235-264

[18] Maturana H, Varela F. Autopoiesis and cognition: The realization of the living. In: Cohen RS, Wartofsky MW, editors. Boston Studies in the Philosophy of Science. Vol. 42. Dordrecht: D. Reidel Publishing Co.; 1980

[19] Sargis-Roussel C. Une approche constructionniste du processus de création de connaissances organisationnelles dans un projet. LEM LILLE Economie &Management (UMR CNRS 8179) IAE Lille. 2006. Extrait, novembre 2007, http://www.strategie-aims.com/events/conferences/8-xveme-conference-de-l-aims/communications/2242-une-approche-constructionniste-du-processus-de-creation-de-connaissances-organisationnelles-dans-un-projet/download

[20] Tsuchiya S. Improving knowledge creation ability through organizational learning. In: ISMICK'93 Proceedings, International Symposium on the Management of Industrial and Corporate Knowledge, UTC, Compiègne; October 27-28; 1993

[21] Polanyi M. The Tacit Dimension. London: Routledge & Kegan Paul; 1966

[22] Polanyi M. Sense-giving and sense-reading. The Journal of Royal Institute of Philosophy. 1967;**XLII**(162):301-325

[23] Jones NA, Ross H, Lynam T, Perez P, Leitch A. Mental models: An interdisciplinary synthesis of theory and methods. Ecology and Society;**1**(16):46. Available from: https://www.ecologyandsociety.org/vol16/iss1/art46/

[24] Haeckel SH. Managing knowledge in adaptive enterprises. In: Despres C, Chauvel D, editors. Knowledge Horizons (Chap. 14). Woburn, MA: Butterworth-Heinemann; 2000. pp. 287-305

[25] Porter ME. Competitive Advantage: Creating and Sustaining Superior Performance. New York: The Free Press; 1985

[26] Nelson RR, Winter SG. An Evolutionary Theory of Economic Change. Cambridge, MA: Harvard University Press; 1982

[27] Grundstein M, Rosenthal-Sabroux C. Three types of data for extended company's employees: A knowledge management viewpoint. In: Khosrow-Pour M, editor. Information Technology and Organizations: Trends, Issues, Challenges and Solutions, IRMA Proceedings. Hershey, PA: Idea Group Publishing; 2003. pp. 979-983

[28] Snowden D. The social ecology of knowledge management. In: Despres C, Chauvel D, editors. Knowledge Horizons (Chap. 12). Woburn, MA: Butterworth-Heinemann; 2000. pp. 237-365

[29] Alavi M, Leidner DE. Knowledge management and knowledge management systems: Conceptual foundations and research issue. MIS Quaterly. 2001;**25**(1):107-136

[30] Penrose E. The Theory of the Growth of the Firm. Oxford University Press; 1959

[31] Drucker P. Au-delà du Capitalisme, La métamorphose de cette fin de siècle. Paris: Dunod, Edition originale "Post-capitalism Society". Oxford, Great Britain: Butterworth-Heinemann Ltd; 1993

[32] Prahalad CK, Hamel G. Competing for the Future. Harvard Business School Press; 1995

[33] Thiétard RA. Méthodes de recherche en management (Introduction). 2nd éd ed. Paris, France: Dunod; 2003. pp. 1-10

[34] Osborn AF. L'imagination constructive. Créativité et Brainstorming. Paris: Dunod; 1964. (Nouveau tirage, 1974)

[35] Mc Gregor D. La dimension humaine de l'organisation. Paris: Gauthier-Villars Editeur (Nouveau tirage); 1971. Traduction par J. Ardoino et M. Lobrot de The human side of enterprise. McGraw-Hill Book Company Inc.; 1960

[36] Dortier JF, Ruano-Borbalan JC. Les théories de l'organisation: Un continent éclaté? In: Cabin P, editor. Les Organisations. Etat des savoirs (Chap. 1). Auxerre: Sciences Humaines Editions; 1999. pp. 27-38

[37] Plane JM. Théorie des organisations. Paris: Dunod; 2000

[38] Cohen D, Prusak L. In Good Company: How Social Capital Makes Organizations Work. Boston MA: Harvard Business School Publishing; 2001. p. 61

[39] Système de management des connaissances—Exigences. International Standard ISO 30401:2018 (November 2018). La Pleine Saint-Denis, 93571: AFNOR; 2018

[40] Coakes E. Knowledge Management: A Sociotechnical Perspective. In: Cokes E, Willis D, Clarke S, editors. Knowledge Management in the Sociotechnical World (Chap. 2). London: Springer-Verlag; 2002. pp. 4-14

[41] Laudon KC, Laudon JP. Management Information Systems, Managing the Digital Firm. 9eme ed. Upper Saddle River, New Jersey: Pearson Education, Inc.; 2006. 07458 p

[42] Chua BB, Brennan J. Enhancing collaborative knowledge management systems design. In: Remenyi D, editor. Proceedings of the 5th European Conference on Knowledge Management. Reading, UK: Academic Conferences Limited; 2004. pp. 171-178

[43] Darby R, Herbolzheimer E, van Winkelen C. Cross-cultural context in the implementation of knowledge management: A cross-cultural case study analysis. In: Remenyi D, editor. 5th European Conference on Knowledge Management. Reading, UK: Academic Conferences Limited; 2004. pp. 231-242

[44] Grundstein M. CORPUS, an approach to capitalization on company knowledge. In: Ein-Dor P, editor. Artificial Intelligence in Economics and Management. Tel-Aviv, Israel: Kluwer Academic Publishers; 1996. pp. 139-152

[45] Grundstein M. From capitalization on company's knowledge to knowledge management. In: Morey D, Maybury M, Thuraisingham B, editors. Knowledge Management, Classic et Contemporary Works (Chap. 12). Cambridge, Massachusetts: The MIT Press; 2000. pp. 261-287

[46] von Bertalanffy L. General System Theory. New York: George Braziller, Inc; 1968. Translated by Jean-Benoist Chabrol. Théorie Générale des Systèmes (p. XI). Paris: Dunod; 1973

[47] Morin E, Le Moigne JL. L'Intelligence de la Complexité. Paris: L'harmattan; 1999

[48] COBIT®. Gouvernance, Contrôle et Audit de l'Information et des Technologies Associées. Translation of Control Objectives for Information and Related Technology. Information Systems Audit and Control. 3rd ed. Rolling Meadows Illinois: IT Governance

Institute; 2005. Translated into French language by AFAI the French Chapter of the Information Systems Audit and Control Association—ISACA. Paris: AFAI, 2000, 2002, 2005

[49] Martin J. The Great Transition. Using the Seven Disciplines of Enterprise Engineering to Align People, Technology, and Strategy. New York, NY: AMACOM, a division of American Management Association; 1995. p. 207

[50] ISO 9004, Système de management de la qualité; Ligne directrices pour l'amélioration des performances (Quality Management Systems, Guidelines for Performance Improvements). Paris La Défense: AFNOR; 2000

[51] Argyris C, Schön DA. Organizational Learning II. Theory, Method, and Practice. Readings, MA: Addison-Wesley Publishing Company; 1996

[52] Watzlawick P, Weakland J, Fisch R. Changements: Paradoxes et psychothérapie. Paris: Éditions du Seuil; 1975. Original title: Change. Principles of Problem Formation and Problem Resolution

Section 2

Strategic Knowledge Management

Chapter 4

Knowledge Management and Its Role in Strategic Sustainability Management in the Finance Sector

Timothy Donnelly and Mark Wickham

Abstract

Given the broad economic, environmental, and social challenges in the modern competitive environment, it is not surprising that effective sustainability management has emerged as an important variable in the strategic management process. Increasingly, firms are finding it necessary and beneficial to build sustainability principles into their strategic planning, and the extant research has shown that effective strategic management of sustainability can have a variety of positive outcomes for the firm such as improved economic. Given its demonstrable importance to the strategic management process, and the noted absence of a knowledge management process in the literature, this chapter seeks to address the broad research opportunity to explore what elements comprise a sustainability knowledge management system.

Keywords: knowledge management, sustainability, finance sector

1. Introduction

Given the broad economic, environmental, and social challenges in the modern competitive environment, it is not surprising that effective sustainability management has emerged as an important variable in the strategic management process [1, 2]. Increasingly, firms are finding it necessary and beneficial to build sustainability principles into their strategic planning, and the extant research has shown that effective strategic management of sustainability can have a variety of positive outcomes for the firm such as improved economic [3, 4], improved human resource factors [5, 6], and reputational benefits [7, 8]. Historically, strategic sustainability management has had an 'outputs' focus [9, 10], such as, the focus on reporting sustainability outcomes fundamental to the triple-bottom line (TBL) framework. However, scholars have recently noted the shortcomings of the TBL (and similar) frameworks that emphasise the outputs of sustainability management rather than the antecedent resources and capabilities [11]. Recently, there has been a push to reassess the research approach to researching effective sustainability management processes by refocusing on the application and nature of strategic inputs [12]. Over the past 30 years, the focus on strategic antecedents has been evident in other disciplines (e.g., human resource management, accounting and finance, and marketing) that have been elevated to operate as integral aspects of the strategic management process.

The most popular theoretical strategic management lens for the exploration of strategic inputs is the resource-based view of the firm (RBV) [13, 14]. As RBV literature developed, scholars increasingly focussed on the nature of intangible assets, as research showed that it was these assets that were the most integral to establishing a sustainable competitive advantage [15]. One such asset that has received increasing attention is the knowledge capabilities that exist within a firm, and how that knowledge can be accessed and applied to strategic decision making [16]. This has led to the establishment of the knowledge management (KM) field of strategic management research, an extension of the RBV focussing exclusively on the application and nature of knowledge in a competitive context [17, 18]. The concept of knowledge management (KM) has become the key theoretical framework through which knowledge is examined and researched [19, 20].

Insofar as there has been research seeking to align principles of KM and sustainability, these have been retrospective in nature rather than deliberate and systematic [21]. Frameworks such as those by [22] have sought to improve the sustainability of the KMs themselves. Whilst this is a valuable pursuit that has the potential to benefit firm processes, it does not offer solutions to the effective management of sustainability. Other frameworks, such as, the one devised by [23] sought to reconfigure sustainability at the conceptual level so as to fit it into extant finance/HRM/marketing KM structures. These have ultimately been proven to be insufficient for the challenges facing modern firms operating in today's competitive landscape [21, 24]. There is a notable absence in the literature of a KM that actually provides insight into the effective strategic management of sustainability [24]. Given its demonstrable importance to the strategic management process, and the noted absence of a knowledge management process dedicated to the sustainability concept, this chapter seeks to address the broad research opportunity to explore what elements comprise a sustainability knowledge management system.

2. Literature review

2.1 Knowledge management

The inclusion of 'knowledge management' as an organisational concept has been attributed to the McKinsey consulting firm in 1987 when they implemented a motion study of their information handling and utilisation processes [25]. For the purposes of this chapter, KM is defined as the systematic approach to the management of information and knowledge within a firm, including the identification, acquisition, storage, sharing, conversion, and application of knowledge for firm processes [26]. KM as an organisational process, therefore, seeks to facilitate the collection, application and development of firm knowledge to establish and sustain competitive advantage across three specific dimensions: (a) the strategic dimension—i.e., related to the strategic importance of knowledge and its management, (b) the managerial dimension—i.e., related to firm knowledge assessment and management, and (c) the operational dimension—i.e., related to the development and usage of knowledge and intellectual asset. The effective management of KM requires the firm to invest in knowledge management infrastructure—the key elements of this infrastructure will be discussed in the next section.

2.2 Knowledge management infrastructure

For knowledge to be used to effectively and efficiently improve the strategic capabilities of a firm, it must possess an appropriate infrastructure (both

technologically and organisationally) to support the acquisition, conversion, and application of relevant knowledge [27–29]. Gold et al. [30] and later, [28], identified a series of fundamental elements of KM infrastructure: technology, organisational culture, knowledge acquisition, knowledge conversion, and knowledge application.

2.2.1 Technology

In the early 2000s, researchers tended to emphasise the benefits of IT above all other organisational infrastructure assets in the knowledge management process [31]. Today, it is widely accepted that effective IT systems play a key role in contributing to organisational processes. However, research indicates that effective IT systems need to be adequately integrated with structural and cultural elements in order to substantively contribute to KM [30, 28]. When effectively implemented and integrated, technology-based assets and IT can contribute to more advanced knowledge creation, sharing, distribution and application [30, 28]. For example, KM systems relating to all of the discipline areas noted above are supported by wide array of advanced software packages (e.g., Zendesk, ProProfs KnowledgeBase, Atlassian Confluence, Bitrix24, etc.), and it is now considered a necessity for firms to invest in technology-based KM processes in order to remain competitive and responsive in dynamic market conditions [32, 33].

2.2.2 Organisational culture

Given the increasing importance of knowledge management processes to strategic performance, a majority of firms make efforts to integrate knowledge-sharing into their organisational culture [29]. The inclusion of knowledge-sharing as a corporate value and organisational norm allows organisations to quickly react to the changing competitive landscape, ensuring that employees and management will either possess the knowledge required or the ability to quickly acquire the knowledge required, to adapt to new competitive challenges [19]. One major influence on a firm's knowledge sharing willingness is the issue of reciprocity [29], that is, the perception that they will receive a valuable return because of the knowledge they choose to share with others (e.g., direct compensation of some kind; enhanced reputation, being given an employee award, etc.). In this way, the elements of an organisation's culture (i.e., stories, rituals, language, values, etc.) can operate as powerful mechanisms in the knowledge management process [28, 34].

2.2.3 Knowledge acquisition

Knowledge acquisition refers to the process of understanding the need for knowledge, identifying the source of information, and undertaking the steps needed to collect it effectively and efficiently [28, 35]. This aspect of KM can be done by '... seeking, generating, creating, capturing, and collaborating on knowledge' by individuals who observe, experience, imitate, practice, or otherwise interact with others [28], p. 317. These activities can be conducted externally to the firm in order to acquire knowledge from a wide variety of stakeholders (e.g., customers, competitors, suppliers, regulators, etc.) or conducted internally from analysis of the organisation's past experiences or mistakes [28]. Internal knowledge is sometimes considered 'tacit' in that is exists within the firm but is possessed by one individual (or a close group of people) and is not readily accessible to others [28, 35].

2.2.4 Knowledge conversion

Knowledge conversion refers to the process by which knowledge (at this point already acquired, stored and shared) is made useful to the firm by the conversion of tacit knowledge to explicit knowledge (i.e., available for those who need it or can use it more effectively) [30]. Cho and Korte [28] note that in small firms, this knowledge conversion often happens through casual dialogue and exchange, and [36] demonstrates that often in this process new knowledge or innovative capacity is generated. Cho and Korte [28] emphasise that the need for knowledge conversion to be conducted systematically and deliberately in large firms due to the inherent complexity in that context. Technological support is required for the management of knowledge in these more complex contexts, through the use of information databases, document management systems, and instant messenger communication channels [28].

2.2.5 Knowledge application

Knowledge application refers to the process whereby the knowledge generated by the KM system is developed to a point where it is fit for use in decision-making and task performance within the firm [37]. This process requires management to define and codify the decision-making and task performance routines within their firm to standardise the mechanisms by which the quality of the knowledge is verified as being fit for purpose (e.g., managerial review processes, cross-checking implications, peer-review of data, etc.), and the manner in which it informs task performance (e.g., training manuals, key performance indicators, performance management systems, etc.).

2.3 Specific research question

Given the discussion above, the specific research question to be addressed in this chapter is: *What comprises best-practice knowledge management systems for the acquisition, conversion, and application of sustainability information in a strategic context?*

3. Method

3.1 Sustainability knowledge management and the case of the international finance sector

For the purposes of this research, the industrial context chosen to explore best-practice sustainability knowledge management was the international finance sector (and credit providers in particular). Recently, researchers have noted that the engagement with strategic sustainability practices has become increasingly important for credit providers in this industry, particularly in response to the poor reputation of the sector and the increased political and regulatory scrutiny that has been placed on it post-global financial crisis (GFC) [38, 39]. Events including the industry sector's response to the GFC, the U.S. governments bailout of the banks (i.e., the *Emergency Economic Stabilization Act 2008*) and the 2017/18 Australian Royal Commission provide a unique industrial and societal context where the effective use of strategic sustainability processes and social accountability is seen as increasingly important to restore public trust [40, 41].

3.2 Qualitative content analysis

In order to address the specific research question, this research adopted a qualitative content analysis research design following the protocols recommended by [42–44]. Content analysis was deemed appropriate for this research area as it provides a flexible method by which to explore complex phenomena and enables researchers to move freely between stages of analysis, allowing for a thorough thematic analysis [45]. The content analysis process in this research comprised of three stages.

3.2.1 Stage one: data selection and acquisition

In stage one, appropriate data was selected and acquired. Firstly, it needed to be considered what sample of firms could represent best-practice performance in sustainability and engage in effective KMPs. To this end, the annual reports of nine firms (see **Table 1**) were gathered and analysed. All firms operated in the finance industry as credit providers and were B-Corporation (B-Corp) certified. Firms in the credit providing industry were chosen due to the inherent importance of knowledge and information in effectively competing in the industry [46]. B-Corp certification status is awarded by the U.S. non-profit 'B-Lab' organisation and certifies best-practice performance against a range of social and environmental performance, public transparency, and legal accountability standards (B-Corporation Website 2019). Annual reports were collected as they represent the main corporate communication tool used by firms [47] and are accepted as a reliable and valid source of strategic information [48, 49]. All annual reports were downloaded in PDF format directly from the firms' official websites.

3.2.2 Stage two: extracting sustainability data

In stage two, coding rules relating to the three pillars of sustainability (i.e., economic, environmental, and social) were developed using the global reporting initiative (GRI) G4 reporting criteria as a guide [50]. The GRI is an international independent non-profit organisation founded in 1997 in association with the United Nations that has published a comprehensive set of economic, environmental and social sustainability performance standards considered globally to be the basis for best-practice sustainability reporting [51]. Due to its function as a leading

Firm name	Type	Location	Certified
Beyond Bank Australia	Banking and financial services	Australia	2015
Charity Bank	Banking and financial services	United Kingdom	2014
City First Bank	Banking and financial services	United States	2017
Kindred Credit Union	Credit union	Canada	2016
Mascoma Bank	Banking and financial services	United States	2017
O-Bank	Banking and financial services	Taiwan	2017
Silver Chef	Hospitality equipment funding	Australia	2015
Sunrise Banks	Banking and financial services	United States	2009
Triodos Bank	Banking and financial services	Netherlands	2015

Table 1.
Summary of sample firms.

KM variables		Coding rule
Knowledge infrastructure capability	Technology	This node captures data relating to technology infrastructure such as IT, search and retrieval engines, KM databases, and learning technologies
	Culture	This node captures data relating to organisational culture such as knowledge sharing, interaction, vision and mission, and participation
Knowledge process capability	Acquisition	This node captures data relating to any knowledge acquisition from suppliers, customers, competitors and others
	Conversion	This node captures data relating to the storage, transforming, and transportation of knowledge
	Application	This node captures data relating to the actual application of knowledge within the firm

Table 2.
Knowledge management variables and coding rules.

international benchmark, the GRI has served as the basis for content analysis coding firm sustainability strategies and activities in a range of academic research disciplines [52–54]. All annual report data gathered in Stage One were entered into a codified database using the GRI definitions. Coding refers to the process of converting data into a contextual value for the purposes of storage and thematic analysis [54]. The coding was facilitated using the NVIVO (version 12) software package, which is a computer-aided qualitative data analysis tool that researchers use to organise data and conduct thematic analysis. The data were coded in a 'line-by-line' manner according to the process prescribed by [55].

3.2.3 Stage three: applying a knowledge management lens

In stage three, coding rules for detecting data relevant to KM were developed (see **Table 2**) by adapting the operational definitions of KM elements provided by [28], p. 319 that were described in the literature review section. The data were then entered into a codified database using the same techniques as described above for stage two. The data emanating from stage three of this content analysis process for the basis of the findings that follow.

4. Findings

4.1 Technology

In terms of the technology element of a sustainability-focused KM system, the data indicated that the sample firms made use of their technological infrastructure for two main sustainability purposes: (a) to enhance their economic processes through iterative technological improvement, and (b) to share information technology knowledge with stakeholders (most notably disadvantaged segments of the population) through technological and financial literacy education. In terms of enhancing their economic processes through technological improvement, the sample firms demonstrated an ongoing investment in IT as well as technological training for employees.

> *This level of profitability was in line with forecast and was achieved on the back of the strong growth, low interest margins and the Board's decision to continue to*

> *invest in the business strategy, particularly Information Technology and our People (Beyond Bank Australia).*

> *Furthermore, we are continuing to implement an electronic approval system for official document, and promote the frequent use of e-forms and e-mail, and have installed bank-wide videoconferencing equipment in order to reduce the use of paper (O-Bank).*

In terms of sharing information technology knowledge with stakeholders, the sample firms demonstrated a willingness to engage with customers in order to improve financial and technological literacy, simultaneously contributing to both economic and social sustainability agendas:

> *At these events, the Bank engages with customers by making them financially aware about Banking products and services, technology-based products, teach them how to use ATMs, mobile banking and internet banking, online account opening, remittance services, etc., (Sunrise Banks).*

> *To accommodate the Bank's recent shifting towards digital banking, we also invited outside experts to give talks or offer training and asked in-house experts to devise online courses so that employees could strengthen their expertise in financial technology and related issues. In addition, we actively work with a number of universities to develop training programs in an effort to seek out even more promising financial innovation professionals (O-Bank).*

The data demonstrated that in terms of the technology element of a sustainability-oriented KM system, technological infrastructure underpinned and enabled a wide variety of sustainability and KM processes within the firms. In their key lending and finance driven operations (i.e., economic sustainability), technological infrastructure facilitated communication, project management, reputation management, market/targeted research, and most other aspects of managing a credit provider in the modern complex financial landscape. In non-economic sustainability areas, technology contributed primarily to the education of customers and potential customers regarding 'digital banking' and overall financial and technological capability. This has the dual benefits of providing a desirable social outcome, whilst simultaneously building the firms' potential customer base.

