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Dipartimento di Ingegneria Gestionale e della Produzione

Digital & Knowledge: Analisi degli effetti e dei limiti della digitalizzazione nel caso di studio Pattern S.p.A.

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1 Introduzione

Gli ultimi anni sono stati caratterizzati da una pervasiva digitalizzazione e il boom tecnologico ha portato profondi cambiamenti in aziende di tutti i settori: dalla meccanica di precisione, al settore medico, passando per settori tradizionali come il tessile o agroalimentare. Il boom digitale e tecnologico è stato favorito dal costante aumento della potenza di elaborazione che ha permesso di digitalizzare e automatizzare compiti sempre più complessi. Basti pensare all'evoluzione che è avvenuta nel settore automotive nell'ambito della guida autonoma che necessita di raccogliere ed elaborare attraverso algoritmi di intelligenza artificiale un'enorme mole di dati.

Oggi l'introduzione di strumenti digitali e la meccanizzazione di alcuni processi risultano essere un elemento imprescindibile per le aziende al fine di rimanere al passo con i tempi e mantenere il proprio vantaggio competitivo. Adeguarsi alle nuove tecnologie o cercare di svilupparne di nuove consente di allinearsi con le richieste di un mercato sempre più esigente e veloce, e permette allo stesso tempo di non perdere le quote di mercato conquistate nel naturale svolgersi dell'attività aziendale. L'imprescindibile evoluzione digitale ha causato un naturale mutamento nelle logiche di lavoro andando a mutare compiti o in alcuni casi interi mestieri. Ad esempio, con l'introduzione di macchine a taglio automatico in aziende che operano nei settori tessili, la figura dell'addetto al taglio è stata completamente sostituita da una macchina costruita ad hoc per svolgere il compito in maniera più veloce e precisa. L'addetto, quindi, in questo caso è passato da effettuare il taglio a mano a svolgere un lavoro di controllo qualità del taglio svolto dal macchinario. Se invece guardiamo ancora indietro, possiamo osservare come nel tempo la figura del bibliotecario abbia anch'essa subito una trasformazione. All'inizio dell'era di internet, egli era considerato un "maestro della ricerca" in quanto internet era un prodotto embrionale il cui utilizzo risultava difficoltoso. Con l'evolversi dei motori di ricerca, questi sono diventati sempre più "user-friendly" e l'utilizzo non era più solo precluso ai cosiddetti "maestri della ricerca". Il bibliotecario, quindi, è diventato un mediatore che collegava le persone alle informazioni. La digitalizzazione però non ha solo modificato alcuni mestieri, ma ha anche costruito delle nuove figure come, ad esempio, quello dell'analista dei dati.

Quello su cui la tesi si interroga e mira a dare risposte è se esista un limite alla digitalizzazione e quali siano gli elementi idiosincratici della conoscenza che non possono essere digitalizzati. Esistono professioni che per loro natura risultano essere molto umano-centrici, come ad esempio lo psicologo, l'avvocato o l'assistente sanitario, ma nonostante questo si stanno sviluppando soluzioni tecnologiche che puntano a sostituire l'uomo in questi mestieri. Ad esempio, se da una parte è stato sviluppato in

Cina un algoritmo in grado di giudicare gli imputati in completa autonomia, dall'altra sono stati costruiti robot in grado di assistere anziani sulla base della percezione dell'emotività. Tutto ciò porta quindi a chiedersi:

- Tutti i mestieri, che siano più o meno umano-centrici o routinari, possono subire gli effetti della digitalizzazione ed essere completamente sostituiti da un algoritmo o da una macchina?
- Quali possono essere gli aspetti della conoscenza che sfuggono alla digitalizzazione impedendo quindi una completa sostituzione dell'individuo in un determinato mestiere?

Per dare una risposta a queste domande, è stato costruito un framework sulla base dell'analisi della letteratura scientifica disponibile e mediante il quale è stato analizzato un caso di studio.