4.2 Organisational culture

In terms of the organisational culture element of a sustainability-focused KM system, the data indicated that the sample firms communicated knowledge-based sustainability principles to their salient stakeholders through (a) their mission/vision statements, and (b) their dedicated sustainability reporting documents. In terms of their mission and vision statements, the sample firms consistently communicated their sustainability values and priorities (i.e., language) of sustainability to their stakeholder groups:

> *To make real the vision of sustainable development, the bank commits itself to the following five key areas: corporate governance, employee care, customer relations, social engagement, and environmental protection (O-Bank).*

> *Since 2002, Charity Bank's innovative approach to lending and its mission to benefit society have enabled it to lend over £200 million worth of loans to hundreds of social sector organisations across the UK (Charity Bank).*

> *The NMTC program has proven to be an effective tool, helping us achieve our mission of supporting community development and stimulating economic growth in low-income communities across our region. We are pleased the CDFI is supportive of our efforts (Mascoma Bank).*

In terms of their dedicated sustainability reporting documents, the sample firms emphasised their sustainability 'success stories' in much greater detail for consumption by their stakeholder groups:

> *For Triodos Bank integrating reporting does not just mean reporting on how the organisation behaves as a responsible corporate citizen—by using renewable energy to power its buildings, for example, important as this is. It means reporting in-depth on the impact of its activity in the widest sense, through the impact of its loans and investments in particular. A growing number of integrated reports suggests more businesses consider their impact on society and the environment as core to their activities (Triodos Bank).*

> *Beyond Bank Australia cares about the community and is committed to environmental sustainability. This annual report has been printed on Monza Recycled, manufactured by an ISO 14001 certified mill, and contains 99% recycled fibre and elemental chlorine free pulp. All virgin pulp is derived from well-managed forests and controlled sources (Beyond Bank).*

The data demonstrated that in terms of the organisational culture element of a sustainability-oriented KM system, the sample firms utilised their culture-fostering capabilities to orient their (sometimes 'broad' and 'flat') organisational structures towards sustainability projects when feasible. Mission and vision and statements often referenced non-economic benefits such as community development, cultural preservation, and environmental conversation. With their dedicated sustainability reporting documents, firms took an active approach to managing their reputation among those external stakeholders and supply-chain partners that consume such content, branding themselves as actors for positive change and focussing on whichever particular aspect of sustainability was most appropriate for that market or industrial sector.

4.3 Acquisition

In terms of the acquisition aspect of a sustainability-focused KM system, the data indicated that the sample firms acquired sustainability knowledge through two main activities: (a) exchange with stakeholders (i.e., strategic partners, investors, industrial alliances, and benchmarking organisations), and (b) targeted talent acquisition, particularly sustainability experts either from the academic or professional sphere. In terms of exchange with stakeholders, the sample firms demonstrated the capability to gather economic, environmental and social information and knowledge from partners and potential partners with greater expertise in their given field. By maintaining this exchange (beyond the initial investigation for investment purposes), the sample firms ensured that they always possessed the most up-to-date sustainability information:

> *Today, citizen energy makes the 'business case' for investing in clean energy technology. The DC based consulting firm helps communities join the clean energy economy through the simplest energy efficiency upgrades, like solar power and LED lighting. The company provides integrated energy auditing, financing, value engineering,*

> *technology procurement, project management, installation, and ongoing performance management. Citizen Energy has helped building owners improve building efficiency, add value to their buildings and cut their carbon footprint by at least 30% (City First Bank).*

> *In keeping with its commitment to corporate social responsibility, the Bank maintains a spirit of service that values learning, innovation, and sustainability. Setting up an education foundation as early as July 2000, we draw on our corporate expertise, government support, and private resources to vigorously promote various industry-academia collaborations, technology management seminars, entrepreneurship workshops, and art and cultural activities (O-Bank).*

In terms of targeted talent acquisition, the sample firms demonstrated the capability to identify and attract experts that could provide valuable assistance in assessing the sustainability potential of potential strategic partnerships, as well as guide the firms' own internal sustainability activities:

> *[The Bank hopes to] become more relevant in the major shifts in energy production by financing larger projects. In parallel, we will want to use our expertise to finance smaller energy projects which contribute to a distributed energy system including efficiency, and energy storage (Triodos Bank).*

> *This model creates value by transforming capital inputs. These inputs include the skills and entrepreneurship of the people within our organisation and money from customers, via our core products and services. It transforms these inputs into value outputs so that they make a positive contribution to the development of a healthy society that is able to flourish within our planetary limits (Triodos Bank).*

The data demonstrated that in terms of the acquisition element of a sustainability-oriented KM system, the sample firms demonstrated the ability to both 'cast a wide net' in assessing the sustainability agendas suitable for a sustainable return on investment, and the ability to 'focus in' on the specific research, technology, processes, or strategies required to target investment effectively. The firms did not appear to rely on secondary data in this regard and often engaged in productive dialogue with a wide variety of supply-chain and environmental actors, seeking to acquire a well-rounded perspective on whichever sustainability agenda they were either considering investing in, or in which they had an ongoing financial stake. These activities benefitted from the acquisition of appropriate sustainability and finance experts that were effectively integrated into existing structures and, indeed, often given a great deal of autonomy in deciding how to best contribute to a (usually environmental or social) sustainability agenda.

4.4 Conversion

In terms of the conversion aspect of sustainability-focused KM system, the data indicated that sustainability knowledge is stored within specialised teams within the sample firms. This is particularly evident in the management of environmental sustainability information and operations regarding the renewable energy sector:

> *LEAF lab (local economy alternative finance) is a dedicated innovation team working for Triodos Bank in the Netherlands. Its experiments in 2017 included 'Participating with Passion,' an initiative to connect sustainable start-ups with Triodos' private banking customers. The first private banking client invested in a*

> *sustainable start-up during the year. The group also continued to develop finance for decentralised local renewable energy cooperatives. It is also co-developed a circular currency initiative, United Economy, during the year enabling sustainable entrepreneurs to trade with each other with sustainable money, or Uniteds (Triodos Bank).*

The sample firms also demonstrated an ability to communicate their sustainability knowledge to partners further down the supply-chain, in order to contribute to the achievement of broad sustainability goals such as economic strength, environmental preservation and self-efficacy for socially disadvantaged groups:

> *We provided vigorous support for schools and daily assistance in remote areas: offering scholarships to outstanding young students, joining schoolchildren in celebrating the holidays, conducting financial knowledge instruction, and collecting second-hand books for donation to schools in remote areas (O-Bank).*

> *The bank provides knowledge on basic accounting and tax policy for existing and prospective SME clients to enable them to cope with, and comply with government policies so that they can sustain and run their business smoothly (Sunrise Banks).*

The data demonstrated that in terms of the conversion aspect of a sustainability-focused KM system, the sample firms had already acquired a sufficiently sized knowledge-base that they were able to establish and operate specialised teams dedicated to various aspects of sustainable research and operations (i.e., financial investment). The most widely reported of these was teams specialising in investment in the renewable energy sector. Almost all of the sample firms reported the existence of some kind of specialised renewable energy sector team, or demonstrated a sophisticated level of renewable energy sector knowledge. In addition to this specialised and structured knowledge-base, firms demonstrated the capability to communicate both broad and specific sustainability principles, processes and information to their supply-chain partners, most notably to sources of financial capital and firms with whom they possessed a financial stake.

4.5 Application

In terms of the application aspect of sustainability-focused KM system, the data indicated that all of the sample firms applied sustainability knowledge in across of their functional operations. In terms of economic sustainability, knowledge was utilised to maximise return on investment, attract investor capital, and effectively manage ongoing projects:

> *Triodos Bank puts sustainable banking into practice. First and foremost, this means offering products and services that directly promote sustainability (Triodos Bank).*

> *This model creates value by transforming capital inputs. These inputs include the skills and entrepreneurship of the people within our organisation and money from customers, via our core products and services. It transforms these inputs into value outputs so that they make a positive contribution to the development of a healthy society that is able to flourish within our planetary limits (Triodos Bank).*

> *Become more relevant in the major shifts in energy production by financing larger projects. In parallel, we will want to use our expertise to finance smaller energy*

> *projects which contribute to a distributed energy system including efficiency, and energy storage (Triodos Bank).*

In terms of environmental sustainability, knowledge was utilised to identify, finance and assist strategic partners in working towards the achievement of environmental conservation agendas, most notably in renewable energy markets:

> *Triodos Bank and its investment funds, offered via Triodos investment management, finance and cofinance enterprises that augment the use of renewable resources in particular and supports projects that reduce the demand for energy and promote energy efficiency. Triodos Bank describes and independently verifies the contribution it makes to the avoided carbon emissions that result from these energy projects. We are transparent about this approach in the annual report because we think it is important that our stakeholders understand the approach we take to these disclosures (Triodos Bank).*

> *The DC based consulting firm helps communities join the clean energy economy through the simplest energy efficiency upgrades, like solar power and LED lighting. The company provides integrated energy auditing, financing, value engineering, technology procurement, project management, installation, and ongoing performance management. Citizen energy has helped building owners improve building efficiency, add value to their buildings and cut their carbon footprint by at least 30% (City First Bank).*

> *The Bank's purchasing prioritizes and emphasizes environmental protection and suppliers that comply with green energy requirements, and we strive to engage in green purchasing (O-Bank).*

In terms of social sustainability, knowledge was utilised to target investment towards organisations (charities, social enterprises, and philanthropic foundations) focussed on social sustainability goals:

> *With its sponsorship of art events meant for charity, innovative startups, and social engagement events, our Education Foundation was a recipient of the Arts & Business Awards of the Council for Cultural Affairs in 2010 and of the 9th National Civic Service Awards of the Ministry of the Interior in 2011. These honours attest to the Bank's dedication to fulfilling its corporate social responsibility (O-Bank).*

> *We are the financial partner for social organisations delivering services for people struggling to meet their nutritional requirements, in Europe. We finance Biosabor, in Spain, an organic agricultural company that produces 300 hectares of vegetables and fruit in a sustainable way. Good quality food surpluses are distributed to disadvantaged people (Triodos Bank).*

The data demonstrated that in terms of the application aspect of a sustainability-focused KM system, the sample firms demonstrated the capacity to apply their sustainability knowledge in a wide array of contexts. In an economic sustainability context, the firms demonstrated the capability to leverage their reputation in financial markets as 'sustainable' to attract suitable financial investors, maximise return on investment, and effectively manage short and long-term projects, enabling them to offer more to supply-chain partners than just financial capital. In

an environmental context, the firms demonstrated the capability to interact with environmental preservation and conservation agendas in a sophisticated manner. All of the sample firms targeted investments in the environmental sector, most commonly renewable energy but also agendas such as sustainable agriculture and flora and fauna preservation. Given the economic obligations of the firms, environmental investments were selected that could also provide a competitive return on investment margin. In a social sustainability context, financial resources were directed towards organisations that offered to contribute to the ongoing wellbeing of societal units, most often at the community level. Such investments were often integrated with economic and environmental sustainability goals.

5. Discussion

5.1 Insights

The findings in this research provide three valuable insights for sustainability and knowledge management scholars and practitioners. Firstly, there is the apparent effectiveness of engaging in deliberate and deep stakeholder relationship management. Secondly, there is the manner in which the sample firms' top-management emphasise sustainability knowledge principles through their organisational culture-fostering activities. Lastly, there is the way in which firms applied their sustainability knowledge in almost all of their operations. Each of these insights are discussed in detail below.

5.1.1 Stakeholder engagement

The thematic analysis of the data in this research indicated that all the sample firms utilised deep stakeholder engagement to support, gather, apply, and make sense of the complex concepts and information required to contribute to and/or achieve broad sustainability agendas. This was particularly evident in regard to the acquisition aspect of KM systems; firms gathered information from financial investors, organisations in which they had an ongoing financial stake (or were considering investing in), strategic alliances with both competitors and non-competitors that were contributing to intersecting sustainability agendas, and secondary data from academic and benchmarking institutions. In addition to acquiring data from stakeholders, firms utilised stakeholder engagement in order to most efficiently apply their sustainability knowledge (i.e., firms used their relationships to apply their capital and sustainability knowledge *strategically*), maximising economic, environmental and social outcomes.

5.1.2 Sustainability culture

Analysis of the data indicates that the top-management of the sample firms consistently emphasised relevant sustainability principles throughout all of their culture-fostering activities. Beyond this, top-management also tended to include words and phrases related to knowledge management in organisational vision and mission statements and reporting documents. Words such as 'sharing' and 'learning' relate specifically to the conversion aspect of KM systems and were often paired with relevant sustainability concepts such as environment preservation and community development. The inclusion of these concepts at the top of level of the sample firms had a marked effect on the type of organisations the sample firms

were seeking to invest in (which is consistent with previous organisational culture research demonstrating the effect of top-management cultural guidance [34]).

5.1.3 Widespread application

Perhaps the most interesting insight to be derived from this research is the widespread and deliberate application of sustainability knowledge the firms demonstrated in a wide array of operations. The application of sustainability knowledge was evident in internal human resources management, operational decision-making (i.e., investment decisions), supply-chain management, reputation management, marketing, and strategic planning. In all of these areas, the firms consistently applied sustainability knowledge in order to maximise the effectiveness and efficiency of both their own financial interests as well as of contributions to sustainability agendas. The interrelationships between economic, environmental and social agendas provided rich ground for the development of investment strategies that aimed to achieve both organisational and societal goals. These investment strategies, in turn, provided valuable reputational capital with which to form differentiated market positions, and attract appropriate strategic partnerships. In managing supply-chain relationships, firms could use this sense of 'common purpose,' as well as traditional self-interest, to more closely align themselves with their stakeholders.

5.2 Model of a sustainability-oriented KM system

Figure 1 demonstrates the theoretical relationships inferred by the findings of this research. Sustainability principles informed the activities of the entire organisation, with technology and knowledge infrastructure providing the framework within which the firms sustainability operations could function. The principles and infrastructure then supported and enabled the acquisition, conversion, and

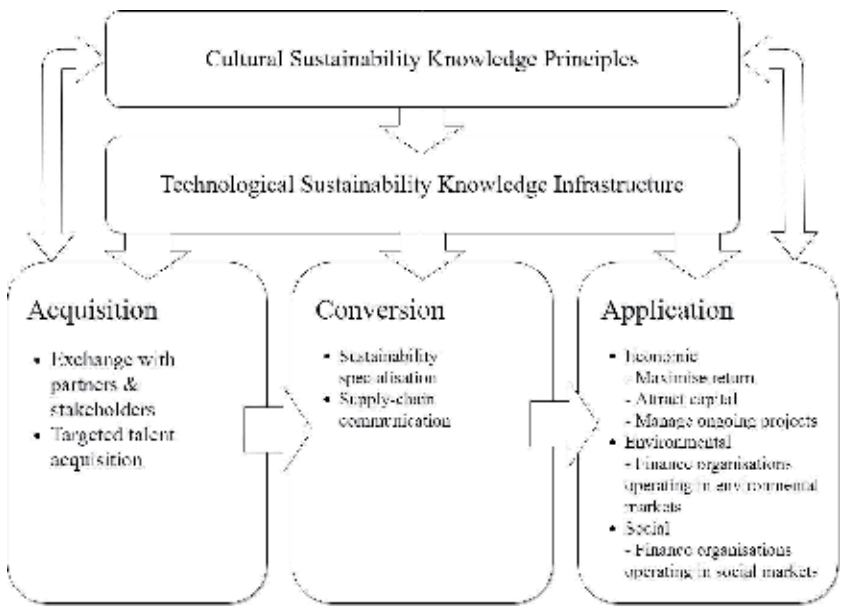


Figure 1.
Theoretical sustainability-oriented knowledge management system.

application of sustainability knowledge. Two feedback loops were formed between the acquisition and application functions, and the sustainability principles being cultivated through the sample firms' organisational culture. Over time, these loops are likely to reinforce the effectiveness of the KM system, building a solid base of knowledge that further informs strategic decision-making.

6. Conclusion

6.1 Limitations

The findings and theoretical and practical implications presented in this chapter need to be considered in terms of the limitations inherent to the adopted research design. There are three limitations the need to be considered. Firstly, the qualitative research design adopted in this research means that the findings and implications cannot be readily generalised to other firms in the finance industry or to other industries. Secondly, the data gathered for this research were from the sample firms' annual report documents only, and the data contained in the array of other official communications (e.g., sustainability reports, integrated reports, public relation announcements, website content, etc.) was not considered for this research. Thirdly, the data gathered for this research was from a limited (but exhaustive) sample of nine B-Corp certified firms from a single industry setting whose annual report documents were published in English. This limitation means that the sustainability-focussed KM systems of firms that publish their annual report documents in other languages are not represented in this research.

6.2 Future research opportunities

Given the findings and limitations of this research, seven avenues of future search into sustainability-oriented KM system are apparent. In terms of the insights into the effective management of sustainability knowledge described in the previous section, three avenues of future research appear promising. Firstly, future research should explore the stakeholder management techniques with which firms of this type engage so thoroughly with their supply-chain and strategic partners. Secondly, future research should seek a finer-grained understanding of the organisational culture-fostering activities that the firms' top-management engaged in so as to widely spread sustainability knowledge and principles throughout their organisation. Thirdly, future research should seek to explore the specific ways in which sustainability knowledge can be applied to all aspects of modern business, as it appears that the sample firms in this sample utilised such knowledge in every aspect of their operation. In terms of the limitations of this research, four avenues of future research into sustainability-oriented KM systems are apparent. Firstly, and in order to capture a wider array of sustainability data than that published in a firm's annual report document alone, future search should seek to gather and analyse secondly data from a wider range of firm publications (e.g., sustainability reports, integrated reports, public relation announcements, website content, etc.). This will increase the quantity, quality and timeliness of firm data in this regard, and provide the basis for more detailed analysis of firms' sustainability-oriented KM systems. Secondly, and in order to generate a finer-grained understanding of the elements that make up a sustainability-oriented KM system, the collection and analysis of primary data is warranted. Primary data gathered from a range of key firm informants (e.g., senior executives, CEOs, etc.) would be particularly useful for verifying and expanding on the findings presented in this research. Thirdly, the

use of longitudinal data in the adopted research design would provide insights into how the discussed KM system elements develop and change over time. Given the overall context of rapidly changing competitive environments, analysis of firms that have been effective in this regard over the long term would provide valuable insights into how firms are able to adapt these complex processes as required. Lastly, this research should be replicated in other industry settings in order to provide a finer-grained understanding of how the discussed concepts and elements change and adapt to different competitive challenges.

Author details

Timothy Donnelly and Mark Wickham*
University of Tasmania, Australia

*Address all correspondence to: markwickham@hotmail.com

References

[1] Engert S, Rauter R, Baumgartner RJ. Exploring the integration of corporate sustainability into strategic management: A literature review. Journal of Cleaner Production. 2016;**112**:2833-2850

[2] Williams A, Kennedy S, Philipp F, Whiteman G. Systems thinking: A review of sustainability management research. Journal of Cleaner Production. 2017;**148**:886-881

[3] Lin C-H, Yang H-L, Liou D-Y. The impact of corporate social responsibility on financial performance: Evidence from business in Taiwan. Technology in Society. 2009;**31**(1):56-63

[4] Gossling T, van Beurden P. The worth of values: A literature review on the relation between corporate social and financial performance. Journal of Business Ethics. 2008;**82**(2):407-424

[5] Lee C-K, Song H-J, Lee H-M, Lee S, Bernhard BJ. The impact of CSR on casino employees' organizational trust, job satisfaction, and customer orientation: An empirical examination of responsible gambling strategies. International Journal of Hospitality Management. 2013;**33**:406-415

[6] Farooq O, Payaud M, Merunka D, Valette-Florence P. The impact of corporate social responsibility on organizational commitment: Exploring multiple mediation mechanisms. Journal of Business Ethics. 2014;**125**(4):563-580

[7] Galbreath J, Shum P. Do customer satisfaction and reputation mediate the CSR-FP link? Evidence from Australia. Australian Journal of Management. 2012;**37**(2):211-229

[8] Tetrault Sirsly C-A, Lvina E. From doing good to looking even better: The dynamics of CSR and reputation. Business & Society. 2016;**58**(6):1234-1266

[9] Maguire K, Hanrahan J. Assessing the economic impact of event management in Ireland: A local authority planning perspective. Event Management. 2017;**21**(3):333-346

[10] Wong IA, Wan YKP, Qi S. Green events, value perceptions, and the role of consumer involvement in festival design and performance. Journal of Sustainable Tourism. 2015;**23**(2):294-315

[11] Ziakas V, Boukas N. The emergence of "small-scale" sport events in "small island" developing states: Towards creating sustainable outcomes for island communities. Event Management. 2016;**20**(4):537-563

[12] Rambaud A, Richard J, editors. The 'Triple Depreciation Line' Instead of The 'Triple Bottom Line': Towards a Genuine Integrated Reporting. Amsterdam, Great Britain: Elsevier Science B.V; 2015

[13] Barney J. Gaining and sustaining competitive advantage. Long Range Planning. 1998;**31**(4):643

[14] Newbert SL. Empirical research on the resource-based view of the firm: An assessment and suggestions for future research. Strategic Management Journal. 2007;**28**(2):121-146

[15] Čater T, Čater B. (In) tangible resources as antecedents of a company's competitive advantage and performance. Journal for East European Management Studies. 2009;**14**(2):186-209

[16] Kristandl G, Bontis N. Constructing a definition for intangibles using the resource-based view of the firm. Management Decision. 2007;**45**(9):1510-1524

[17] Halawi LA, Aronson JE, McCarthy RV. Resource-based view of knowledge

management for competitive advantage. The Electronic Journal of Knowledge Management. 2005;**3**(2):75

[18] Meso P, Smith R. A resource-based view of organizational knowledge management systems. Journal of Knowledge Management. 2000;**4**(3):224-234

[19] Gamble PR, Blackwell J. Knowledge Management: A State of the Art Guide. London: Kogan Page Publishers; 2001

[20] Zhang X, Venkatesh V. A nomological network of knowledge management system use: Antecedents and consequences. MIS Quarterly. 2017;**41**(4):1275-1306

[21] Norlida Abdul M, Nazliatul Aniza Abdul A. Integrating knowledge management in sustainability risk management practices for company survival. Management Science Letters. 2019;**4**:585

[22] Wu L, Baggio JA, Janssen MA. The role of diverse strategies in sustainable knowledge production. PLoS ONE. 2016;**11**(3):e0149151

[23] Caldelli A, Parmigiani ML. Management information system: A tool for corporate sustainability. Journal of Business Ethics. 2004;**55**(2):159-171

[24] Akram MS, Aljarallah AM, Goraya MAS, Malik A. Organizational performance and sustainability: Exploring the roles of IT capabilities and knowledge management capabilities. Sustainability. 2018;**10**(10):1-20

[25] McInerney C, Yoon W, Marchionini G, Koenig MED. Knowledge Management Processes in Organizations. Vermont, USA: Morgan & Claypool Publishers; 2011

[26] Girard J, Girard J. Defining knowledge management: Toward an applied compendium. Online Journal of Applied Knowledge Management. 2015;**3**(1):1-20

[27] Sabherwal R, Becerra-Fernandez I. An empirical study of the effect of knowledge management processes at individual, group, and organizational levels. Decision Sciences. 2003;**2**:225

[28] Cho T, Korte R. Managing knowledge performance: Testing the components of a knowledge management system on organizational performance. Asia Pacific Education Review. 2014;**2**:313-327

[29] Davenport T, Prusak L. Working knowledge: How organizations manage what they know. Sloan Management Review. 1998;**39**(3):92

[30] Gold AH, Malhotra A, Segars AH. Knowledge management: An organizational capabilities perspective. Journal of Management Information Systems. 2001;**18**(1):185-214

[31] Butler T, Feller J, Pope A, Emerson B, Murphy C. Designing a core IT artefact for knowledge management systems using participatory action research in a government and a non-government organisation. The Journal of Strategic Information Systems. 2008;**17**(4):249

[32] Huusko J, Kuusisto-Niemi S, Saranto K. Knowledge management in health technology SMEs. Studies in Health Technology and Informatics. 2017;**245**:878-881

[33] Hashemi P, Khadivar A, Shamizanjani M. Developing a domain ontology for knowledge management technologies. Online Information Review. 2018;**42**(1):28-44

[34] May-Chiun L, Mohamad AA, Ramayah T, Abdullah MA, Mei-Chee L. The role of knowledge management on organizational effectiveness:

Organisational culture as the moderator. International Journal of Business and Society. 2017;**18**:808-818

[35] Muthuveloo R, Shanmugam N, Ai Ping T. The impact of tacit knowledge management on organizational performance: Evidence from Malaysia. Asia Pacific Management Review. 2017;**22**(4):192-201

[36] Vvsin KS, Aaue S. Identification and amplification of tacit knowledge: The positive deviance approach as knowledge management praxis. Electronic Journal of Knowledge Management. 2017;**15**(1):17-27

[37] Carrasco FJC, Porta CR. Basic principles of knowledge management and its application to the industrial company in tactical operations of maintenance and operational exploitation: A qualitative study. Intangible Capital. 2013;**9**(1):91-125

[38] Jansen D-J, Mosch RH, van der Cruijsen CA. When does the general public lose trust in banks? Journal of Financial Services Research. 2015;**48**(2):127-141

[39] Lins KV, Servaes H, Tamayo A. Social capital, trust, and firm performance: The value of corporate social responsibility during the financial crisis. The Journal of Finance. 2017;**72**(4):1785-1824

[40] Edelman Intelligence Report. 2019. Available from: https://www.ausbanking.org.au/images/uploads/Edelman_ConsumerStudy_wavetwo.pdf [Accessed: 6 February 2019]

[41] Ernst & Young Report. 2019. Available from: https://www.ey.com/Publication/vwLUAssets/ey-the-relevance-challenge/$File/ey-the-relevance-challenge-2016.pdf [Accessed: 6 February 2019]

[42] Finn M, Walton M, Elliott-White M. Tourism and Leisure Research Methods: Data Collection, Analysis, and Interpretation. London: Longman Pub Group; 2000

[43] Hodson R. Analyzing Documentary Accounts. Thousand Oaks: Sage; 1999

[44] Neuman WL. Content analysis. In: Social Research Methods: Qualitative and Quantitative Approaches. Boston: Allyn and Bacon; 2003. pp. 310-319

[45] Krippendorff K. Content Analysis: An Introduction to its Methodology. 2nd ed. Thousand Oaks, California: Sage; 2004. p. 413

[46] Shih KH, Chang CJ, Lin B. Assessing knowledge creation and intellectual capital in banking industry. Journal of Intellectual Capital. 2010;**11**(1):74-89

[47] Branco MC, Rodrigues LL. Positioning stakeholder theory within the debate on corporate social responsibility. Electronic Journal of Business Ethics and Organization Studies. 2007;**12**(1): 5-15

[48] Abraham S, Shrives PJ. Improving the relevance of risk factor disclosure in corporate annual reports. The British Accounting Review. 2014;**46**(1):91-107

[49] Muttakin MB, Khan A, Azim MI. Corporate social responsibility disclosures and earnings quality: Are they a reflection of managers' opportunistic behavior? Managerial Auditing Journal. 2015;**30**(3):277-298

[50] Global Reporting Index-G4. 2019. Available from: https://www.globalreporting.org/resourcelibrary/grig4-part1-reporting-principles-and-standard-disclosures.pdf [Accessed: 6 February 2019]

[51] Brown HS, De Jong M, Lessidrenska T. The rise of the global reporting initiative: A case of institutional entrepreneurship.

Environmental Politics. 2009;**18**(2):182-200

[52] Gill DL, Dickinson SJ, Scharl A. Communicating sustainability: A web content analysis of North American, Asian and European firms. Journal of Communication Management. 2008;**12**(3):243-262

[53] Boiral O, Heras-Saizarbitoria I, Brotherton M. Assessing and improving the quality of sustainability reports: The auditors' perspective. Journal of Business Ethics. 2019;**155**:703-721

[54] Manetti G. The quality of stakeholder engagement in sustainability reporting: Empirical evidence and critical points. Corporate Social Responsibility and Environmental Management. 2011;**18**(2):110-122

[55] Ticehurst G, Veal A. Questionnaire surveys. In: Business Research Methods: A Managerial Approach. Frenchs Forest: Longman; 2000. pp. 135-158

[56] Clarke V, Braun V. Thematic analysis. In: Encyclopedia of Quality of Life and Well-Being Research. Springer; 2014. pp. 6626-6628

Chapter 5

Aligning Human Resource Management with Knowledge Management for Better Organizational Performance: How Human Resource Practices Support Knowledge Management Strategies?

Hadi El-Farr and Rezvan Hosseingholizadeh

Abstract

Contributing to the HR-approach to knowledge management (KM), this chapter aims at outlining the role of human resource management (HRM) in supporting KM through utilizing the theoretical and empirical literature. The article is divided into two sections. The first section presents various knowledge concepts, KM perspectives and KM strategies. This section ends up by linking these topics in a KM sequential model which helps us to track the philosophical underpinnings and perspectives of each KM strategy. The second section investigates various HR orientations and HR practices and situates their differing contextual characteristics under each KM strategy. It aligns various HR practices with different KM strategies; suggesting that HRM is most effective as a combination of practices that are consistent and sharpened in supporting each KM strategy, which is part of the organizational strategy. The debated practices are recruitment and selection, compensation management, training and development, performance management, retention management and career management. Each of those practices is speculated to alter based on the chosen KM strategy; presenting a framework that is useful for practitioners and academics alike. The review ends up by identifying some research gaps and opportunities to be carried out in future studies. Those research gaps, if addressed, will extend our understanding of KM and the supporting role HRM.

Keywords: knowledge management, human resource management, organizational strategy

1. Introduction

In the knowledge economy, knowledge is recognized as the major source of wealth production, and managing knowledge effectively and efficiently is considered to be a key success factor to gain sustainable competitive advantage for organizations [1–3]. Notably, competitive advantage is increasingly based on the successful application, leverage and creation of knowledge—especially knowledge embedded

in human assets. Managing knowledge effectively is as a significant factor in innovating faster and better than competitors [4–6]. Human resource management (HRM) practices—major contributor to organizations' competitive advantage—should be utilized to manage organizational human assets through facilitating the development of competencies that generate organizational knowledge [4, 5, 7–9]. Ananthram et al. [3] suggested that a new paradigm of HRM is evolving towards "strategic human assets" theory in pursuit of firm global competitive advantage. This paradigm is built on two pillars: strategic agility and knowledge management (KM). However, much of the literature of KM continues to reflect a techno-centric focus, similar to that of information management, which in essence regards knowledge as an entity that can be captured, manipulated and leveraged. This is a limited and ultimately hazardous perception [4]. It is widely accepted that "it is not technology, but the art of human- and humane-management" that is the continuing challenge for executives [5]. In this regard, Gloet [4] illustrated a revitalization of the HRM function to respond to the demands of the knowledge economy, looking both within and outside the organization. The traditional focus on managing people has been broadened to managing organizational capabilities, relationships, learning and knowledge. Banerjee [6] also believes that we must look beyond human capital to a more sustainable and holistic view of individuals; suggesting the term "sustainable human capital" that moves away from the traditional view of human capital.

The collective knowledge of human expertise through their abilities, experience and interaction with the individual's environment has become such a critical resource to reinvest [1]. It is important that knowledge is viewed as a social creation emerging at the interface between people and information, especially within communities engaged in communication, knowledge-creation, and knowledge-sharing and learning [4]. The most crucial point about HRM is that people and their interpersonal relations become and are treated as resources [10]. The success of strategic HRM in the knowledge economy also depends on its ability to harness the hidden potential in the informal social architecture, including tacit knowledge, co-operation and informal learning [5].

HRM and KM are two people-centered concepts focusing on using, sharing and creating knowledge [5, 8]. Mainly, knowledge cannot be managed in the void—without people—and vice versa [10]. As Thite [5] identified some key HR strategies for effective people-centric partnership in KM, namely, trusting HR philosophy, institutionalizing learning to learn, and fine-tuning HR systems in recruitment, retention, performance and reward management [5]. Most researchers suggest that KM can be interpreted as a form of HRM. In particular, HRM supports employees in creating and managing knowledge through the sharing of ideas, opinions and experiences [8].

Successful businesses demand high-performing HRM practices and effective KM capacity. Those are two complementary processes and interdependent constructs in the theory of knowledge-based view of the firm as they have a direct link with strategic management and strategic HRM [3, 8]. At the firm-level, the theory suggests that organizations must make investments in developing the human capital of their workforce in order to increase firm performance [6]. Svetlik and Stavrou-Costea [10] demonstrate the benefits of using an integrative approach between HRM and KM, where one reinforces and supports the other in enhancing organizational effectiveness and performance. Gope et al. [8] argue that HRM practices can improve management process at the organizational level by increasing employees' skills and abilities, influencing their behavior and attitudes and increasing their motivation and learning capacity, and through facilitating the development of competencies. Specifically, the contribution of HRM to KM is at the high end of the value chain as it primarily creates and sustains a culture that fosters innovation,

creativity and learning [5]. A collection of research articles explores how HRM and KM are interrelated and provide empirical support for such a connection, and many will be highlighted in this review. The implicit assumption is that HRM and KM should still come closer together.

To this end, this chapter examines developments in research on KM and HRM linkage and then seeks to elaborate on their implications for practice. The chapter is structured as follows, a background to conceptualization, approaches and strategies of KM, and then the role of HRM in supporting various KM strategies.

2. Knowledge and knowledge management

In order to understand KM, the underpinning idea of the knowledge concept needs to be examined and understood, as differing perceptions of knowledge tend to shape the various KM perspectives. Broadly, the knowledge concept is debated among two main groups: objectivists and those who adopt "epistemology of practice" [11]. This categorization in Ryle (1963), cited in Nilsson and Ellström [12], is referred to as a "theoretical component" and a "practical component". Objectivists view knowledge as an object that can be referred to as declarative, propositional or codified knowledge and can be managed separately. Objectivists classify knowledge into various types and provide models of how to manage their interactions and transformations. The most popular categorization is the differentiation between explicit and tacit knowledge, for example, see [13]. Another common labeling is concerned with where knowledge is situated. It differentiates between personal and organizational knowledge. Organizational knowledge is infused in the organization itself, whether systematically through procedures or unsystematically through culture [14]. Their main philosophical approach is dualism, which depends on classifications, taxonomies and contingencies [15].

Alternatively, members of the "epistemology of practice" propose that knowledge is tacit in nature and is unlikely to be transformed fully into explicit knowledge. Practical knowledge or "know-how" is associated with experience, is implicit or expressed only in practice, and is thus inseparable from actions [12, 15]. Even if tacit knowledge was partially transformed into explicit knowledge, it will unavoidably contain tacit aspects. Moreover, even if employees are willing to express the knowledge they are in possession of, the likelihood is that they know more than they initially realize. In this sense, knowledge cannot be perceived as a separate object from the knower. "Epistemology of practice" follows a duality philosophy that depends upon structurational models, theories of practice and pragmatism [15]. The most important factor here is the personal nature of tacit knowledge, which requires the willingness, on the part of those workers who possess it, to share and communicate it [16].

Differing perspectives of what knowledge is lead to differing KM formulations. Reviewing existent various KM definitions and categorizing them based on defining the nature of knowledge, reflects the basic assumption of two paradigms that have been labeled differently. These two paradigms can be illustrated in a continuum with a range from IT-based/Hard/Calculative/Mechanistic/Scientific paradigm to a Social/Organic/Soft/Humanistic one. In reality, juncture and co-proximity orientations of each paradigm stem from ontological and epistemological assumptions on KM's nature [17]. Those two paradigms lead to two KM approaches/perspective. The first is IT-focused, where organizations approach KM in a mechanistic, systematic and techno-centric way to enhance knowledge integration and creation [2, 17]. The second is HR-focused, where firms' orientation to KM is more ecological-focused and people-centric, aiming to increase employee interaction and to flourish employee behaviors and an organizational culture that enhances KM activities such as knowledge sharing and creation [2, 17].

The IT perspective perceives KM as a process to store information into databases logically and make knowledge accessible [11, 18]. With this in mind, the main KM goal here could be seen as the codification of knowledge. This codification step is believed to minimize the risk of knowledge loss and maximize knowledge sharing, protection and utilization. A major criticism of IT usage in this context is that it deals with knowledge as information, i.e., it separates it from the knower. However, even if this could be considered "doable," there are still other factors to be considered. The "interpretive flexibility" symptom is one of these factors and is a symptom that reveals itself when an employee is contributing or interpreting information.

In contrast, the HR perspective emphasizes the point that IT solutions are information providers only. They are considered to lack comprehension, be vulnerable and not to encourage trust and loyalty among the workforce of a company. The quintessence of the HR perspective is based on interaction, networking, direct tacit knowledge-sharing and building a knowledge-sharing/creating culture [19]. Knowledge-intensive organizations need to develop a culture that promotes organizational learning; that encourages innovation and the development of novel systems and processes, products and services [20].

KM approaches take an organizational focus in order to optimize organization design and workflows [2]. The approach and perspective to KM can be considered essential to forming a KM strategy. Decision makers' attitude towards the knowledge concept, KM perspective and their managerial philosophy translates into a KM strategy. Alignment between organizational, HRM and KM strategies is a key element for organizational management in the knowledge era [7]. So, in order to operationalize KM into a strategy, we need to understand how organizations view KM.

The predominant view among academics and practitioners seems to be that KM is a "process"; a set of interrelated activities that should be facilitated—mainly through informal mechanisms that are supported by leadership styles and organizational practices, for example, see [15]. The process aims to make the maximum use of knowledge existent within organizations. Hosseingholizadeh [17] on the base of reviewing 32 KM models, found that nine main components (core knowledge activities) that can be viewed as a process of KM. Those are goal setting and knowledge identification, creation, acquisition, evaluation, organization, preservation, retention and update, sharing, application, and finally KM effectiveness evaluation. She added that this process-based approach is vital to improving knowledge work activities.

Following the IT and HR perspectives, Hansen et al. [21] proposed two main strategies: codification and personalization, respectively. Each stresses various KM activities and their interrelations and management.

Codification aims at codifying and storing knowledge with a high dependency on IT for further reuse. Its competitiveness lies in the ability to deliver fast, reliable and high-quality solutions, which are usually mature services and competitively priced [21]. Personalization refers to the development of tacit knowledge that is based on employee insights, intuition and personal skills for solving complex problems. Such knowledge is mainly shared through direct person-to-person contacts. Dialogs, learning histories and communities of practice are among the techniques that have to be used in order to facilitate tacit knowledge sharing. Personalization and explorative learning are closely related, where explorative learning is associated with complex search, basic research, innovation, risk-taking and more relaxed controls. The stress is on flexibility, investment in learning and the creation of new capabilities [22]. Personalization competitive advantage is creativity and innovation in supplying unique and customized services that can be priced at high-profit margins [21].

Hansen et al. [21] highlighted that the two strategies differ in addressing the competitive strategy, economic models, IT and HR. This account stresses the need for the best fit between HRM practices an organization's approach to managing knowledge work [22]. Realizing that, in reality, organizations usually use a combination of the two strategies, Hansen et al. [21] argued that one strategy will be used to a greater extent whilst the other one is relegated to a more supportive role. They claimed that one should be stressed or else the KM strategy's focus will be confusing and will lead to failure and inconsistency with the organizational strategy. The codification strategy and low-cost strategy, for instance, both focus on effectiveness, lowering cost and standardization. The combined KM and general strategy of this kind are called exploitative strategy. Similarly, personalization strategy and differentiation center on new capabilities, innovation and new ways of working. This kind of KM and general strategy is termed as an explorative strategy [22]. Both strategies have the capacity to be successful, if the correct strategy is chosen according to the organizational situation.

However, many scholars criticized Hansen et al. [21] claim that either personalization or codification should be dominant. For example, Edwards et al. [23] found that many practitioners believe that a combination of both strategies should be utilized and should be considered to be of equal importance. Support for the latter observations is visible in a socio-technical approach laid down by Pan and Scarbrough [24], who suggested a multi-layered interaction model for KM. The model takes into account the following facets: infrastructure, info-structure and info-culture.

Based on previous discussions, it can be deduced that there is a logical sequence that links knowledge concepts, KM perspectives and KM strategies (see **Figure 1**). If a particular person favors the objectivist approach, then ultimately the KM aspect aims at transforming tacit and personal knowledge into explicit and organizational knowledge. Following on from this, the IT approach is adopted, with the eventual use of the codification strategy. Alternatively, if the decision makers are supporters of the "epistemology of practice" philosophy, then they believe that knowledge

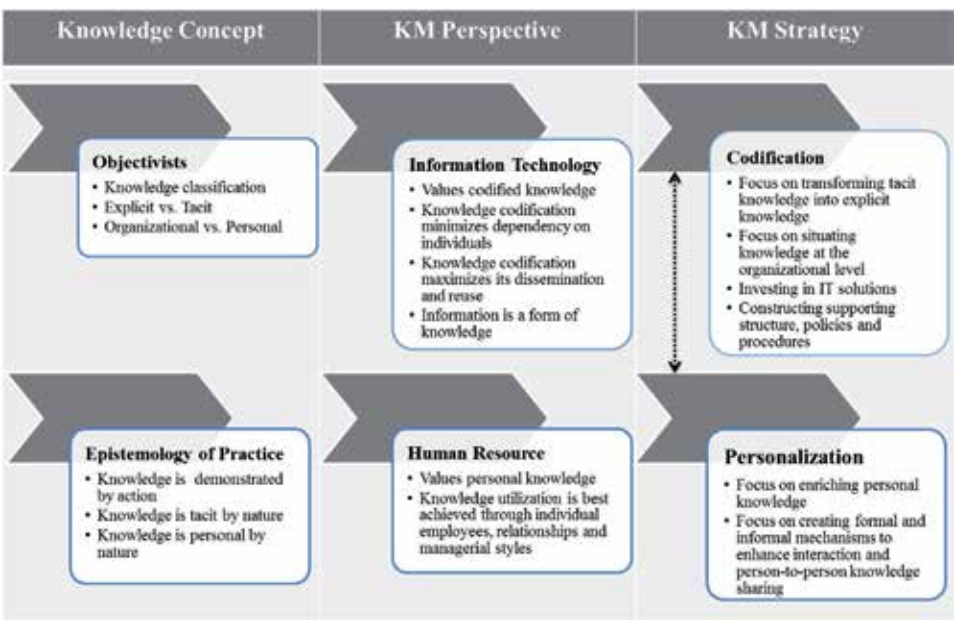


Figure 1.
The knowledge management sequential model.

exists within individuals and is tacit in nature. The decision makers are then likely to support an HR-based approach to KM with an underpinning personalization strategy. It has been noted, however, that these two approaches are not mutually exclusive and completely independent of one another. Alternatively, Edwards et al. [23] suggested a combination strategy; where opposing perspectives and strategies are held on an equal footing. It then follows that if the premise of this approach is followed then the debate concerning the knowledge concept is of less concern.

3. Human resource management and knowledge management: a review of extant literature

Knowledge as an asset and KM as a process has received considerable attention in the strategic management and strategic HRM-literature, as a means to attain competitive business advantage [3]. KM's effectiveness often depends on HRM processes and on the quality of management's strategic alignment (organization, people and knowledge). HRM must be analyzed as a factor influencing KM implementation [7]. From the strategic HRM perspective, a set of integrative HR practices that support a firm's strategy produce a sustainable competitive advantage. Human capital (skills, knowledge and behaviors) and organizational capital (routine, systems, tacit knowledge) are the most cited resources in the resource-based view literature, which are gained over time and make it difficult for competitors to interpret and imitate [25].

HRM is understood here as a set of policies, practices and systems that influence behaviors, attitudes and performance of organizational members, aiming to increase their competitiveness and learning capacity, to the extent of creating a culture of learning. For example, Gope et al. [8] found that HRM practices, which enhance individual learning, motivation and retention of employees with an intention to boost knowledge-acquisition and knowledge-sharing, improve organizational performance. Their findings also showed that the traditional roles of HRM practices are evolving to support the achievement of talent management goals such as talent identification, talent development and talent engagement. As suggested by Bontis and Serenko [26], employees' capabilities depend on their training and development as well as job satisfaction levels. Arunprasad [25] noted that strategic HRM practices are significantly and positively related to learning outcomes. For instance, staffing and performance evaluation are the factors that significantly contributed to learning dynamics in software firms. Therefore, according to Theriou and Chatzoglou [16], firms pursuing best HRM practices achieve higher performance through designing HR practices that support KM and organizational learning capability, and in return, the creation of organizational capabilities. It is suggested that best HRM practices are not only related directly to organizational capability, but also indirectly related to the processes of organizational learning capability and KM. In fact, HRM acquires a key role in potentiating and facilitating both KM and learning processes [7]. Thus, if HRM is about managing people effectively and if people's most valuable resource is knowledge, then HRM and KM are closely interrelated [10].

Studies of an alternative point of views have examined the type and quality of HRM and KM linkages. It is widely accepted that HRM is not KM [27]. For example, Teece (2000), cited in Svetlik and Stavrou-Costea [10], argues that KM is more multifaceted than HRM because it involves managing intellectual property rights and the development and transfer of individual and organizational know-how. However, Svetlik and Stavrou-Costea [10] stated that HRM and KM share common activities, goals and strategies when creating work units, teams, cross-functional

cooperation, as well as communication flows and networks inside the organization and across its borders. They proposed an integrative approach between KM and HRM, so that if we compare the KM cycle with HRM processes, we will find that various activities are shared between both.

The literature has for a long time supported the claim that employees are the most important organizational asset, especially when it comes to achieving an effective KM process [12, 22, 27, 28]. Employees are the vehicles for knowledge creation, sharing and implementation. Nilsson and Ellström [12] emphasized that the general organizational success is increasingly associated with identifying, recruiting, managing, and retaining high performers or talented individuals to meet the present and future demands of an organization. Therefore, the core purpose of the HR function is to develop, select and hire people, train and develop the staff, evaluate their performance, reward them and create a culture of learning to support and achieve the business strategy [22]. In fact, human capital advantage stems from having more capable people than the competition [29]. Shaw et al. [30] argue that human capital can meet the criteria of sustained advantage, when HRM investments are aimed at increasing the knowledge and skills of the workforce and also to tightly integrate the human capital.

Therefore, HRM activities, such as recruitment and selection, education and training, performance management and reward systems, are essential for managing knowledge properly [28] and contribute instrumentally to improving the knowledge flow, i.e., acquisition, transfer and its integration in the organization [7]. Zhou et al. [31] found that several HRM practices (namely, internal communication, training and performance appraisals) play an important role in helping firms to build absorptive capacity and to enhance knowledge transfer during mergers and acquisitions. Knowledge sharing practices must be integrated into strategic business objectives, human resources practices, and the organization's culture so as to encourage and support on-going collaborative behavior [32].

Some scholars have highlighted recently "Knowledge-based HRM" including those HRM practices purposefully designed to enhance knowledge processes within an organization [33] with the need to reposition its functions, orienting them towards strategic capacities of knowledge. That is to manage knowledge workers, to construct a value from knowledge and to assess the risk of knowledge loss [7]. For instance, Hussinki et al. [34] divided HRM practices into several categories such as heterogeneous workgroups and brainstorming commitment-based HR practices (e.g., employee empowerment and career development) and knowledge-based (e.g., recruiting, professional development, and employee retention).

Broadly speaking, HRM should be aligned with KM and organizational strategies, especially as there is a positive relationship between HRM and those of performance and innovation [21, 35, 36]. HR policies should also be evaluated on their ability to foster the application of personal knowledge for the benefit of the firm. Gourlay [37] added that the employees' willingness to cooperate with KM initiatives is likely to be dependent on HRM policies and procedures. Moreover, Kase and Zupan [35] commented that the performance of HRM should be linked with learning, innovation and intellectual capital. It should focus on building social capital and knowledge networks. An advantage of using HRM is that it is built through the maintenance and development of human capital and organizational processes. This gives it a major role in managing social networks, which are essential in transferring tacit knowledge. Hosseingholizadeh et al. [38] added that HR practices have a vital role in supporting knowledge-work within organizations, especially that they empirically confirmed that motivation, ability and the opportunity provided to knowledge-workers influence knowledge application, sharing and creation. HR practices should focus mainly on enhancing employees' ability and motivation for them to contribute individually to KM activities.

Some scholars have stated previously that the HR section in an organization is the one best equipped to handle KM initiatives due to the fact that the activities of the department itself do not directly conflict with the KM initiatives [39]. However, whether or not the HR section is chosen to undertake this role is based on the performance of the department, i.e., the better it performs, the more trust is generated within the organization and the more likely it is to be chosen as the best candidate to roll out KM initiatives [40]. It should also be borne in mind that HRM practices are not exclusively actioned by the HR department per se; top, medium and line managers are highly involved in HR practices as well. This leads to the assumption that, even if HR departments are assigned to play a leading role in KM, strong results are not expected exclusively from them [19].

HRM at its strategic and functional levels should be aligned with organizational and KM strategies and practices. The personalization approach usually aids decentralized, explorative and double-loop learning along with organic organizational strategies. This is different from the codification approach, which aids to a greater extent centralized, exploitative and single-loop learning along with standardization strategies [22, 41]. HRM practices in an organization are adjusted in line with which approach is adopted. In the literature, it is not clear exactly how the combination approach, when used, handles the different KM approaches and organizational strategies in the context of translating their goals into HRM practicalities. Thus, the chapter focuses on the personalization and codification strategies while assigning the contextual HR practices under each strategy.

To understand the overall effect HRM practices can have, it is best to view them in combinations [41]. Horwitz et al. [42] stated that HRM practices should be aligned with HRM, KM and organizational strategies but also noted that other organizational factors could also be considered to influence the development of HRM practices. These factors could be the size and nature of the industry, the organizational characteristics of a firm and the ownership structure of a firm, along with cross-cultural factors and cultural differences. The competitiveness of human capital has also been claimed to have an effect on the selection of HRM practices, which inevitably goes on to affect KM [43].

In short, various HRM practices do have a noticeable effect on KM [36, 40, 44–46]. There are, of course, numerous HRM practices that exist in current literature; however, only six HR practices that have been discussed in depth in previous literature are analyzed in this article. These six HR practices are: recruitment and selection, compensation management, training and development, performance management, retention management and career management. Although each will be discussed separately, the alignment of each practice with others under each KM strategy is highlighted in **Table 1**. In this study, according to Kianto et al. [33], traditional HRM practices have seen from a knowledge-based perspective and integrated with KM. The nature of these practices is outlined in the following sections.

3.1 Knowledge-based recruitment and selection

Constantly new and changing demands in the world of work create challenges for HR professionals attempting to identify and develop relevant talent. However, the identification and development of talent have generally been based on a technical rational perspective that is driven from labor economics [12]. But, it seems that traditional recruitment and selection practices can block knowledge sharing between groups or departments in firms organized according to the functional principle [22]. In a knowledge-intensive labor market, it is increasingly difficult to assess the competence of individuals in relation to the requirements of specific jobs [12].

	Codification	**Personalization**
HRM	Alignment with the codification and organizational strategies Focus on retrieving and contributing to explicit knowledge Focus on short-term contributions Catering for centralization, exploitative, single-loop learning and standardization strategies	Alignment with the personalization and organizational strategies Focus on knowledge sharing and creation and innovation Focus on the short-term, medium-term and long-term contributions Catering to decentralization, explorative, double-loop learning and organic strategies
Recruitment and selection	Limited sets of skills and experience for most new recruits with a focus to fill "job vacancies" Highly qualified "key employees" with demonstrated technical knowledge The tendency towards seeking a cultural fit	Focus on filling "knowledge gaps" Highly qualified new recruits with knowledge depth and breadth, ability to learn and willingness to share knowledge The tendency towards achieving a flexible and diversified culture
Compensation management	Individual incentives Extrinsic rewards Short-term incentives	Both individual and group incentives Intrinsic rewards are primary while extrinsic ones should satisfy Both short-term and long-term incentives
Training and development	For most, training subjects are limited to procedural knowledge and IT skills needed to accomplish current tasks Formal T&D Internal T&D Structured T&D	Training subjects are diversified and address technical and interpersonal skills needed for current and future tasks The training aims to strengthen the depth and breadth of knowledge embedded in employees Informal T&D is primary and formal T&D is secondary Both internal and external T&D Unstructured T&D is primary and structured T&D is secondary
Performance management	Focus on basic business and IT knowledge Focus on individual performance Utilized to identify underperformers Underperformers face a high risk of dismissal	Focus on the breadth and depth of knowledge/skills/competencies Focus on individual and group performance Utilized to locate the knowledge gaps and to form personal development plans Underperformers are tolerated
Retention management	Low retention rates Retention plan focuses on a few key experts Knowledge-retention orientation through codification	High retention rates People-retention orientation Direct knowledge-sharing between leavers and successors
Career management	Limited progress for most employees Rare hierarchal and lateral movements	Promotion is encouraged and, at many organizations, it is a must Dual career ladders Early lateral movements Potential shortage in managerial skills due to emphasizing technical career ladders

Table 1.
The role of HRM in supporting various KM strategies.

The recruitment and selection process are what provide the input of human capital. From a KM standpoint, recruitment and selection should aim at filling knowledge gaps, which allows an organization to adopt a more flexible approach, as opposed to simply "filling jobs" [47]. The aim of the recruitment process is to attract, obtain and create knowledge [42]. Moreover, Arunprasad [25] found that staffing is a significant factor contributing to the learning dynamics and innovation within firms—both at the individual and group levels.

Firstly, within the personalization strategy, knowledge workers' essential abilities and skills required for efficient KM, which are: a commitment to learn and develop, creativity, the ability to deal with complexity, adaptability and cooperation [33, 47]. Smith [36] added to this list lateral and visionary thinking, demonstrated skills and abilities, resilience, the capacity to be a team player and a willingness to share accrued knowledge. Further to this, Robertson and Hammersley [48] identified high specialization, knowledge in other disciplines, commercial awareness and innovative ability as strong characteristics on which to base a recruitment decision. Narasimha [49] also stressed demonstrated depth and breadth of knowledge as being important. Taylor [50] stated that new recruits must also have altruistic behavior. Arunprasad [25] observed that selection criteria of new recruits test for learning ability of individuals, decision-making approach, a desire to share tacit knowledge and readiness to take additional responsibility. In addition to the aforementioned abilities and competencies, it could be argued that the higher the occupation level recruited for under the personalization strategy, the more the hiring decision accounts for the intensity of industry experience and the demonstrated depth and breadth of specific bodies of knowledge. In short, knowledge-based recruitment involves a strong and explicit focus on choosing candidates with relevant knowledge, learning and networking capabilities [33].

As for the process of recruitment and selection under a codification strategy, most new recruits target to fill vacancies at the entry-level positions. Hansen et al. [21], stipulates that new recruits—at junior levels—need limited specialized knowledge for their employment as their job description is mainly concerned with extracting knowledge from databases. Accordingly, the selection decision focuses on the candidates' abilities and skills to effectively utilize codified knowledge, to abide by preset work processes and procedures and to be productive within a short time frame after joining the organization. However, when it comes to the few experts that organizations depend on to design products and services, formulate work processes and procedures and ensure customer satisfaction, the selection processes focus on their demonstrated experience and depth of knowledge that could be directly exploited after joining the firm. Consistently, an effective selection is vital to acquire new knowledge and increase innovation for top key employees in the hotel industry [51]. That said, they found that this is not true for low-skill workers; where recruiting them will not have a significant effect on increasing the human capital. Firms which adopt the codification strategy, the development of technological solutions is encouraged, particularly in electronic recruitment and psychometric testing [22, 52]. Therefore, based on the preceding analysis of required KSAs under each strategy, it could be argued that the recruitment and selection process is more stringent for companies that adopt a personalization strategy as opposed to those that adopt a codification strategy.

Another major debate in relation to the recruitment and selection process is concerned with so-called "cultural fitness." Studies highlight the importance of a fit between new recruits and the organization's knowledge culture. They stress a fit between organizational culture and hiring of suitable personalities, as well as the socialization of individuals into the culture of the firm [22]. Others emphasized the need to select individuals capable of adapting to different cultures rather than

fitting an existing culture [47]. The logic behind this thinking is that the organizational culture of a firm may change in essence over time, rather than remaining fixed and static. Furthermore, Currie and Kerrin [53] placed emphasis on the importance of new employees having a good level of general business knowledge rather than simply having the functional skills required for the role, the reason being that employees with good general business knowledge can more effectively "bridge" the cultural gap between organizational entities. To present a different point of view, Kase and Zupan [35] emphasized the importance of recruitment and selection in being able to find people who fit the organizational culture and support knowledge networks. This "cultural fit" perspective was criticized due to the potential risk of duplicating employee skills, which in turn could limit the ability of newly recruited employees to contribute their new skills to the knowledge base of the company [47]. It may be hypothesized from the literature that the "cultural fit" approach to recruitment is more suitable for companies that adopt the codification approach to KM, whilst recruiting employees who embody cultural diversity and flexibility would be better suited to companies that adopt the personalization approach to KM. Thus, the recruitment process for all the companies considers the level of fit between the individual and the organizational culture. This influences the cultural aspects of the socialization process of individuals within the organization, as well as encourages and supports the interchange of knowledge among the old and new members [8].

Adding to the work of Hansen et al. [21], Haesli and Boxall [19] highlighted that the organizations that adopt the codification strategy to KM suffer from a relatively higher labor turnover than those that follow the personalization strategy. So, to maintain a level of staff necessary to sustain the organization, a large portion of the duties undertaken in the HRM department will be based around the recruitment and replacement of people to fill the natural vacancies caused by high staff turnover. The working environment in a company also tends to repress the full range of skills an employee possesses. This is due to the fact that there are often few opportunities to utilize such skills, as these types of companies often have an expected dependency on IT and existing information and solutions. These kinds of companies, however, do tend to exhibit a higher level of overall HR spending due to the relatively larger expense of training and recruiting new employees along with having to live with reduced productivity during the induction periods of new recruits. Gope et al. [8] found that most of the companies tend to focus on the use of employment agencies to recruit talented employees and introduce new knowledge into the company. However, also the internal recruitment process is adopted, mainly for promotions and change of positions.

3.2 Knowledge-based compensation and rewards management

Arguably, compensation management acts as an effective tool to motivate employees to acquire, use, share, transfer and create knowledge [33, 36, 39]. Compensation management system should recognize innovation, risk-taking and group collaboration [46]. Furthermore, some scholars have suggested that relative compensation should also be based on contribution, knowledge and skills without sole emphasis on hierarchical position, i.e., taking into account teamwork and flexibility rather than functional and individual measures [54, 55]. Despres and Hiltrop [54] added that rewards should be engineered based on employees' perceptions and not those of managers, with proper justification and communication.

One of the main arguments in this area is focused on whether individual or group incentives should be utilized as a source of motivation to stimulate KM activities. Kase and Zupan [35] stressed the importance of group incentives, arguing that they

encourage network cohesion. Yet, they also acknowledge the importance of all incentive levels being included in the overall compensation of individuals. Laursen and Mahnke [41] state that individual incentives serve to underline the strong performance of individual employees when carrying out personal tasks. Yet, they also stress that the process of allocating individual incentives should be reliably measured or the process could be viewed as being complicated and lacking in fairness. Siemsen et al. [56] graded compensation management based on inter-employee linkages within workgroups. These gradings can be categorized under three group headings: outcome, help and knowledge linkages. The first group, outcome, tends to emphasize the coordination of the group whilst the latter two promote cooperation. They found that if employees are "outcome-linked" then individual incentives were found to work best; however, if the employees are reliant on helping each other (or "help-linked") within the group to complete the goal, then group incentives produce an optimal result. When employees are knowledge-linked then both individual and group incentives are considered vital and complementary. Individual incentives are important in encouraging an employee to put his/her acquired knowledge into use, while the group incentives encourage possessors to share their knowledge. Siemsen et al. [56] made similar findings that add to Taylor's [50] contribution in which he found that group-based incentives promote a greater degree of co-operation between employees. Moreover, Quigley et al. [57] found that group incentives are stronger in promoting knowledge sharing from the provider perspective when supported by organizational norms.

Therefore, whenever tasks are interrelated, group incentives are perceived as a better choice of compensatory measure for employees. This holds true whenever the standardization level is low and the output process is complex. Another potential drawback to individual incentives is that they limit potential knowledge and information sharing, i.e., they create an atmosphere of secrecy. When individual incentives are used by organizations, they tend to be used to reward the achievement of personal and short-term goals. Overall knowledge creation and the achievement of long-term objectives are rewarded through group incentives. Thus, the literature indicates that group incentives are more suitable than individual ones when interaction and direct tacit knowledge sharing are required. In this fashion, group incentives then seem to serve companies that adopt personalization strategies the best; however, individual incentives are not wholly excluded: rather they are relegated to playing a secondary role. If individual incentives were dominant in this type of organization, then employees would be encouraged to push for an outcome favorable to themselves as opposed to pursuing the group goal. For companies with a codification-based strategy, personal incentives are more commonplace. This is due to the fact that interaction between employees is less necessary to the company goal and personal effort in extracting explicit knowledge is considered more essential.

Another issue related to compensation management is whether intrinsic rewards, extrinsic rewards or a combination of the two should be given to personnel completing KM-based tasks. For this circumstance, it seems that the characteristics of personnel described in knowledge worker-based literature are in alignment with those described in the literature published about the personalization strategy. Smith [36] claimed that knowledge workers value nonfinancial incentives more than financial ones. Consistently, Zhou et al. [31] found that performance-based compensation (extrinsic) has an insignificant effect in supporting absorptive capacity and knowledge transfer in mergers and acquisitions. Additionally, Despres and Hiltrop [54] suggested that effective compensation systems during the knowledge economy era should place emphasis on social and intrinsic needs rather than extrinsic needs (which should be regarded as secondary). Not underestimating extrinsic motivators, Hosseingholizadeh et al. [38] empirically demonstrated that intrinsic motivators have much more influence on knowledge-work than extrinsic motivators. Lee and Ahn [58], in addition to

this, argued that intrinsic rewards tend to support the vision of a company that holds a personalization-based approach, whilst formal extrinsic rewards tend to support the vision of a company that holds a codification-based approach.

Whereas Vicere [59] stressed that knowledge workers should be paid fairly and mostly want part of the organizational profit through methods of equity sharing. Gope et al. [8]' findings also stated employees are expected to repeat positive behavior in obtaining rewards and recognition by the company. Thus, the firms use compensation and rewards as tools to elicit, enhance and maintain the desired knowledge sharing behavior of employees.

Many scholars stated that compensation systems should strike a balance between intrinsic and extrinsic rewards, for each addresses a different "need" [39, 58]. Managers can use both tangible/financial (e.g., bonuses and one-off rewards) and intangible/nonfinancial incentives (e.g., status and recognition) to motivate employees to share, create and apply knowledge [33]. This is consistent with the practices of most companies, where this kind of rewarding system motivates and supports individual employee's performances through better learning and commitment that increase the motivation to share and create new knowledge, as already confirmed in other studies [8].

Another debate in this topic area is that concerning the use of short-term and long-term rewards. Many argue that using a combination of the two is the most favored method for companies, as the short-term rewards act as a direct motivator encouraging individual and group contributions, whilst long-term rewards are important for the retention of employees by rewarding them for long-term organizational performance [47]. Olomolaiye and Egbu [39] highlighted the importance of long-term incentives in the process of grouping key contributors with the organization. It can be hypothesized that short-term incentives would be utilized to a greater degree in the codification-based companies; however, both reward types seem important in personalization-based and combination-based companies.

3.3 Knowledge-based training and development

Training and development allow the employees of an organization to acquire and develop key skills that improve personal and organizational performance. The process itself is viewed by many scholars as being an effective HRM practice that aids the implementation of the KM strategy, activities and outcomes. HRM-related research on KM is chiefly focused on the transfer of knowledge by training [60]. Knowledge transfer concerns various forms of learning, the creation of a knowledge sharing climate, the establishment of training units which assess and analyze training needs, provide and evaluate training, and lead towards learning organizations [10]. Application of training is important to develop employees' learning capabilities and provide a common language and shared vision. This would develop a high level of self-efficacy so that employees may feel more assured of their abilities and will be more likely to exchange knowledge with others, thus fostering the acquisition of new knowledge and the dissemination of individual knowledge within the firm [8]. Training and development has a positive effect on increasing human capital and subsequently innovation within the hotel industry [51]. They argued that employee development tends to be much more effective than recruitment in increasing human capital. Similarly, Keat and Lin [61] found that talent development has a mediating effect between knowledge management and organizational performance in Malaysian private colleges. They added that employee development is more important than retention management, as their findings found no support that talent retention has a mediating factor between knowledge management and organizational performance.

To begin with, this section investigates the subjects of training under each KM strategy. Training subjects under personalization are more diverse than under codification and include subjects that strengthen employees' technical and interpersonal skills. Yahya and Goh [46] also declared that training should include some leadership skills and the ability to manage change as well as further training in the use of creativity, problem-solving skills and quality initiatives. Training is an important way of complementing the breadth and depth of knowledge that already exists in individuals in line with the KM strategy of the organization (which should identify the current competencies and the competencies that are desired in the future) [49]. Similarly, Kianto et al. [33] stated that knowledge-based training and development involve regularly developing the depth and breadth of employees' knowledge and expertise, personalizing training to fit particular needs and, finally, ensuring continuous employee development. In order to stay at the forefront of their professional fields they must be constantly aware of developments within their specific disciplines and professions and they need to participate in activities that offer opportunities to further their own professional development [22]. Smith [36] also added that developing a breadth of knowledge helps to create a strong general ability within employees, whilst developing a depth of knowledge produces employees with specialist knowledge. Training should be suggested as a means of focusing on growing the exploratory knowledge of employees instead of simply concentrating on developing traditional exploitative knowledge [36]. For skilled workers, providing team-based training, project-oriented training, on-the-job training, leadership development and other programs that are designed to improve quickly the employees' learning capability are vital [8].

On the other hand, the vast majority of training under a codification strategy is concerned with equipping employees with the technical skills that are needed for employees to be functional within their current role. The main training subjects focus on gaining procedural knowledge and enabling employees' to effectively utilize IT.

The training and development process is generally classified as being either formal or informal, with each classification contributing differently to KM. Brelade and Harman [47] saw formal training as an aid enabling employees who have the relevant skills to utilize information, create knowledge and work in teams. Smith [36] highlighted the importance of educating employees to enable them to understand the knowledge concept and the approach to knowledge that their company has adopted. This can be achieved by using awareness programs and by informing the employees within the company of new processes and procedures. The training should also include the appropriate usage of IT, and employees should know how and what knowledge should be located, extracted, used and shared. Moreover, as the mentors and coaches of employees, managers should be well trained especially when it comes to delivering feedback on how they can improve and foster creativity [59]. According to O'Neill and Adya [32], effective communication strategies by themselves are insufficient to transform employees into active knowledge workers. Managers must educate employees on how to share knowledge in ways that benefit the organization as well as their own careers. This necessitates familiarity with effective knowledge sharing practices, processes, and supporting technologies [32]. Direct training also involves building people skills such as networking, team building and effective communication.

As for informal training and development, Olomolaiye and Egbu [39] highlighted its importance in strengthening knowledge sharing and competencies such as through mentorship and on-the-job training. They suggested that employees should be involved in different teams, to help build their cooperation and knowledge-sharing capabilities, as an excellent informal training method. Alonderiene

et al. [62] stated that up to 70 or 90% of workplace learning takes place at an informal level. Kase and Zupan [35] also stressed that employees' skills can be developed strongly if they are moved between different workgroups to experience different working patterns. Filius et al. [44] also state that a high level of effective learning takes place when employees are involved in innovative projects. Smith [36] added that partnership working, peer assistance and a strong apprentice-mentor relationship all contribute to effective informal training. Cai et al. [63] found that informal network, not a formal one, has a significant impact on employees' performance. A study conducted by Manuti et al. [64] showed that communities of practice are effective learning spaces; beneficial for both individuals and organizations. From an individual perspective, communities could be beneficial in developing professional skills, a stronger sense of identity and finding continuity even during discontinuity and change. From an organizational perspective, communities of practice could help drive the strategy, start new lines of business, solve problems quickly and transfer best practices. Sprinkle and Urick [65] suggested that improved learning will occur in organizations that facilitate targeted socialization, respond to new preferences and trends in development programs while leveraging multiple approaches including informal/individualized initiatives (such as on-the-job education, mentorship programs), and embrace multiple types of volunteering activities.

The majority of literature that focuses on informal training tends to emphasize its role in building interaction, tacit knowledge sharing, creativity and innovation, which directly contribute to the goals of a company that has a personalization-based approach. Formal training is still important in an organization that has adopted this strategy type, but it tends to play a more secondary role. As for organizations that have a codification-based approach, the majority of the training is conducted formally and consists of the teaching of routine skills that are generally basic business- and IT-based.

Also, training can be classified as internal or external. Laursen and Mahnke [41] realized that internal training helps to form effective teams and develop strong team working. Internal training also aids in the externalization (converting tacit knowledge into explicit knowledge) and socialization (sharing tacit knowledge) phases in Nonaka's Socialization-Externalization-Combination-Internalization (SECI) model whilst external training strengthens the internalization phase (converting explicit knowledge into tacit knowledge). Both are essential for knowledge creation and sharing. External training can help employees to acquire new skills and learn about new technologies. However, the training is not usually firm-specific. Varying forms of internal training such as internal seminars and "on-the-job" training are seen to be of greater help in nurturing more company-specific knowledge. Kase and Zupan [35] also stated that internal training helps to build cohesive groups while external training helps to form intra-organizational and extra-organizational networks.

Firms adopting codification strategies tend to hire undergraduates and train them in groups to be implementers, i.e., to emphasize knowledge acquisition, manipulation, and storage, including the focus on technology [21, 52]. Personalization firms hire graduates to be inventors, i.e., to use their analytical and creative skills on unique business problems, and to share and disseminate knowledge [22]. In codification-based firms, employees are trained to achieve specific tasks that generally only need existing firm processes to achieve their goals; therefore, internal training is seen to be sufficient. However, personalization-based firms tend to emphasize knowledge creation and innovation, which often require both external and internal input. Consequently, the dual use of both internal and external training is seen to be favorable.

Moving onto a different aspect of training and development, Robertson and Hammersley [48] stated that training and development needs should be specified by the employees themselves due to the fact that they, more than anyone

else, should have an idea of their strengths and weaknesses. Employees should be trusted with their choices and consequently make it their own personal responsibility to integrate training activities into their schedule without interfering with their workload and productivity. A parallel view of this theory was found by Filius et al. [44], who noted that firms seem to prefer unstructured training. However, many scholars argue that such freedom offered to workers should be infrequent and training direction should be disseminated from the top of an organizational hierarchy downwards. There are also positive aspects to such structured training, which consist of the ability to build a common understanding of a workforce that helps lower "barriers" when developing a work culture. Bearing these factors in mind, it can be hypothesized that structured training best serves firms that have a codification-based approach. For firms that have an underpinning personalization-based strategy, unstructured training can act as a primary teaching tool, with structured training acting as a secondary training method.

3.4 Knowledge-based performance management

When compared with other HRM practices, performance management seems to have the strongest impact on the activity of knowledge sharing within an organization [53]. Criteria that are measured send a message to employees of what is valued in the organization; therefore, performance management can hinder or support KM activities within and across organizational agents. Hannula et al. [45] stressed the use of this practice in measuring various competencies, as it tends to be a strong indicator for assessing KM activities within a firm. Olomolaiye and Egbu [39] went one step further by stating that performance appraisal should measure its outcome in terms of knowledge sharing and not simply through inputs and processes. Yahya and Goh [46] also emphasized its importance in changing employees' behavior towards KM and also in highlighting the knowing-doing gap. The outcome of such an assessment should then act as an input to the KM process. Additionally, Arunprasad [25] found that performance evaluation, in addition to other HRM practices, contributes significantly to the organizational learning dynamics. He added that performance evaluation contributes to individual and team level learning, which is in line with some of the previous research conclusion.

That said, performance management systems can inhibit knowledge sharing. Along the performance management lines, Currie and Kerrin [53] recognized that varying company departments have differing performance management systems that tend to reflect an individual department's goal as opposed to a company one. This seems to have caused knowledge sharing to be stronger within the company departments but weakened from department to department. Consistently, Edvardsson [22] found that conflict between different functions can be due to the divergent objectives set out for employees in the performance agreements. In this circumstance, the focus should be given to long-term organizational goals such as learning rather than solely stressing the short-term targets set for departmental performance. O'Neill and Adya [32] stressed the need to involve managers to individually motivate workers to share knowledge, especially that knowledge-sharing as an activity tends to be intrinsically motivating to employees on their own and in the moment. Therefore, orientation coaching and mentoring should be provided by managers in addition to including knowledge sharing in performance appraisals.

Olomolaiye and Egbu [39] also argued that performance appraisal should stress intrinsic needs, teamwork and collaboration. Additionally, Brelade and Harman [47] were of the view that the assessment should include the acquisition of new skills and knowledge by an employee and how he or she has taken on new projects and responsibilities, contributed to a community or a team and participated in

developing others. Along similar lines, Narasimha [49] looked at the performance appraisal process as a measurement of innovation level and how an employee has sought to develop knowledge. However, Smith [36] raised the issue of complexity and difficulty in measuring intangible outcomes such as tacit knowledge sharing. That said, Kianto et al. [33] stressed that performance appraisal should focus on development and feedback, rather than taken as an evaluative tool only. Feedback helps to identify gaps between performance and targets.

One of the main outcomes of the appraisal process is the aim to reward employees who contribute positively to KM outcomes and activities. Reasonable failures should be tolerated in order to promote a culture of action and risk-taking [46]. In their case study on a knowledge-intensive organization, Robertson and Hammersley [48] realized that underperformers were endured due to the realization that the knowledge-creation process is inconsistent and unpredictable and holds the possibility that it may not succeed. Olomolaiye and Egbu [39] added that performance appraisal helps to allocate key knowledge holders, which then enables organizations to focus on the retention of those employees. However, all of these aims are based on healthy feedback from management, which requires a high level of specific training for managers on how to develop such skills.

Finally, performance management has been recognized by some as one of the strongest influences on KM as a whole. The topics of debate that have occurred in the literature about this subject can be summarized as follows: how and what is measured in the appraisal process, who should be rewarded and the process to deal with underperformers. In companies with a codification approach, performance management is all about measuring and improving known and expected tasks, which are based around an employee's ability to grasp and implement basic business and IT knowledge. Underperformers can be considered somewhat expendable and easily replaced due to the simple nature of the skills needed for the role. Also, within the codification strategy, efforts associated with systems and technologies are more likely to be recognized and rewarded. Inside such a paradigm, key performance is related to technology, technology application and the volume of data [22]. At the opposite end of the scale, a company with a personalization-based approach is concerned with the breadth and depth of an employee's skills and competencies. Underperformers are tolerated as the tasks they undertake can be considered as relatively more complex, mostly intangible and riskier. Moreover, the personalization paradigm focuses more on people, where key performance indicators are related to people and tacit forms of knowledge as well as the quality of data [22].

3.5 Knowledge-based retention management

Many scholars claim that organizations should value the high levels of tacit and personal knowledge that many people have, and it should be down to HRM to build effectively a good level of loyalty and retention rates [39]. Papa et al. [66] found that employee retention improves the effect of knowledge acquisition and innovation performance. They explained that employee retention increases employee commitment and trust, thus fostering knowledge specialization and fortification and creating an innovation culture. Moreover, employee retention increases knowledge retention and organizational knowledge base. Knowledge retention will even augment when benefiting from the employee knowledge-acquisition.

Developing the knowledge worker's organizational loyalty does appear to be more problematic because of labor market conditions, where the skills and knowledge of knowledge workers are typically relatively scarce, creates conditions for knowledge workers which are favorable to mobility. This is a potential problem because the knowledge possessed by knowledge workers is typically highly tacit [18].

Horwitz et al. [42] found that retention management was a useful tool for retaining organizational knowledge. They added that high retention rates help to protect the cultural fabric, competitive capability and intellectual capital of an organization. Moreover, Kase and Zupan [35] mentioned that, in certain networks, there are individuals who are placed in a central position that makes them essential for KM activities. With that in mind, effort should be made to retain, train and develop such personnel. This could require changing the HR strategy to an organization that is more learning-based. Studies on knowledge workers have found that they tend to have a high need for autonomy, significant drives for achievement, stronger identity and affiliation with a profession than a company, and a greater sense of self-direction. These characteristics make them likely to resist the authoritarian imposition of views, rules and structures [22].

Retention management is currently facing many challenges, one of which was raised by Young [67]—the aging workforce issue. This particular problem has been intensified because of increasing competition to attract younger employees and complications that have arisen from passing knowledge from one generation to another, as well a lack of age diversity in an organization [42]. Some of the solutions that have been suggested for knowledge retention in these circumstances are: the codification of retirees' knowledge, potentially offering them part-time or flex-time jobs, undertaking succession planning, making early identification of potential leaders for the organization and training them in mentoring programs and, finally, phased retirement options. Another issue is the higher turnover rates of knowledge workers. Knowledge workers have higher turnover rates that result in them costing 2.5 times more than other workers due to re-employment costs [42]. It has been noted though that the new generation, generally, tends to have less organizational loyalty [67].

Smith [36] suggested that retention management should be about retaining knowledge rather than people. For this purpose, some organizations have created formal knowledge-retention methods in order to capture the existing level of knowledge held by experienced personnel who are due to leave. Some firms conduct exit interviews and knowledge-capture sessions, while others opt for even more systematic and scheduled knowledge-retention approaches. The knowledge that is acquired by these means can be utilized to set up various beneficial company practices. However, the ability of organizations to transform tacit knowledge into explicit knowledge is still considered to be problematic and there are still many academics who question the effectiveness of using formal methods to capture tacit knowledge.

On the subject of why a company may have a high retention rate, the cause among some knowledge workers is a supportive working environment [48]. They state that recommendations should be made to companies to trust employees to manage their own time and tasks as well as offering them the freedom to choose the projects they are willing to work on based on their judgment of their own ability to contribute to a project. High retention rates could be achieved through motivating employees by using an incentive system that rewards the sharing of knowledge and provides recognition [42]. They added that job satisfaction is the result of a fair salary, the nature of work undertaken and future employability prospects along with good quality relationships with peers. Similarly, Gope et al. [8] found that many companies provide high professional training, career opportunity and high compensation packages to attract the employees and enhance their ability and motivation for acquiring knowledge. If the company succeeds to retain their employees, then the organization benefits from the knowledge embedded within them. Besides, the organizational and dynamic culture based on individual empowerment, reciprocal engagement and flexible benefit encourages employees to continue to work in the same organization. Accordingly, mixtures of rewards are needed to motivate knowledge workers. These include: equitable salary structures; profit-sharing or

equity-based rewards; a variety of employee benefits; flexibility over working time and location, as well as being given credit for significant pieces of work.

For many knowledge workers it is as motivating to have free time to work on knowledge-building projects, going to conferences or spending time on interesting projects, as monetary rewards [22]. Haesli and Boxall [19] realized, through empirical evidence that organizations that follow a personalization-based approach do tend to emphasize the retention of employees as a methodology for maintaining overall competency levels. The retention process can be achieved through understanding employees' particular needs and by meeting their expectations, engineering an adequate compensation system, providing challenging work and autonomy and linking payments to an individual's performance and capabilities. However, firms must be aware that retention is not the "be all and end all," i.e., complete focus must not be placed on only retaining personnel skills as recruiting new employees is still a powerful method of enriching the current body of knowledge in an organization.

Alvesson [68] managed to identify two forms of loyalty. The first is institutional loyalty, which is formed through the working culture, the social norms and supporting practices within a particular group or company. The second type of loyalty is called communication loyalty. It is formed by creating an identity for oneself through a group and by forming strong interpersonal relationships and sharing common interests. Both can be considered important; however, for the knowledge workers group, communication loyalty seems to act as a stronger retention factor. Additionally, Brelade and Harman [47] emphasized the importance of the psychological contract with an employee and the addressing of personal aspirations and lifestyle issues in relation to retaining knowledge workers. They added that knowledge workers are more inclined to leave due to the leadership and managerial styles exhibited in a company rather than salary issues.

Companies with a codification-based approach seem to be less concerned with employee retention, with the exception arising when it comes to keeping key experts who contribute to their explicit knowledge body. Companies that have a personalization-based approach place more value on personal and tacit knowledge and tend to be keener to engage in the struggle for high retention rates. In other words, codification-based companies tend to concentrate on pure knowledge retention whilst personalization-based companies place a greater emphasis on retaining people.

3.6 Knowledge-based career management

Career management is the personal and organizational responsibility for employee professional progression by increasing their knowledge base and allowing them to progress within the organizational hierarchy. The changing nature of work towards knowledge work has resulted in a major transition in the shape of careers and their management within organizations and novel approaches for the management of careers evolve, at both the individual and the organizational levels [69].

Many scholars emphasize that knowledge sharing is enabled through functional teams and individuals who act to decrease the potential barriers between different divisions or departments. Yet, such adjustments, especially when it comes to lateral movements that are needed to form such teams, are somewhat risky in nature, as there is a risk that some individuals may leave their organizations due to this situation [53]. The conscious choice of an employee to leave in this situation is down to their personal preference to stay within their expertise area. Examples of other causes may include fear of losing power and status, lack of awareness of potential benefits and lack of trust. So, it has been suggested that such movements should be

undertaken at the early stages of careers, so as to establish a "norm" within a career plan. This could potentially aid the new recruits from the outset, in forming their internal network and utilizing it as they progress later on.

Hansen et al. [21] suggested that different KM strategies require different methods of career management. Companies that have adopted the personalization approach like to promote upward movements: it is either "up or out" for some. Some scholars claim that knowledge workers have primary responsibility for their own career development [69]. Employee seen as especially valuable to the organization are developed more proactively by the organization and this often includes a stronger role for the organization in planning their careers and facilitating careers moves-now part of 'talent management' [70]. Along the same line, Gope et al. [8] revealed that companies encourage their employees towards self-choice career development and unhindered growth and provide them with flexibility and opportunities to enhance individual learning capabilities for creating new knowledge and sharing it in different functions and divisions. This is consistent with other studies on knowledge acquisition and knowledge sharing. Subsequently, some firms have created two hierarchies as a response to the personal career needs: a managerial hierarchy and an expert-oriented hierarchy. However, the increasing willingness of knowledge workers to stay in their domain of expertise mixed with the onset of increased organizational de-layering (which forces a reduction in the numbers of middle managers), there is a relative drought occurring of managerial talents that are needed to fill senior positions. Accordingly, firms are looking outside their own firms and recruiting externally to fill top managerial positions. This is increasing the personnel cost due to the labor market shortage and the decreasing retention rate.

This is at odds with a codification-based company, where progress is limited due to emphasis being placed on routine job roles [21]. Hierarchal movements are also limited for low-skilled employees. There is always difficulty in sparking interest in career progression in such mundane environments.

Overall, however, most scholars believe that career adjustments should always concentrate on involving KM roles and functions and then altering them to filling the knowledge gaps within the organization.

4. Discussion, recommendations and conclusions

The contributions made by this chapter can be separated into two major areas. The first contribution can be deemed as being the utilization of the KM Sequential Model to produce a logical link between various knowledge concepts, KM perspectives and KM strategies (**Figure 1**). The second contribution can be deemed as the suggestions made, based on the literature review, for the role of various HR practices in supporting different KM strategies (**Table 1**). The chapter suggests an alignment between HRM and its practices and various KM strategies. As many scholars have highlighted, in this study we proposed an integrative approach between KM and HRM, so that if we compare the KM cycle with HRM processes, we found that various activities are shared between both.

The constructed framework of HR practices under each KM strategy assumed that the practices should be consistent in order to best support the organizational strategy towards KM. Arguably, the HR strategy achieves its optimal supportive role by constructing a combination of practices that are consistent and complimentary in catering to the objectives set by the organizational strategy. However, in reality this might not be the case. HR strategies are subject to other forces such as organizational size, available resources, leadership climate, internal politics and power

structures, structural inertia and cultural considerations that might inhibit the alignment of HR practices with the identified KM strategies.

So far, the available literature on the role of HRM in supporting KM theoretically suggests a strong potential contribution for HR practices in implementing effective KM strategies. Various HRM practices were discussed and relationships made with KM activities, although the relationships mooted were mainly theoretical in nature or focusing on a few HR practices to empirically claim such a relationship. Due to the perceived novelty of this research field within HRM specifically and management studies in general, there are many contributions that have the potential to be made in this field. That being said, there is a definite niche for empirical research to be undertaken in this particular area. There is, of course, a probability that undiscovered gaps between theory and practice do indeed exist. Moreover, most of the studies focused on a few HR practices and not comprehensively covered HR practices in supporting KM strategies. Therefore, future empirical studies that look at HR practices as a combination in supporting KM are needed to claim the alignment of HR practices in supporting KM activities in practice and not only in theory.

A targeted empirical research effort is definitely needed to uncover the mechanisms that link HRM and KM and aid the deepening of our academic and practical understanding of the subject. Academically, empirical research will add to the available body of knowledge in the KM and HRM literature and allow amendments to be made to theoretical assumptions. Practically speaking, this effort would help to enforce KM initiatives within firms and it would assist in repositioning HRM in a more strategic position fit for tackling the knowledge economy era.

With the KM strategy and the implications it has for HRM, there is a debate regarding whether organizations should place emphasis on the personalization-based approach, the codification-based approach or a combination of the two. Although this argument may sound theoretical in nature, its empirical consequences are, nonetheless, important. Agreeing with Hansen et al. [21], the chapter indicates complications and inconsistencies when both a personalization strategy and a codification strategy are stressed. This is due to the differing—and sometimes contradictory—HRM practices suggested to support each strategy.

However, the suggestion put forth by Edwards et al. [23] is equally viable, based on a number of reasoning points. Firstly, both standpoints agree that a personalization approach and a codification approach coexist within a single organization, yet with different roles. They can either be rated as being of equal importance or as one method acting as a primary method with the other as a secondary method. Therefore, if Hansen et al. [21] are indeed right, then how can a supportive strategy be highlighted given that the firm places sole emphasis on its primary strategy? Secondly, although a combination approach may indicate an unclear strategic orientation within a company; this may actually be a reflection of the organizational complexity and the need to accommodate different strategies to serve various needs.

Nonetheless, the combination approach is tempting in that it sums up well the benefits of the personalization and the codification strategies. However, if it is practiced then empirical examinations are needed so its implementation mechanisms can be understood. In theory, the combination approach seems more inclined towards a personalization-based approach, with minor differences. So, it can be hypothesized that, within a combination strategy, the HRM and organizational practices of a company with a personalization approach would prevail over those of a company that has adopted the codification approach. Yet, how would contradictory practices be resolved in such a strategy? Also, the adoption of the combination strategy would raise issues, one being equality and fairness based on whether employees are treated differently within one firm.

Moreover, the literature focuses on debating and studying KM strategies at the organizational level. However, this might be a limited perception of reality. Different KM strategies might exist at various organizational levels. Thus, further research studying KM strategies at the intra-organizational level might be useful to address how knowledge is managed at various geographical locations, occupational levels, departments and practices. Subsequently, How HRM practices accommodate for various KM strategies within the same organization? Are HRM practices customized within organizations to support various strategies or are they standardized based on the holistic KM orientation at the organizational level.

Also, it is possible that both the HR and IT approaches within the same organization are weak and underdeveloped. Therefore, under such circumstances, how organizations manage their knowledge to ensure their output quality and quantity?

It is also interesting to further investigate the contextual characteristics under each KM strategy. Hansen et al. [21] focused on the competitive strategy, economic models, IT and HR. Other attributes such as the leadership style, culture type and organizational structure are some factors that might act as forces influencing the KM strategy formulation and implementation.

Another factor that future studies should focus on is the rise of artificial intelligence and its impact on KM and HR practices. It might be that the debate of either having a codification or personalization dominant strategy or the argument of having an equal-dominance coexistence of those strategies are obsolete. New KM strategies might emerge in organizations that highly depend on automation, artificial intelligence and big data, with a mass customization competitive advantage. For example, KM might be leaning towards a more partnership model between human capital and machines and software. Under such a strategy, what will be the role of HRM and how HR practices will be constructed? A parallel influence, related to the increasing embedment and dependence on technology within some organizations is the changing nature of the workplace and work arrangements. For example, the impact of the increasing trends of crowd-workers, virtual employees, teleworkers, dematerialization of workplace, etc., will definitely have an impact on KM and the supporting HR practices.

Author details

Hadi El-Farr[1*] and Rezvan Hosseingholizadeh[2]

1 Rutgers University, Piscataway, New Jersey, United States of America

2 Ferdowsi University of Mashhad, Mashhad, Iran

*Address all correspondence to: hadi.elfarr@rutgers.edu

References

[1] Zaim H, Keceli Y, Jaradat A, Kastrati S. The effects of knowledge management processes on human resource management: Mediating role of knowledge utilization. Journal of Science and Technology Policy Management. 2018;**9**(3):310-328

[2] Syed J, Murray PA, Hislop D, Introduction MY. Managing knowledge in the twenty-first century. In: The Palgrave Handbook of Knowledge Management. Cham: Palgrave Macmillan; 2018. pp. 1-18

[3] Ananthram S, Nankervis A, Chan C. Strategic human asset management: Evidence from North America. Personnel Review. 2013;**42**(3):281-299

[4] Gloet M. Knowledge management and the links to HRM: Developing leadership and management capabilities to support sustainability. Management Research News. 2006;**29**(7):402-413

[5] Thite M. Strategic positioning of HRM in knowledge-based organizations. The Learning Organization. 2004;**11**(1):28-44

[6] Banerjee PM. Sustainable human capital: Product innovation and employee partnerships in technology firms. Cross Cultural Management: An International Journal. 2013;**20**(2):216-234

[7] Figueiredo E, Pais L, Monteiro S, Mónico L. Human resource management impact on knowledge management: Evidence from the Portuguese banking sector. Journal of Service Theory and Practice. 2016;**26**(4):497-528

[8] Gope S, Elia G, Passiante G. The effect of HRM practices on knowledge management capacity: A comparative study in Indian IT industry. Journal of Knowledge Management. 2018;**22**(3):649-677

[9] Uddin M. Knowledge management: Tool for enhancing HRM practices and organizational innovation. International Journal of Humanities and Social Sciences. 2017;**9**(4):31-40

[10] Svetlik I, Stavrou-Costea E. Connecting human resources management and knowledge management. International Journal of Manpower. 2007;**28**(3/4):197-206

[11] Hislop D. Mission impossible? Communicating and sharing knowledge via information technology. Journal of Information Technology. 2002;**17**(3):165-177

[12] Nilsson S, Ellström PE. Employability and talent management: Challenges for HRD practices. European Journal of Training and Development. 2012;**36**(1):26-45

[13] Nonaka I. A dynamic theory of organizational knowledge creation. Organization Science. 1994;**5**(1):14-37

[14] Tsoukas H, Vladimirou E. What is organizational knowledge? Journal of Management Studies. 2001;**38**(7):973-993

[15] Schultze U, Stabell C. Knowing what you don't know? Discourses and contradictions in knowledge management research. Journal of Management Studies. 2004;**41**(4):549-572

[16] Theriou NG, Chatzoglou P. The impact of best HRM practices on performance–identifying enabling factors. Employee Relations. 2014;**36**(5):535-561

[17] Hosseingholizadeh R. Managing the knowledge lifecycle: An integrated knowledge management process model. In: Proceedings of the 4th International eConference on Computer

and Knowledge Engineering (ICCKE). Mashad, Iran: Ferdowsi University of Mashhad; 2014. p. 102-110

[18] Hislop D, Bosua R, Helms R. Knowledge Management in Organizations: A Critical Introduction. New York: Oxford University Press; 2005

[19] Haesli A, Boxall P. When knowledge management meets HR strategy: An exploration of personalization-retention and codification-recruitment configurations. International Journal of Human Resource Management. 2005;**16**(11):1955-1975

[20] Millar CC, Chen S, Waller L. Leadership, knowledge and people in knowledge-intensive organisations: Implications for HRM theory and practice. The International Journal of Human Resource Management. 2017;**28**(2):261-275

[21] Hansen MT, Nohria N, Tierney T. What's your strategy for managing knowledge? Harvard Business Review. 1999;**77**(2):106-116

[22] Edvardsson IR. HRM and knowledge management. Employee Relations. 2008;**30**(5):553-561

[23] Edwards JS, Handzic M, Carlsson S, Nissen M. Knowledge management research & practice: Visions and directions. Knowledge Management Research & Practice. 2003;**1**(1):49-60

[24] Pan SL, Scarbrough H. Knowledge management in practice: An exploratory case study. Technology Analysis & Strategic Management. 1999;**11**(3):359-374

[25] Arunprasad P. Guiding metaphors for knowledge-intensive firms: Strategic HRM practices and knowledge strategies. International Journal of Organizational Analysis. 2016;**24**(4):743-772

[26] Bontis N, Serenko A. The moderating role of human capital management practices on employee capabilities. Journal of Knowledge Management. 2007;**11**(3):31-51

[27] Pillania RK. Demystifying knowledge management. Business Strategy Series. 2009;**10**(2):96-99

[28] Santoro G, Usai A. Knowledge exploration and ICT knowledge exploitation through human resource management: A study of Italian firms. Management Research Review. 2018;**41**(6):701-715

[29] Medina R, Medina A. The competence loop: Competence management in knowledge-intensive, project-intensive organizations. International Journal of Managing Projects in Business. 2015;**8**(2):279-299

[30] Shaw JP, Park T, Kim E. A resource-based perspective on human capital losses, HRM investments, and organizational performance. Strategic Management Journal. 2013;**34**:572-589

[31] Zhou AJ, Fey C, Yildiz HE. Fostering integration through HRM practices: An empirical examination of absorptive capacity and knowledge transfer in cross-border M&As. Journal of World Business. 7 Jun 2018. https://DOI.org/10.1016/j.jwb.2018.05.005

[32] O'Neill BS, Adya M. Knowledge sharing and the psychological contract: Managing knowledge workers across different stages of employment. Journal of Managerial Psychology. 2007;**22**(4):411-436

[33] Kianto A, Sáenz J, Aramburu N. Knowledge-based human resource management practices, intellectual capital and innovation. Journal of Business Research. 2017;**81**:11-20

[34] Hussinki H, Kianto A, Vanhala M, Ritala P. Assessing the universality of

knowledge management practices. Journal of Knowledge Management. 2017;**21**(6):1596-1621

[35] Kase R, Zupan N. HRM as a means of shaping relational networks within a company: A comparison of two knowledge-intensive companies. Economic and Business Review for Central and South-Eastern Europe. 2007;**9**(3):213-234

[36] Smith H. The interface between knowledge management and human resources: A qualitative study [PhD Faculty of Economic and Management Sciences]. Rand Afrikaans University; 2004

[37] Gourlay S. Knowledge management and HRD. Human Resource Development International. 2001;**4**(1):27-46

[38] Hosseingholizadeh R, Mahdi SEK, El-Farr H. The role of motivation, ability, and opportunity in achieving effective knowledge-work: Knowledge work and MAO. International Journal of Knowledge Management. 2016;**12**(4):20-36

[39] Olomolaiye A, Egbu C. Linking human resources management and knowledge management for performance improvements: A case study approach. In: Sivyer E, editor. Proceedings of COBRA2006 the Annual Research Conference of the Royal Institution of Chartered Surveyors, University College London; 2006

[40] Oltra V. Knowledge management effectiveness factors: The role of HRM. Journal of Knowledge Management. 2005;**9**(4):70-86

[41] Laursen K, Mahnke V. Knowledge strategies, firm types, and complementarity in human-resource practices. Journal of Management & Governance. 2001;**5**(1):1-27

[42] Horwitz FM, Heng CT, Quazi HA. Finders, keepers? Attracting, motivating and retaining knowledge workers. Human Resource Management Journal. 2003;**13**(4):23-44

[43] Perez JR, POD P. Knowledge management and organizational competitiveness: A framework for human capital analysis. Journal of Knowledge Management. 2003;**7**(3):82-91

[44] Filius RE, De Jong JA, Roelofs EC. Knowledge management in the HRD office: A comparison of three cases. Journal of Workplace Learning. 2000;**12**(7):286-295

[45] Hannula M, Kukko M, Okkonen J. The fourth perspective—Knowledge management in human resources context. In: Business Excellence, Institute of Business Information Management. Finland: Tampere University of Technology; 2003

[46] Yahya S, Goh WK. Managing human resources toward achieving knowledge management. Journal of Knowledge Management. 2002;**6**(5):457-468

[47] Brelade S, Harman C. How human resources can influence knowledge management. Strategic HR Review. 2001;**1**(1):30-33

[48] Robertson M, GOM H. Knowledge management practices within a knowledge-intensive firm: The significance of the people management dimension. Journal of European Industrial Training. 2000;**24**(2/3/4):241-253

[49] Narasimha S. Organizational knowledge, human resource management, and sustained competitive advantage: Toward a framework. Competitiveness Review. 2000;**10**(1):123-135

[50] Taylor EZ. The effect of incentives on knowledge sharing in

computer-mediated communication: An experimental investigation. Journal of Information Systems. 2006;**20**(1):103-116

[51] Nieves J, Quintana A. Human resource practices and innovation in the hotel industry: The mediating role of human capital. Tourism and Hospitality Research. 2018;**18**(1):72-83

[52] Gloet M, Berrell M. The dual paradigm nature of knowledge management: Implications for achieving quality outcomes in human resource management. Journal of Knowledge Management. 2003;**7**(1):78-89

[53] Currie G, Kerrin M. Human resource management and knowledge management: Enhancing knowledge sharing in a pharmaceutical company. International Journal of Human Resource Management. 2003;**14**(6):1027-1045

[54] Despres C, Hiltrop JM. Human resource management in the knowledge age: Current practice and perspectives on the future. Employee Relations. 1995;**17**(1):9-23

[55] Godbout AJ. Managing core competencies: The impact of knowledge management on human resources practices in leading-edge organizations. Knowledge and Process Management. 2000;**7**(2):76-86

[56] Siemsen E, Balasubramanian S, Roth AV. Incentives that induce task-related effort, helping, and knowledge sharing in workgroups. Management Science. 2007;**53**(10):1533-1550

[57] Quigley NR, Tesluk PE, Locke EA, Bartol KM. A multilevel investigation of the motivational mechanisms underlying knowledge sharing and performance. Organization Science. 2007;**18**(1):71-88

[58] Lee DJ, Ahn JH. Rewarding knowledge sharing under measurement inaccuracy. Knowledge Management Research & Practice. 2005;**3**(4):229-243

[59] Vicere AA. New economy, new HR. Employment Relations Today. 2000;**27**(3):1-11

[60] Mohsin M, Syed J. Knowledge management in developing economies: A critical review. In: The Palgrave Handbook of Knowledge Management. Cham: Palgrave Macmillan; 2018. pp. 601-620

[61] Keat KK, Lin A. The relationship between knowledge management and organizational performance of malaysian private colleges: A mediating role of managing talent practices. Advances in Economics and Business. 2018;**6**(2):81-89

[62] Alonderiene R, Pundziene A, Krisciunas K. Tacit knowledge acquisition and transfer in the process of informal learning. Problems & Perspectives in Management. 2006;**3**:134-145

[63] Cai M, Du H, Zhao C, Du W. Relationship between employees' performance and social network structure: An empirical research based on a SME from a whole-network perspective. Chinese Management Studies. 2014;**8**(1):85-108

[64] Manuti A, Impedovo MA, De Palma PD. Managing social and human capital in organizations: Communities of practices as strategic tools for individual and organizational development. Journal of Workplace Learning. 2017;**29**(3):217-234

[65] Sprinkle TA, Urick MJ. Three generational issues in organizational learning: Knowledge management, perspectives on training and "low-stakes" development. The Learning Organization. 2018;**25**(2):102-112

[66] Papa A, Dezi L, Gregori GL, Mueller J, Miglietta N. Improving innovation performance through knowledge acquisition: The moderating role of employee retention and human resource management practices. Journal of

Knowledge Management. 2018. https://doi.org/10.1108/JKM-09-2017-0391

[67] Young T. Implementing a knowledge retention strategy. Knowledge Management Review. 2006;**9**(5):28-33

[68] Alvesson M. Social identity and the problem of loyalty in knowledge-intensive companies. Journal of Management Studies. 2000;**37**(8):1101-1123

[69] Baruch Y. Career development in organizations and beyond: Balancing traditional and contemporary viewpoints. Human Resource Management Review. 2006;**16**(2):125-138

[70] Hirsh W. Career Development for Knowledge Workers: Facing the Challenge. Brighton: Institute for Employment Studies; 2006

Chapter 6

The Management, Sharing and Transfer of Knowledge in the Oil Districts - The Case Study of an Italian District

Giovanna Testa

Abstract

Knowledge management is one of the most innovative and effective tools available to companies to manage an economic and organizational ever-changing environment. The chapter is based on an empirical study starting from the classification of oil district and aims to understand how firms' position affect knowledge transfer process within the district. We support the idea that knowledge transfer is deeply affected by firms' contractual power as well as by their position within the district. The companies of the industrial districts have the advantage of exploiting and sharing knowledge with each other. The literature generally holds that knowledge transfer requires a sense of equality and fairness among the firms, to create conditions in which firms will share their own knowledge for joint competitive advantage. However, empirical evidence shows that the value chains are often characterized by hierarchical relations and asymmetry between the parties: this feature is particularly evident in the oil districts. For companies attempting to acquire new information, the typologies of their intercompany collaboration and their cultural relationships are crucial.

Keywords: knowledge transfer, knowledge sharing, industrial district, hub-and-spoke district, oil district

1. Introduction

In the last few years, managerial and organizational disciplines have increasingly focused on knowledge management (KM) studies as an innovative tool for both the managerial and organizational management changes that are linked to the environmental and market growths [1]. Competitiveness does not have national boundaries anymore, and companies have to deal with often unknown contexts. In an age of continuous technological evolution, in which technology is basically at everybody's grasp, knowledge has become a key factor in interfirm competition, because it is difficult to reproduce and to standardize [2]. Furthermore, companies are not able to develop internally all the knowledge they need: transfer and sharing of knowledge becomes important, both intra-organizational and inter-organizational, as a process that involves all hierarchical levels of the organization and the different categories of people [2]. For companies seeking to acquire new

information, the forms of their intercompany collaboration and their cultural relationships are crucial, since these play an important role in determining the relevant knowledge transfer processes. Some models of development and transfer of knowledge are recognized as defining elements of the "industrial district [3]" (ID). The ID is an economic phenomenon in which the constituent societies engage in the joint production of an asset, optimizing the use of resources and profits [4, 5]. This synergistic production in a district supply chain seems to be more characteristic of the manufacturing sector, where production can follow a linear path along the chain, with a rare overlap of activity [6]. In district realities, the knowledge existing within the district is an intangible asset shared by all its companies: to be exploited by everyone, knowledge must be shared and transferred both within individual companies and between the several district companies [7]. Therefore, the ID can be analyzed as a cognitive system, in terms of internal creation, exchange and management of knowledge. In this way it is possible to evaluate the productivity of the district, both in economic-financial terms and as a generator of intangible and distinctive assets [8]. Companies operating in the district have the advantage of using the knowledge of the other companies involved. The main theories of literature, both national and international, generally sustain that the knowledge transfer requires a sense of equality and equity between companies, in order to create a joint competitive advantage thanks to the sharing of knowledge [9, 10]. However, the empirical evidence shows that the district value chain is often characterized by hierarchical relationships and asymmetry between the parties [11]. Starting both from the analysis of the main characteristics of the cultural and relational environment of KM and from the study of ID—particularly of oil district—this chapter is aimed to investigate the process of knowledge transfer as an activity closely linked to action of human resources who work closely in the district [11].

2. Theories on knowledge management and industrial district

In national and international literature, there are several and structured theories both on knowledge management and on the structure and working of industrial districts. Of course, it is impossible to classify them all. However, the main theories on the subject can be clustered as shown below.

2.1 Knowledge management

Knowledge is one of the main sources of competitive advantage. The ability to acquire and manage knowledge allows companies to achieve leadership positions in their reference markets [12]. Seen from a "knowledge-based" perspective, companies can be interpreted as relational systems composed of numerous actors—in charge of various activities—that operate in a system of exchange of knowledge and experiences [12]. Knowledge cannot be acquired passively: it needs an active and conscious construction, and it is based on a reconstruction of the system of continuous exchange, which connects the background of the individual or the company, the skills acquired previously and the surrounding environment [13]. KM, therefore, is the ability to acquire, explore, absorb and codify the information that leads to knowledge. The most credited literature [7, 14–16] have focused on the study of the different aspects of the knowledge transfer, starting from the difference of "knowledge". Obviously, in this study we have tried to provide a homogeneous concept of knowledge in itself [16]. Nevertheless, some authors distinguish two levels of knowledge [17]:

1. **Experience:** indicates the implicit knowledge that is tacit, the individual's own [17]. The experience is composed of at least four components:

    a. *Credential knowledge*: it is the knowledge one would need to obtain an engineering degree.

    b. *Cultural knowledge*: it is the knowledge of the company and how it works.

    c. *Practice-based knowledge*: knowledge of company-specific routines and how to apply them.

    d. *Knowledge based on personal experience*: it is the knowledge that the manager may have acquired outside the company, in the previous work job [17].

2. **Expertise:** competence is a more explicit knowledge, more related to work than to personal characteristics [17]. The competence includes two main types of knowledge:

    a. *Credential knowledge*: it is that of which an individual needs in order to be recognized and guaranteed an adequate level of knowledge and a certain degree of technicality.

    b. *Specialized knowledge*: it is the deep understanding of a particular scientific area. This knowledge is very personal and is a unique blend of public knowledge (which all industry specialists possess) and knowledge based on experience [17].

Moreover, the knowledge can be tacit and explicit [14] and individual and social [16].

The differences between tacit and explicit knowledge are:

1. **Tacit:** it is the complex of intuitions, skills, abilities and experiences that people store in their minds when they experience problem solving [14]. Obviously, this knowledge is the most difficult to represent and—if it is not translated into some forms—it is the easiest to disperse. Tacit knowledge is one of the most important drivers of innovation and change [14]. It can be transferred and communicated only through cultural mechanisms, informal exchanges, etc. It is strictly personal, contained in the mind of every individual.

2. **Explicit:** it is formalized and codified and involves everything that is represented in a documentary form [14]; it is expressed in a formal language, with grammatical rules, mathematical expressions and technological and manual definitions and is transferred through the use of technological tools [14].

Instead, Spender classifies the difference between individual and social knowledge as follows:

a. **Individual:** individual's knowledge is inherently transferable and moves with the person, giving rise to Paretian contracts and the consequent agency problems [16].

b. **Social:** it is a knowledge publicly available or collective and incorporated in the firm's routine, in the norms and in the culture [16].

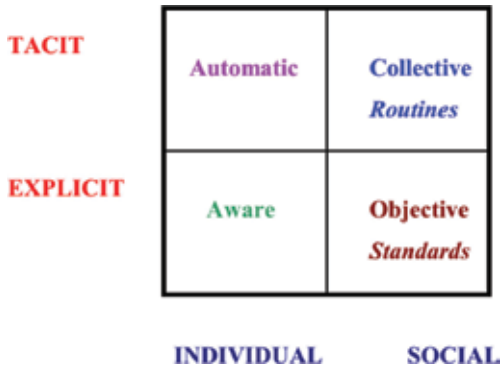


Figure 1.
The knowledge type's matrix.

From the match of these four types of knowledge in a double input matrix, in **Figure 1**, it is possible to identify the characteristics and levels of standardization of the various natures considered.

The characteristics of the knowledge, which emerge from the matrix, are:

1. **Automatic:** it is an absolutely personal, implicit and individual knowledge. It is not codified and deals with the behaviour of individuals [18].

2. **Aware:** it is one of the most objective knowledge. It is explicit and mainly referable to contours and parameters. it is, however, individual, therefore, closely linked to the subjectivity of the person [18].

3. **Collective:** it is based on routines; it is collective and partially transferable, depending on the context to which the individuals belong. Routines have an implicit knowledge base and can become automatisms thus allowing the economization of cognitive resources [18].

4. **Objective:** it is explicit knowledge, based on technical and behavioral standards and represents the mainly transferable type, since the standards are codified and normative. However, it is the most imitable knowledge, because it is little connected to the personality of individuals and easy to imitate [18].

2.1.1 The spread of the knowledge

The spread of knowledge can take place through its transfer through knowledge sharing processes.

Knowledge transfer (KT), instead, has been described as "a process of systematic exchange of information and skills between entities" [19]. An integrated transfer model [11] consists of the total transfer of knowledge from one subject to another. At the base of the resolution and of the ease of the transfer, there are the attitudes, the values, and the competences of the individuals who are part of the organization and who are involved in the exchange [19]. The spread of knowledge can take place through a knowledge transfer on a knowledge sharing processes [19].

Knowledge sharing (KS), substantially, is linked to the organizational culture, which is the key factor for the success of the dissemination of knowledge [19]. For the concept of sharing to exist, there must be a strong corporate identity and strengthened sense of belonging. Sharing can take place only if it is promoted and stimulated by the organization [19].

The transfer mechanism is based on two key elements:

1. **Subjective:** subjective factors relate to the degree of resistance to learning and depend on the subjects involved in the transfer process [20]. They are related to the intentionality, transparency and receptivity of the subjects involved, which are:

    a. *Source:* it is the one who must share his knowledge with others; there is often a mechanism of resistance of the subject to the transfer caused by the fear of a possible loss of power and/or prestige [21].

    b. *Receiver:* he/she is the one to whom knowledge must be transferred; it is a subject that must have a good capacity for assimilation.

2. **Objective:** objective factors concern the nature of knowledge, i.e. characteristics and level of coding: tacit and explicit knowledge [14] or implicit and explicit knowledge [22].

The main authors argue that social organizations, businesses, classes and societies evolve by adapting the body of knowledge shared by their members and that much of the process takes place at the tacit level. The distinction between explicit and implicit is vital, because it allows scholars to identify different adaptation mechanisms with different characteristics or types of knowledge and learning.

Some authors [15] suggest that an effective inter-intra transfer of knowledge within or between one or more organizations is a function of the following five forces:

1. The value of the unit knowledge source reserve: the higher the value, the greater the attraction for the other units.

2. The motivational disposition of the source of knowledge: organizational policy, competition and other obstacles can reduce a unit's desire to share its knowledge with other parts of the organization.

3. Existence and richness of communication channels: the flows of knowledge within the organization are facilitated if there are clear communication channels and open and frequent communication between the parties.

4. Motivational disposition of the receiving unit: if the receiver underestimates the importance of knowledge of the source, mechanisms of resistance to the adoption of knowledge can be created.

5. Capacity of absorption or capacity of assimilation of the target unit: the ability to recognize the value of information, assimilate it and apply it to commercial purposes of the recipient determines its success in adopting external knowledge. More new knowledge is similar to the knowledge of target unit, greater is the similarity between the transmitter and the target unit, greater will be the absorption capacity of the target unit.

The transfer process in **Figure 2** is composed of five phases:

a. **Acquisition**: in order to be transferred, knowledge must be acquired. The organization could learn from its past; by "doing", borrowing and acquiring individuals with new knowledge; and through a continuous process of research or scanning [23].

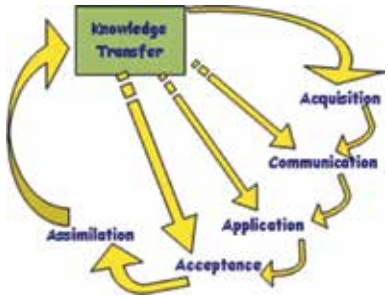


Figure 2.
The knowledge transfer process.

b. **Communication:** once acquired, knowledge can be communicated. The communication can be written or verbal. There may be both barriers to knowledge transfer and the risk of losing information during the process. The communication mechanisms must be developed so as to encourage knowledge transfer opportunities [23].

c. **Application:** the knowledge acquired and communicated can be applied for preservation. The results of the application of knowledge allow the organization to learn [23].

d. **Acceptance:** in order for knowledge to be assimilated, after having been acquired and communicated, it must be accepted; otherwise the knowledge transferred is not internalized by the subject who receives it [23].

e. **Assimilation:** it represents the key to the knowledge transfer process. The assimilation of the results influences its applicability; this happens through the consolidation of routines [23].

In the process of knowledge transfer and like more in the sharing process, the personal interaction is fundamental [23]: the receiver must be able to understand the context in which the source of knowledge finds itself acting, in order to learn it and make it its own [23]; the system in which the two subjects operate must promote and encourage the interaction between the involved subjects. KT can be realized into an intra-organizational and an inter-organizational level: the fundamental difference existing between two atmospheres of reference resides in the fact that, while in the same organization the sharing of common cultural values can enface the process, many other problems affect inter-organizational knowledge transfer.

The main barriers that the transfer can find, on its distance, are represented by:

a. **Culture:** it is the collective programming of the mind that identifies one group or one category of people over another [24]. It reflects the ideas, values, and meanings shared by the members of a society and handed down by families and communities. In a learning system, culture shapes the processes through which to create, legitimize and distribute new organizational knowledge [24].

b. **Values:** they are global beliefs or abstract ideas that automatically guide actions and judgements through specific objects and situations. Values are derived from culture and play an important role in shaping the manager's attitudes about work as well as the choices they make and the behaviors they engage in [24].

c. **Attitudes:** these are the natural inclinations that each individual has for a given activity [24].

d. **Behaviors:** they are the external and directly observable manifestations which are individual responses to certain psychological situations.

Among several fundamental factors that affect KT, a key role is carried out by the management: in fact, it is just in the top management that the collective tacit knowledge resides [25].

Effective KT is a complex process that requires a manager to consider problems at different levels [25]. It also requires a balance between soft and hard factors to facilitate the process. The most important managerial activities to ensure an effective transfer of knowledge are [25]:

a. The existence of a high level of trust among people working at different levels of the organization. This is demonstrated by the widespread sharing and immediate access to information about the organization. Leaders' behaviour must also be consistent with a philosophy of openness.

b. A culture of strong collaboration and cooperation must exist. It is developed through work practices that encourage and allow individuals and groups to work together, on projects and problems. It is important to emphasize teamwork and form cross-functional work teams.

c. The existence of a strong culture of continuous improvement and learning linked to problem research and problem solving and focused on specific values, such as product quality and customer service. It is important to encourage employers: to gather relevant information, to use and share that information in problem solving and to implement innovative solutions and practices.

d. An organizational project is needed to encourage horizontal communication. For knowledge transfer to be favored, there should be few hierarchical barriers that could block the flow of communication; to this end, the level of skills and competences among employees must be relatively consistent.

If the employees are well trained, they have both the knowledge and the skills to do their job and achieve the desired value [26]. Moreover, there must be a balanced approach in encouraging the transfer of knowledge and sharing through structured processes—such as sharing best practices—and through best practices and less structured processes, such as mentoring, group dialog and the session of reflection [27]. Finally, the system of rewards and incentives should not be focused only on financial results or results based on competition between the groups of the organization: they should be based on other criteria, such as knowledge sharing, cooperation and work team [25].

2.2 Industrial district

The industrial districts are a field of analysis that is very rich in contributions that have outlined, in a complex way, the profile and characteristics of the production systems. In the Italian economics and business sphere, the concept of ID was first introduced [28] in a contribution intended to integrate Marshallian thought on business clusters with reflections and research on the nature of industrial development in more recent decades. The ID and its configurations are defined as

"a socio-territorial entity characterized by the simultaneous active presence, in a circumscribed territorial area, determined from a naturalistic and historical point of view, by a community of people and business population" [29]: it constitutes a productive area, in which the factors of the sociocultural matrix are placed as determinants of the competitive advantage achieved by small businesses located in the same geographical unit [30, 31]. In these terms, it derives from the interaction, both of economic-industrial elements and of a historical-sociological nature. Thus, the district is an integrated, ordered system of companies in which the local culture serves as the unifying element. The individual components become functions of the whole, or expressions of the connections with the other units, and are both cause and effect of the social environment. Some Italian economists and sociologists, starting from the concept of the Marshallian agglomeration of companies, have given a strong improvement in building and highlighting the concept of ID, as a new research unit of economic analysis [28] halfway between the concept of industry and business. The authors grouped in the neo-Marshallian approach contribute to the definition of industrial districts—as a complex socio-economic environment—which present unique characteristics both in the economic-structural and sociocultural profile. In this perspective, the transationalist study [32–35] aims to identify a particular configuration of the institutional environment and the community market and places the district as a form of industrial organization located in the half between market and hierarchy. The association of the ID with the flexible specialization model, alternative to mass production [36], has increased the interest in the new business category, supporting new study perspectives; these perspectives are focused on the analysis of clusters as evolution of interorganic systems, networks and cognitive systems, within which the driving role of the individual companies that inhabit the area plays a central role. More recent are the studies of business economics that tend to report the survey on the business district, individually designed, on the interpretation of the relational ties that are established between the different district actors, i.e. a relational approach, and on the company analysis as a cognitive system [37–42]. Interest has also grown internationally: of particular interest are the reflections of scholars of economic geography, in particular, by Krugman [43] and Porter's [44] position on cluster, seen as a key element for the competitiveness of nations. Industrial district, cluster, local innovation system, innovative environment and innovative local "milieu" (environment) are the names proposed by various research contributions. In the 1990s, while other studies continued to rework the Marshallian model of districts, an important new classification of ID was proposed by Markusen [45].

2.2.1 Markusen's theory

Markusen is a Professor and the Director of the Project on Regional and Industrial Economics at the University of Minnesota's Humphrey Institute.

Markusen's study, being focused on income-generating activities in city and regional contexts—therefore territorial—has analyzed the dynamics in a district perspective. Markusen's theories originated from her inductive study of the district phenomenon as observed in the United States, particularly in the high-tech districts of Orange County and Silicon Valley. By scanning the conditions in which some manage to remain "sticky" places in a "slippery" space, the study rejects the "new ID", in its Marshallian or more recent Italianized form, as the dominant paradigmatic solution. Beginning from the classic Marshallian model, she identified different types of ID ("sticky places"), corresponding to specific managerial philosophies, with rather disparate company configurations, internal versus external orientations and governance structures. The analysis is showing that the formation of districts is

often stimulated and favored by the presence and power of multinational companies and the state. These elements permit the development of complex systems that small companies would be unable to form alone. Markusen's views the causal elements of aggregation as factors of diversification, leading to a typology of three distinct types of non-Marshallian clusters: (i) the "hub-and-spokes" model, which revolves around one or more dominated, externally oriented companies; (ii) the "satellite platform", a set of unrelated branches inserted in links of external organizations (e.g. skilled labour, natural resources); and (iii) the "state anchored" cluster, focused on one or more public sector institutions, which generate a particular demand flow. The hub-and-spoke and satellite platform variants are considered more prominent in the United States than the other two. The study of industrial districts requires a broader institutional approach and must include incorporation across the boundaries of the districts. The results of the research suggest that a purely locally targeted development strategy will fail to achieve its goals. The analysis of each type was carried out at national, regional and local levels. Particular elements of the industrial agglomeration were considered, such as the reference market, consumers and producers of goods and services and promoters of innovations, with revenues for the distribution and procurement of goods and companies, with the power of the internal and external markets. The hub-and-spoke industrial district is typical of the economies in which, within a geographical region, one or more large companies have the role of a generation of small- and medium-sized enterprises, which gravitate around the hub, to carry out activities of suppliers or subcontractors. The intercompany relations that follow this typology are of two kinds: on the one hand, they are established between small local businesses; we are witnessing a phenomenon based on new enterprises and can give rise to connections with others, which benefit from agglomeration and urbanization. This reality, then, can be seen in their peculiarity in the presence of one or more large companies, in vertical integration.

In our analysis, we considered the hub-and-spoke industrial district, because it reflects the structure of the oil districts.

2.2.2 Hub-and-spoke ID

The hub-and-spoke ID, in **Figure 3**, occurs in situations where one or more large companies serve as an economic centre of attraction within a geographic region, leading to the birth of other small and medium companies, which cluster around the larger ones in the role of suppliers or subcontractors.

The intercompany relations in this type of district are generally of two types: first of all, relations will develop between local small companies of the territory, and secondly, a certain number of new companies will activate new connections with others, developing higher levels of agglomeration and urbanization from which all companies benefit [45].

The identifying characteristics of these districts are the presence of one or more large companies, the vertical integration in one or more productive sectors and the existence of a series of small suppliers, which surround the larger ones [45].

Hub-and-spoke districts can be configured according to two different structures. A "ring" conformation occurs in the case of complete dependence of small businesses on large companies or central institutions, both as suppliers and for market access. A "nucleus" form occurs when small businesses benefit from agglomeration synergies due to the presence of larger organizations but are not necessarily involved in direct commercial transactions with them. Whatever the form, the development of hub-and-spoke structures is based on the situation that local companies do not have significant connections with suppliers and competitors outside the territory [45].

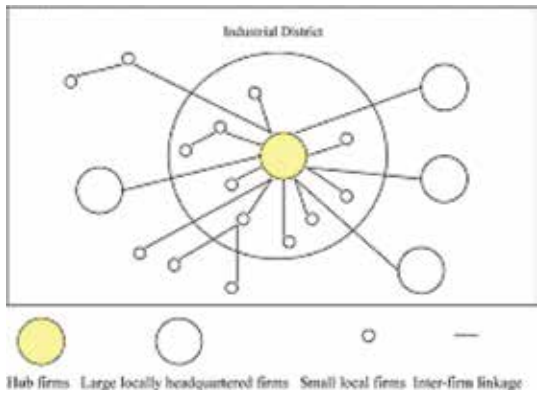


Figure 3.
Hub-and-spoke district.

Furthermore, the economies of scale must be relatively large, while the turnover of companies and personnel will be relatively low, with the exception of contacts with external suppliers [45]. Economic and financial decisions regarding operations in the hub-and-spoke district are usually made at the local level; however they arise and influence situations globally. Commercial relationships between smaller suppliers and larger companies, generally, involve long-term contracts [45]. The "hub" companies can develop a certain depth of understanding and relationships with both local and external societies, which can include the exchange of personnel. However, these will not be characterized by the integration and intensity typical of the relations that characterize the Marshallian district. In the theoretical conception of the hub-and-spoke district, labour markets are usually internal to large companies—for managerial personnel—and within the district as a whole for other employees. In this sense, the situation would be less flexible than the Italian model, in which workers of all types circulate among the large and small companies of the district. Both the original Marshallian and Italian models present a situation in which the district gives rise to a single local identity and culture, with a very close and dependent relationship of the entire district [45].

3. Types and mechanisms of district knowledge transfer

To understand the learning dynamics that take place in ID, it is necessary to make a distinction between learning within the company and the external one. There is a difference between production and the development of knowledge within the business environment and that which is absorbed by the external environment to it. This difference must be emphasized to clarify that the two contexts are two different generation spheres, even if they are connected in some way. In fact, the acquisition of knowledge from the outside can be functional to the improvement of the potential existing in the company, bearing in mind that this acquisition necessarily requires the existence in the company of a cognitive asset [46]. Internal learning is favored by the high level of specialization and poor formalization that characterizes the organization. The formation of the knowledge assets of the district firms is based, mainly, both on mechanisms of "learning by doing" and on interaction, the exchange of experiences and information, which arise due to the presence of stable and lasting relationships—formal and informal—which characterize the businesses of the ID and are closely linked to the high division of intercompany work. Furthermore, the strong interdependencies between the activities

of the district companies ensure that within these realities, over time, collaborative relationships are born and strengthened, which become incubators of learning processes and knowledge sharing [14]. In IDs there is the presence of a third learning dynamic, peculiar to these realities: collective learning [47]. It differs from other types, because its scenario is represented precisely by the local context, in which unique knowledge production processes are made that cannot be reproduced in different territories. The productive vocation of the district communities is the result of specialized skills, accumulated over time, which constitute the intangible assets on which the competitiveness of the district is based. This contextual knowledge is an integral part of the competitive advantage of companies and the system. In identifying the phenomenon, the "Groupe de Recherche Européen sur les Milieux Innovateurs" (GREMI) asserts that "contextual knowledge" is an integral part of the competitive advantage of companies within the district system and that local synergies favor further innovation [48, 49]. According to some scholars [46], "Also significant in these mechanisms are the social relations between the individuals employed in different companies, in particular when the companies are not linked through organized relations. In fact, it is difficult to 'lock up' information within the companies when everything to do with productive activity takes a central position in the conversations that take place in the homes and gathering places of the district. In this way, further indirect relations are created between the contexts of the individual companies in the district." Therefore, the territorial and organizational closeness between the district actors and the network of relations that bind them stimulate collective learning mechanisms [50]. In this environment, the continuous transfer and diffusion of knowledge are in large part unplanned and unintentional. Learning takes place both through training, mobility and turnover of personnel and through processes of imitation between the companies.

In ID, the main mechanisms for knowledge transfer originate in three broad phenomena:

Imitative behaviors: learning from the observed examples is fundamental, particularly for highly innovative activities and products [46]. These products and activities represent packets of explicit and tacit knowledge. The two forms of knowledge can be seen as different states of the same knowledge rather than as distinct goods. Indeed, much knowledge will remain in the tacit state, awaiting the potential for future expression, codification and application [3]. In the transfer due to imitative behaviour, to be successful, the observer of the product—or the activity—must have a knowledge base and skills similar to those of the individual or team that produced the innovation.

Mobility or human resources among local companies: individuals within the district serve as knowledge incubators and also as "carriers" [46]. The tacit knowledge acquired and assimilated by a worker becomes part of the person and accompanies him, even in the transfer to another workplace. If the new context is similar, then this knowledge can be activated; otherwise the transfer is only apparent, without effect. The knowledge transfer mechanism can be implemented only when the corporate environments of origin and destination have a minimum level of similarity, including cognitive juxtaposition. Similarly, cognitive specificity has also been identified as a factor that inhibits inter-contextual knowledge transfer [51]. Therefore, people can play the role of knowledge carriers in a similar way to products. The activation of knowledge in the new context can only involve its owner, or the same knowledge is transferred to other people who work in the company context, through communication and imitative behaviors. The "exclusive competences" accumulated in the districts have a highly specific character, because best practices and innovations are easily appropriated within the district but spread in a limited way outside its boundaries.

Relations between companies: the relationships between the district companies that are part of the production chain are often vertical and involve companies that carry out different phases of a single production process [3]. More rarely they can be horizontal, between companies operating in the same phases or in similar phases of the production process. Some districts take the form of intersectoral clusters, in which there are also relationships between the companies of the district core business and the suppliers of materials and other services used in the production process [3]. The different contacts can give rise to social relations between individuals from different societies. The industrial districts therefore function as meta-contexts, characterized by a strong information transparency, in which the boundaries between company contexts are poorly defined. The phenomenon of information transparency in IDs is best represented by the Marshallian model of the industrial-social environment [45].

3.1 The SECI and the concept of "BA" applied to the districts

As previously emphasized, in the district system, the relationship that is created between companies gives rise, not only to an exchange of goods and services but, above all, to an interaction of knowledge and skills. Business networks and systems represent the place, physical or virtual, where learning and knowledge settling take place [52]. These activities are based on a main strategic resource: communication, which is the fundamental activity for the development of new knowledge. Interestingly, in this perspective, it becomes the analysis of the concept of "BA": it refers to the place, physical, mental or virtual, at the level of which the subjects, involved in the knowledge creation process, interact, directly linking their tacit and explicit knowledge. Nonaka and Konno [52] have built a model of cognitive processes, divided into four phases: socialization, outsourcing, combination and internalization (SECI). Based on this model, the interaction between explicit and tacit knowledge allows us to postulate four ways of converting knowledge:

Socialization: it allows to pass from a tacit knowledge to another tacit knowledge. It is a process of sharing experience and creating forms of tacit knowledge: mental models and technical skills. The key to acquiring tacit knowledge is the shared experience, without which it would be difficult to penetrate other people's thinking process [52].

Externalization: it is the process by which tacit knowledge is expressed through explicit concepts, in the form of metaphors, hypotheses or models [52]. This mode is the key to creating knowledge, because it creates new and explicit concepts from tacit knowledge. One of the systems for converting tacit knowledge into explicit knowledge is the metaphor-analogy-model sequence [52]. Metaphor is a way of perceiving an object by symbolically imagining another; the analogy helps to understand the unknown through the known and to overcome the gap that separates the image from the logical model. In this way, once the explicit concepts are created, it is possible to build models [52].

Combination: it is a process of systematization of concepts, which makes it possible to pass from one explicit knowledge to another [52]. Individuals exchange and combine knowledge using different tools such as documents, meetings and computer networks; the reconfiguration of information through sorting or categorization can lead to new forms of knowledge [52].

Internalization: it is the process of translating tacit knowledge into explicit knowledge [52]. It is a concept linked to that of learning by doing, that is, learning by action. The more knowledge is represented in documents and manuals—which also facilitate its transmission to other subjects—the simpler the conversion is [52]. If we want to "materially" imagine the exchange or interaction of knowledge in which individuals are involved, we can refer to **Figure 4**.

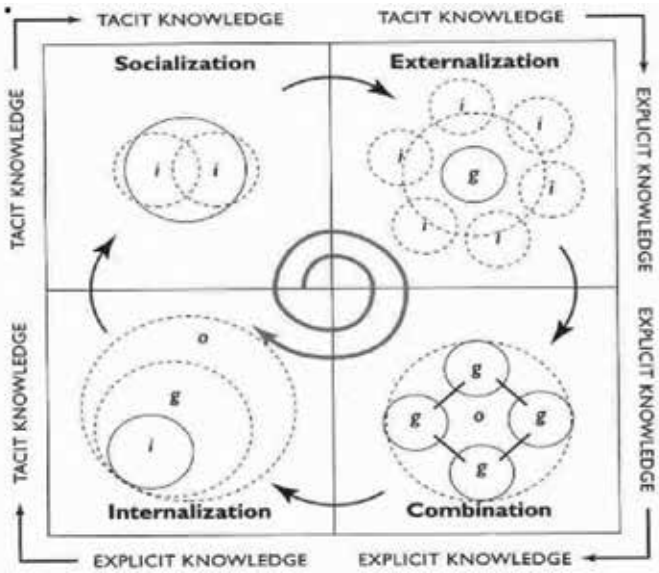


Figure 4.
The spiral of knowledge and the SECI model. i: individual, g: group and o: organization.

In each phase of the interaction, a different level of "BA" comes into play: it represents a support element for the interaction of knowledge possessed by individuals, groups and the entire organization—i.e. the carriers—depending on the level in which the mechanism is activated. Each phase requires a different way of converting the knowledge and, consequently, of a different "BA", depending on the characteristics of the latter [52].

There are, in fact in **Figure 5**, four distinct types of "BA":

- **Originating BA**: is a support for the socialization activity, thanks to the establishment of mainly mental interactions, which are based on the sharing of the same collective imagination and are aimed at the transfer of tacit knowledge

- **Interacting BA**: allows the externalization of tacit knowledge, through basic mechanisms of interaction and dialog that develop within a group

- **Cyber BA**: is a support for the combination of explicit knowledge, necessary for the creation of new applications to tacit knowledge, now becoming explicit

- **Exercising BA**: has the purpose of providing mechanisms for the dissemination of knowledge within the company and for the creation of organizational learning systems, thanks to which communication and sharing of the new knowledge created can be achieved.

In addition to what has been said for individuals, within the industrial systems, there is the existence of a further typology of "BA", closely linked to the division of labour that characterizes this type of business reality: the distrectual "BA".

This further typification is classified as the field of interaction between the various district enterprises, which serves to simplify and encourage the creation and transfer of new knowledge between district companies. Therefore, the fundamental difference between the different "BA" consists in the extension beyond the boundaries of the company, allowing the effective connection between the

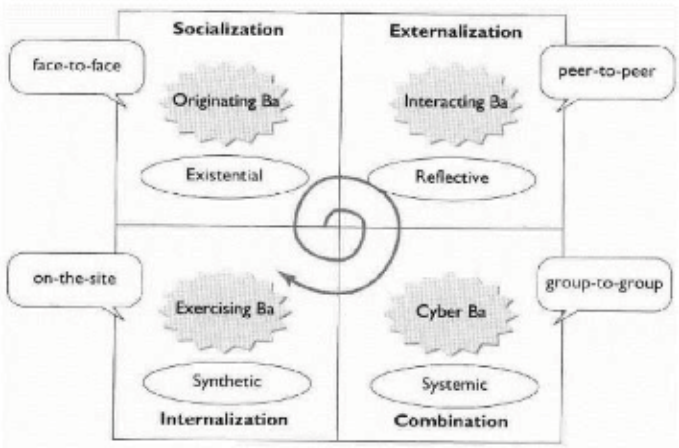


Figure 5.
The four characteristics of the "BA".

different "BA" present in the single companies [52]. The "BA" is characterized by three typical physical, mental and virtual components: the reality of the industrial district contains all three of these characteristics. In fact, it is physical, because it is geographically localized; therefore all the actors, who are part of it, live and work in the same place [52]; it is mental, because the main element of the industrial district is the sharing of everything related to the system—the history, the experiences and the attitudes—typical of this specific reality; and finally, it is virtual, a feature that is not yet distinctive of the ID, but which can be considered feasible in the not too distant future. Ultimately, the context of the industrial district, seen as an economic business reality in itself, represents a true "BA", and it is possible to read the district by applying the logical categories previously introduced:

a. **Originating BA**: the actors of the district share the history, the traditions and the origins of the district through a socialization of tacit knowledge [52].

b. **Interacting BA**: the neighborhood is the place where the actors live, collaborate and interact [52].

c. **Cyber BA**: in the district context, the leading companies connect in the cognitive networks in which they can combine their explicit knowledge [52].

d. **Exercising BA**: the growth and development of new tacit knowledge by district actors is consequent to the previous categories [52].

3.2 Knowledge and power relationships in petroleum supply chains

The oil districts are characterized by a large number of companies that are not always distinct in their activities: in fact, by examining the companies in terms of the services offered and the related inclusion in the various stages of production, many cases of juxtaposition can be distinguished [53]. Companies operating in this "parallel" situation are direct competitors, able to provide the same types of services within the same phase of the production chain. This situation contrasts with the classic district, where companies have complementary knowledge and specialization and operate in sequence along the production chain, creating an entire supply chain [11]. In a sequential structure, every single company is essential for the production of

DOI: http://dx.doi.org/10.5772/intechopen.86298

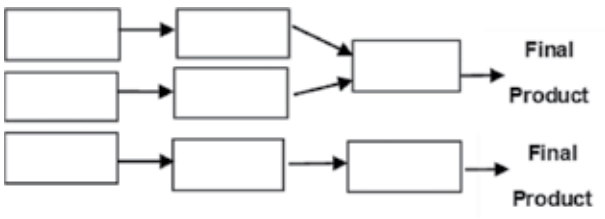


Figure 6.
Parallel and sequential production activity.

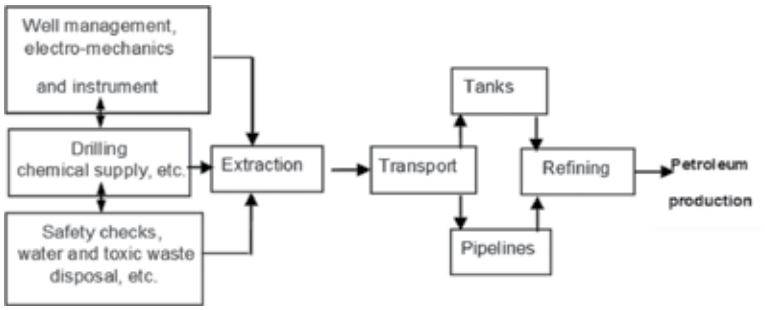


Figure 7.
Petroleum supply chain.

the entire district, and the relationships developed between the component companies take on a collaborative and non-competitive character [11], as can be seen in **Figure 6**.

Since the oil districts are structured around energy systems, very different from the manufacturing districts, their shape is less linear [11], as can be seen in **Figure 7**.

The main productive activities in these districts are exploration and drilling, as well as related activities, such as maintenance, transportation and refining [54]. Looking at these phases, we see that the various similar activities are conducted simultaneously, not only in series. Therefore, the production chain is not a strictly linear structure; it appears, instead, that the output of a company can provide the input for a series of companies, all operating in parallel in the next phase. In a single district, therefore, we find the presence of a mixed production system, in which sequential and parallel structures coexist at the same time. A direct consequence of this is that the supply chain of the hub-and-spoke oil districts is not based exclusively on mechanisms of fragmentation and cooperation, because their asymmetric form generates power structures and disparities in relationships [55]. Instead, the district structure will be dominated by one or more large vertically integrated companies, surrounded by a large number of supplier companies, with relations between large and small businesses established on a contractual basis [55]. These relationships will all be influenced by "power games" within the district, including knowledge management relationship. Empirical evidence suggests that voluntary cooperation mechanisms are quite rare in oil districts, since all companies—many of which operate in parallel—are essentially trying to exploit a single scarce resource [55].

4. The case study of an Italian oil district: features and data analysis

Eni SpA is an integrated multinational energy company, founded in Italy in 1926 [56]. Its activities in the petroleum sector cover the entire production chain, from

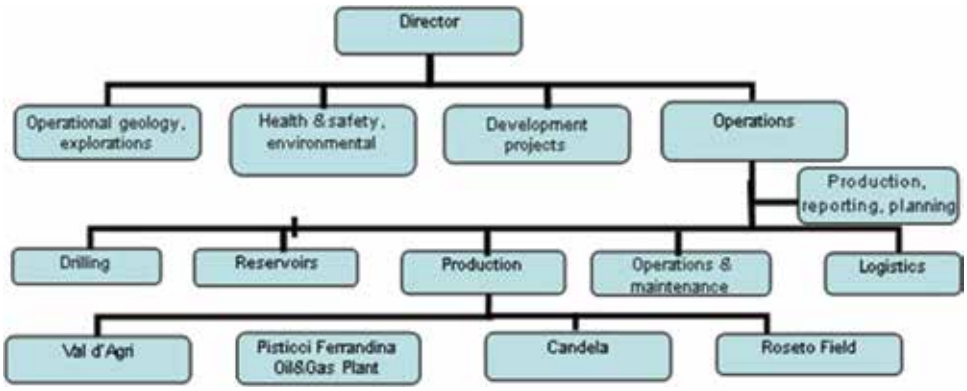
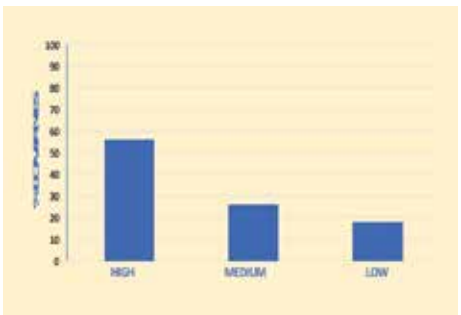


Figure 8.
Eni DIME organizational structure.

upstream, high-value operations, including the search for reserves, to downstream implementation and operation of wells, processing and distribution, as well as secondary logistical activities at all levels of operation. The Eni group operates both in the oil and gas sectors and in onshore and offshore mining. Most of the mining activity is concentrated outside Italy, with the exception of a substantial focus in the Italian region of Basilicata. Eni's administrative structure for Italian production is divided into two major geographical areas: the North-Central District (DICS), with headquarters in Ravenna, Emilia-Romagna, and the Southern District (DIME), based in Viggiano, in the Val d'Agri and in Basilicata. The Val d'Agri field, discovered in 1981, consists of three concessions: Volturino, Caldarosa and Grumento Nova. The ASI Consortium, with a resolution dated July 17, 1992, sold a plot of 60,000 square metres to Eni: only since the mid-1990s, Eni decided to carry out a large-scale cultivation campaign, with the construction of an oil centre (COVA), where the first treatment of the raw extract, which passes through the ducts coming from most of the wells in production. This first treatment consists, more specifically, in the separation of oil from water, gas, sulfur and H2S (odorless hydrogen sulphide, therefore dangerous and deadly). In the following years, an oil pipeline was then built that transports crude oil converted into COVA at the Eni refinery in Taranto. Previously, transport was carried out using tanks, still used today for wells that are not connected to the collection network. **Figure 8** shows the organizational structure of the Dime.

In Basilicata there are about 400 companies operating in the oil sector: among these, in addition to the hub company, i.e. ENI, there are about 120 companies that make up the district system of Val d'Agri.



Graphic 1.
Percentage of business sale figures that depends on the oil industry in Val d'Agri.

However, it is important to highlight that, in the Basilicata region, there is also another drilling area, named Tempa Rossa, in which the Hub company is the French company Total. The business sale, as can be seen in **Graphic 1**, it does not depend only from the activity of Dime.

Therefore, companies do not always have an exclusive commitment relationship with a single company leader, even though most of them owe their turnover to work with Eni. With regard to the volume of oil extraction and the associated royalties, to date the daily extraction, it is about 80,000 barrels of oil per day [56]. Eni in Basilicata, in the last 10 years, paid about 2 billion€ for the production of the Val d'Agri. In the 2014–2016 3-year period, for example, Eni paid a total of 673.5 million€ to the state, the Basilicata Region, the province and the municipalities involved [56].

From a technical viewpoint, the crude oil processing in the final product includes a whole series of activities, ranging from extraction of oil until use, by the final consumer, of finished products. The value chain is composed of three main subprocesses, namely:

Upstream: it includes activities for the discovery and extraction of crude oil.

Midstream: it consists, principally, in the activity of refining, i.e. the process by which the crude is transformed into finished products (gasoline, diesel and fuel oil).

Downstream: it includes the distribution and sale of final product to the consumer, both as the individual who does fill up his car and both industry needs, for example, fuel oil to power its systems.

The production cycle consists of several stages:

1. **Prospecting:** it is finding new deposits.

2. **Punch:** the drilling of wells is the only way to verify the value of a field, i.e. the type and quantity of the hydrocarbons contained.

3. **Extraction:** in the production phase, a number of wells enough to optimize the exploitation of the deposit are provided.

4. **Treatment and storage:** once extracted, the crude oil is constituted by a mixture of gases and liquids, which must be separated and purified, before being placed in the oil and gas pipelines. Typically, these operations take place in a collection site or in the same production platforms.

5. **Transportation:** most of the oil must be transported to reach the refineries and the places of consumption. There are two ways to transport oil, often complementary: oil pipelines and oil tankers.

6. **Refining crude oil**: it consists of a wide variety of hydrocarbons with different amounts of carbon atoms. The refining consists in the separation of the various hydrocarbons based on the different boiling temperature.

The oil district of Val d'Agri operates within the framework of activities ranging from drilling to the processing and storage of oil. The district is composed of the hub company, ENI, which holds the rights to exploit the subsoil and a series of companies that, with different roles, physically implement all the activities necessary for oil extraction. Counting smaller companies in the supply and production chain, the district includes 2400 employees, increasing from about 400 in 1998 [57], as can be seen in **Figures 9** and **10**, representing the companies involved in direct supply and the district structure.

In 2018 DIME employed a total of 316 people. Of these, 64% are actually residents in Basilicata.

Figure 9.
The companies involved in direct supply.

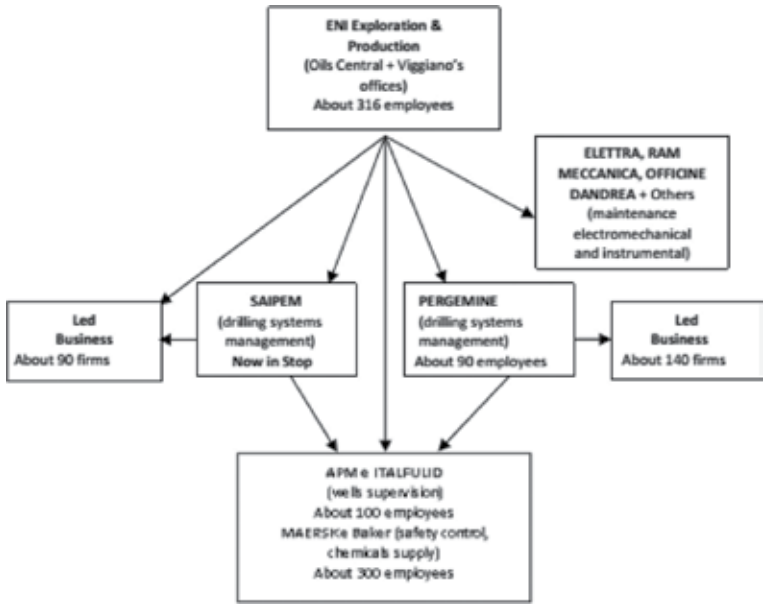


Figure 10.
Val d'Agri district structure.

The study carried out, in addition to being based on the analysis of the literature, was deepened both with the collection of the data of the district companies, through the administration of questionnaires, specially created, and interviewing the managers within DIME and with the directors of other companies in the Basilicata oil district. The characteristics considered are the structure of the individual companies, its specializations, the types of formal relations with the leading company, their stability, the nature of information exchanges, the existence of any common programs or projects for knowledge transfer (R&D, incubators, etc.), the distinctive knowledge of the company and the existence of knowledge management systems and further issues. Another aspect of the study was to illustrate aspects of employment in the district, verifying the potential existence of any common social and cultural context among the various employees, as can be seen in **Table 1**.

The data on the residence of employees within Val d'Agri and the larger area of Basilicata is important in the understanding knowledge transfer in the Hub-and- Spoke ID. The information indicates the existence of a common sociocultural

sphere, which is an essential fundament for transfer behaviour and activities. Once more, with a view to KT, data on the types of employment contracts, in **Table 2**, are important, because, for example, short-term contracts allow greater flexibility among employees, in terms of switching from one company to another. This flexibility leads to the shift of knowledge, both tacit and explicit.

The application of a type of contract, in respect to another, is closely linked to the nature of the productive activities of the individual companies and to the contractual relationships between the district companies. The time length of a contract derives from the contractual relationships, from the orders received, from the quantities and from the types and working times required by the main contracting company, the hub. Nevertheless, some of the smaller companies keep all staff in the district in permanent positions.

Considering all companies active in the Val d'Agri, 35% of these are directly active or provide indirect services to the oilfield. Considering only the DIME and the companies in its direct production chain, employment has increased in recent years, but only a part of the new positions is "permanent". In data, over the past 3 years, the permanent employees in district societies have increased by 50%, and the permanent employees put together have increased by over 100%. Unfortunately, of the 2400 workers only less than half of these are resident in Basilicata (**Table 3**), and less than half have permanent positions. Through the study of the employment of human resources in the district, we were able to obtain a reasonably clear picture

Employment type	**Personnel**	**Of which resident in Basilicata**
DIME employees	316	203
Indirect employment (DIME production chain)	2046	1000
Total	2362	1203

Table 1.
Eni DIME: direct and indirect employment.

DIME indirect employment, by contract type	**Number**
Permanent	1555
Term	394
Project-based	35
Other	62
Total	2046

Table 2.
Eni DIME: indirect employment by contract type.

DIME indirect employment, by residence	**Number**
Other Italian regions	1040
Resident in Basilicata	1000
• *Of which Val d'Agri*	668
• *Of which other part in the region*	332
Other EU nations	6
Total	2046

Table 3.
DIME indirect employment, by residence.

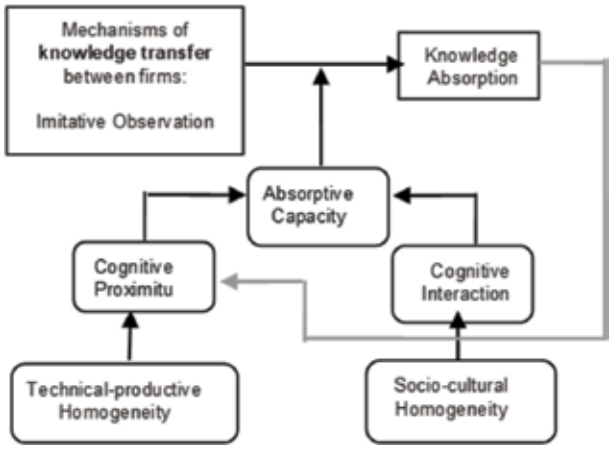


Figure 11.
Knowledge transfer between district firms.

of the role of knowledge transfer and sharing in the characteristics of the vertical relational system of this hub-and-spoke ID. The research is designed to elicit information on the mechanisms of knowledge transfer, whether tacit or explicit, including identification of how each company's degree of contractual power and position within the district might influence the relative mechanisms. Explicit knowledge transfer occurs primarily in the development of production processes along the companies of the district's value chain. In contrast, tacit knowledge transfer occurs primarily through the actions of individuals residing within the district. Human resources thus play an important role in knowledge transfer, through imitative behaviour, personal mobility mechanisms and social interaction (**Figure 11**).

Unfortunately, from the investigation carried, we have not received specific numerical data about the activities that individual firms play in order to promote the knowledge transfer. However, in line with the literature has emerged the key role that employees have in the transfer of district knowledge.

5. Conclusion

In carrying out our study, some research ideas are derived, consequently, from the structural peculiarity of the analyzed industrial district: the first one was to understand, or at least look for, the way in which the companies of the district are linked with one to the other in the value chain, with reference both to the position they occupy in the supply chain and to their "trading power", and the second, focused on understanding how (and if) the position of companies (along the chain), as well as their different trading power, influences the process of knowledge transfer within the district. Taking into account the reference literature on the "hub-and-spoke" morphology and the power relations that influence this district typology, attention was focused on the observation of knowledge transfer mechanisms—regardless of the tacit and/or explicit nature—for identifying the ways in which the trading power of companies and their position within the district influence the transmission of knowledge. From a technical point of view, the transfer of explicit knowledge is mainly linked to the development of the production process, along the entire district value chain; on the contrary, the transfer of tacit knowledge depends above all on the action of people within the district: human capital plays a very important role in the transfer of knowledge through imitation, mobility and social interaction.

Emerging in the oil production chain, there is at least one large company able to influence the way in which knowledge spreads in the local context. Furthermore, the national system of laws and regulations that governs this production environment is so binding that it can, in itself, create the existence of positions of power within the production chain. All this modifies the relationships established between the companies that are part of the production system, if a comparison is made with the relations that characterize the normal Marshallian districts. From the analysis of the collected data, but perhaps even more from the data obtained in an informal way, therefore not quantitative, it is possible to highlight some characteristics of the oil district of the Val d'Agri. First of all, as suggested at the beginning of our study, this type of industrial district responds more to Markusen's theory and hub-and-spoke groups rather than to the parameters of the Marshallian district. However, precisely this structure, based on the existence of a centre, characterized by a larger enterprise with a higher contractual force, and by the rays, that is, the smaller companies that make up the hub, is the cause of onset of particular business relationships. In economic terms, in fact, the non-extraction or slow extraction from any well in the valley leads to a considerable loss of revenue. However, at the moment, no voluntary knowledge transfer mechanisms are implemented in the oil district, if an exception is made for the creation of the training school and the business incubator. From the tacit point of view, the spontaneous relationships that develop among the employees of the district organizations, solely because of the institution of involuntary mental mechanisms, represent an example of tacit transfer of knowledge. In any case, it is believed that a further investigation into inter- and intracompany relationships within the district may allow the specific form of the district in question to be more specifically theorized. Furthermore, this in-depth analysis must be carried out also considering the implementation in the district of the "site contract", a method of employing human resources that limits the territorial displacement of local workers.

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this article.

Author details

Giovanna Testa
Department of Management Studies and Quantitative Methods, University of Naples "Parthenope", Naples, Italy

*Address all correspondence to: giovanna.testa@uniparthenope.it

References

[1] Drucker P. Managing in Time of Great Change. New York: Truman Talley Books; 1995

[2] Nonaka I. A dynamic theory or organisational knowledge creation. Organisational Science. 1994;**5**(1):14-37

[3] Camuffo A, Grandinetti R. I distretti industriali come sistemi locali di innovazione. Sinergie. 2006;**24**:33-60

[4] Becattini G. Il Calabrone Italia. Ricerche e Ragionamenti sulla Peculiarità Economica Italiana. Bologna: Il Mulino; 2007. pp. 231-232

[5] Schilirò D. I distretti industriali in Italia quale modello di sviluppo locale: Aspetti evolutivi, potenzialità e criticità. Vita e pensiero; 2008

[6] Becattini G. Riflessioni sul distretto industriale marshalliano come concetto socioeconomico. Stato e Mercato. 1989;**25**:112

[7] Cohen WM, Levinthal DA. Absorptive capacity: A new Perspective on learning and Innovation. Administrative Science Quarterly. 1990;**35**(1):128-152

[8] Antoldi F. Piccole imprese e distretti industriali: politiche di sviluppo in Italia e in America Latina. Bologna: Il Mulino; 2006

[9] Cerrato D et al. Valor.e un modello di distretto formativo per lo sviluppo locale agroalimentare; 2008

[10] Massa S, Merlino M, Puliafito PP. Knowledge management e vantaggio competitivo. In: Sviluppo & Organizzazione. Milano: Edizioni Scientifiche Tecniche Europee; 1999. p. 173

[11] Testa G. Il distretto petrolifero: Struttura e funzionamento. In: Il caso Val d'Agri. Milano: FrancoAngeli; 2012

[12] Sicca L. La Gestione Strategica Dell'impresa. Padova: Cedam; 2003

[13] Nonaka I. Come un'organizzazione crea conoscenza. Economia & Management. 1994;**3**:31-49

[14] Nonaka I, Takeuchi H. The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation. Oxford: Oxford University Press; 1995

[15] Gupta AK, Govindarajan V. Knowledge flow within multinational companies. Strategic Management Journal. 2000;**21**(4):473-496

[16] Spender JC. Making knowledge the basis of a dynamic theory of the firm. Strategic Management Journal. 1996;**17**(Winter):45-62

[17] Merle J, Golaleh E. Experience vs expertise. The role of implicit understandings of knowledge in determining the nature of knowledge transfer in two companies. Journal of Intellectual Capital. 2001;**2**(1):74-88

[18] Blackler F. Knowledge and the theory of organizations: organizations as activity systems and reframing of management. Journal of Management Studies. 1993;**30**:6

[19] Wang P, Tong TW, Koh CP. An integrated model of knowledge transfer: From MNC parent to China subsidiary. Journal of World Business. 2004;**39**(2):168-182

[20] Polanyi M. The Tacit Dimension. In: Prusak L, editor. Knowledge in Organizations. Boston, MA: Butterworth-Heinemann; 1997. pp. 135-146

[21] Polanyi M. Personal Knowledge: Toward a Post-Critical Philosophy. Chicago, IL: University of Chicago Press; 1962

[22] Nelson RR, Winter S. An Evolutionary Theory of Economic Change. Cambridge, MA: The Belknap Press of Harvard University Press; 1982

[23] Gilbert M, Cordey-Hayes M. Understanding the process of knowledge transfer to achieve successful technological innovation. Technovation. 1996;**16**(6):301-312

[24] Masnikosa VP. On some obstacles in communication and transfer of knowledge. Kybernetes. 1999;**28**(5):575-584

[25] Lyles MA, Schwenk C. Top management, strategy and organizational knowledge structure. Journal of Management Studies. 1992;**29**(2):155-174

[26] Hwang AS. Training strategies in the management of knowledge. Journal of Knowledge Management. 2003;**7**(3):92-104

[27] MacNeil CM. Line managers: Facilitators of knowledge sharing in teams. Employee Relations. 2003;**25**(3):297-307

[28] Becattini G. Dal settore industriale al distretto industriale. Alcune considerazioni sull'unità d'indagine dell'economia industriale. Rivista di Economia e Politica Industriale. 1979;**1**:7-21

[29] Becattini G. Riflessione sul distretto industriale marshalliano come concetto socio-economico. Stato e Mercato. 1989;**25**:114-115

[30] Becattini G. Mercato e Forze Locali. Bologna: Il Mulino; 1987

[31] Bellandi M, Russo M. Distretti Industriali e Cambiamento Economico Locale. Torino: Rosenberg & Sellier; 1994

[32] Martiri P. Sui Rapporti tra Imprese in Un'economia Industriale Moderna. Milano: FrancoAngeli; 1980

[33] Ottati D. Trust, interlinking transactions and credit in the industrial district. Cambridge Journal of Economics. 1994;**18**(6):529-546

[34] Mistri M. Il Distretto Industriale Marshalliano tra Cognizione e Istituzioni. Roma: Carocci; 2006

[35] Ottati D. Il mercato comunitario. In: Becattini G, editor. Mercato e Forze Locali: Il Distretto Industriale. Bologna: Il Mulino; 1987

[36] Piore MJ, Sabel CF. The Second Industrial Divide: Possibilities For Prosperity. New York: Basic Book; 1984

[37] Belussi F, Pilotti L. Knowledge creation and collective learning in the Italian local production system. In: Quaderni del Dipartimento di Scienze Economiche. Padova: Marco Fanno; 2001

[38] Boari C, Lipparini A. Networks within industrial districts: Organizing knowledge creation and transfer by means of moderate hierarchies. Journal of Management and Governance. 1999;**3**(4):339-360

[39] Belussi F, Pilotti L. Knowledge creation and learning within the governance of the Italian production systems. In: Paper at SMEs and Districts: Hybrid Governance Forms, Knowledge Creation & Technology Transfer Conference, LIUC; 5-7 November, 1998

[40] Belussi F, Pilotti L. Learning and innovation by networking within the Italian industrial districts: The development of an explorative analytical model. In: Paper at 4th International Seminar on Technological Development in Industrial Networks; University of Urbino; 7-8 April; 2000

[41] Boschma RA, Lambooy JG. Knowledge, market structure and economic coordination: Dynamics of

industrial districts. Growth and Change. 2002;**33**(3):291-311

[42] Pilotti L. Evolutionary and adaptive local systems in North East Italy: Strategies of localized learning, open leadership and cooperation. Towards imperfect Communitarian Capitalism. Human Systems Management. 1999;**2**:87-105

[43] Krugman P. Geography and Trade. Cambridge, MA: MIT Press; 1991

[44] Porter ME. In: Porter ME, editor. Clusters and Competition. Boston: Harvard Business School Press; 1998

[45] Markusen A. Sticky places in slippery space. A typology of industrial districts. Economic Geography. 1996;**72**(3):293-313

[46] Grandinetti R. Indagine sui distretti del Livenza e del Quartier del Piave. In: Economia e Società Regionale. Milano: FrancoAngeli; 2002. pp. 1-2

[47] Camagni R, Capello R. Milieux innovateurs e apprendimento collettivo: Dalla teoria all'analisi empirica. In: Camagni R, Fiorentini R, Mistri M, a cura di. Auto-organizzazione e Apprendimento Strategico: Saggi in Onore di Eugenio Benedetti. Padova: Cedam; 2002

[48] Camagni R, Capello R. Apprendimento collettivo, innovazione e contesto locale. In: Camagni R, Capello R, a cura di. Apprendimento Collettivo e Competitività Territoriale. Milano: FrancoAngeli; 2002

[49] Aydalot P, editor. Milieux Innovateurs en Europe. Paris: GREMI; 1986

[50] Rullani E. Sistemi territoriali e apprendimento localizzato. In: Biggiero L, Sammarra A, editors. Apprendimento, Identità e Marketing del Territorio. Roma: Carocci; 2002

[51] Rullani E. Il valore della conoscenza. Economia e Politica Industriale. Milano: FrancoAngeli. 1994;**82**:47-73

[52] Nonaka I, Konno N. The concept of "Ba": Building a foundation of knowledge creation. California Management Review. 1998;**40**:30

[53] Crabtree E, Bower J, Keogh W. Conflict or collaboration: The changing nature of inter-firm relationship in UK Oil and Gas Industry. Technology Analysis & Strategic Management. 1997;**9**(2):179-192

[54] Rabia H. Oilwell Drilling. London/ Gaithersburg, MD, USA: Graham & Trotman; 1985

[55] Cumbers A, McKinnon D, Chapman K. Innovation, collaboration and learning in region cluster: A study of SMEs in the Aberdeen oil complex. Environment and Planning A. 2003;**35**(9):1689-1706

[56] www.eni.com/eni-basilicata

[57] Bubbico D. Il Lavoro Nell'indotto ENI della Val d'Agri (Basilicata): Caratteristiche Occupazionali, Condizioni di Lavoro e Livelli Salariali. Osservatorio CGIL/FIOM; Università di Salerno, Dipartimento di Scienze Economiche e Statistiche; 2013

Edited by Mark Wickham

The knowledge management concept has emerged to serve as one of the critical inputs to the strategic management process, and a common factor underpinning competitive advantage. Over the concept's development, knowledge management research has focused on the processes that enable a firm to recognize sources of data, to transform data into useful information, to disseminate the information, and to develop strategies based on its insights. More recently, the development of the concept has begun to focus on the critical antecedents that enable these knowledge management processes to be implemented more effectively and efficiently. This research book serves to highlight some of the antecedents of effective knowledge management through empirical research done by researchers all around the globe.

Published in London, UK

IntechOpen

ISBN 978-1-78985-045-1