Struttura della tesi:

Il Capitolo 2 passa in rassegna la metodologia utilizzata e la letteratura scientifica analizzata al fine di estrarre un framework in grado di spiegare l'evoluzione della conoscenza in un processo di trasformazione digitale posta in essere da una determinata azienda presa come caso di studio, il quale sarà discusso nel Capitolo 3. In questo capitolo, quindi, l'attenzione è posta sui diversi studi riguardanti la conoscenza al fine di trarre una tassonomia in grado di riassumere tutte le diverse catalogazioni e di permettere la costruzione di un framework semplice da utilizzare. Il framework si configura come una matrice 2x2 formata dalle seguenti due variabili:

- Grado di "tacitness": indica quanto la conoscenza risulti più o meno codificata in regole standard e univoche per tutti;
- Grado di individualità: indica quanto la conoscenza risulti più o meno appartenente ad un gruppo di individui accomunati da aspetti di carattere culturale, aziendale o nazionale.

Il Capitolo 3 analizza un'azienda che ha visto mutare il proprio lavoro in virtù dello sviluppo tecnologico. Viene utilizzato il framework per catturare come la conoscenza si sia evoluta per quanto riguarda le variabili di tacitness e individualità al fine di dedurre le motivazioni e le cause sottostanti la trasformazione e lo spostamento da un quadrante del framework ad un altro.

Nel Capitolo 4 sono presentate le conclusioni.

2 Metodologia e analisi letteratura

2.1 Metodologia

Il punto di partenza del presente lavoro di ricerca è stato la lettura e l'analisi degli articoli: "The Digital Transformation of Search and Recombination in the Innovation Function: Tensions and an Integrative Framework" (Lanzolla G., Pesce D., Tucci C.L., 2020), "What's Under Construction Here? Social Action, Materiality, and Power in Constructivist Studies of Technology and Organizing" (Leonardi P.M., Barley S.R., 2010) e "Defining What We Do—All Over Again: Occupational Identity, Technological Change, and the Librarian/Internet-Search Relationship" (Nelson A.J., Irwin J., 2014). L'analisi ha portato a ricavare le prime keyword necessarie per generare una query iniziale da inserire su Scopus al fine di ottenere articoli inerenti all'oggetto della ricerca.

Di seguito sono riportate le keywords individuate riguardanti il concetto di digitalizzazione:

- "digiti?ation
- "digitali?ation"
- "dat?fication"
- "digital transformation"
- "digital artifact"
- "digital twin"
- "digital copy"
- "digital materiality"

Inoltre, al fine di identificare articoli inerenti alla trasformazione digitale e alla codifica di aspetti di business, sono state scelte le seguenti keywords:

- "technolog*"
- "codif*"
- "translat*"
- "identity"

La query era così strutturata:

(TITLE-ABS-KEY ("digiti?ation" OR "digitali?ation" OR "dat?fication" OR "digital transformation" OR "digital artifact" OR "digital twin" OR "digital copy" OR "digital materiality" OR "technolog*") AND (codif* OR translat* OR identity) AND (knowledge)) AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (EXACTSRCTITLE , "MIS Quarterly Management Information Systems") OR LIMIT-TO (EXACTSRCTITLE , "Academy Of Management Annals") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of Management Studies") OR LIMIT-TO (EXACTSRCTITLE , "Organization Science") OR LIMIT-TO (EXACTSRCTITLE , "Strategy Science") OR LIMIT-TO (EXACTSRCTITLE , "Strategic Management Journal") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of Management") OR LIMIT-TO (EXACTSRCTITLE , "Academy Of Management Journal") OR LIMIT-TO (EXACTSRCTITLE , "Academy Of Management Review") OR LIMIT-TO (EXACTSRCTITLE , "Administrative Science Quarterly") OR LIMIT-TO (EXACTSRCTITLE , "Information Systems Research") OR LIMIT-TO (EXACTSRCTITLE , "Management Science") OR LIMIT-TO (EXACTSRCTITLE , "Academy Of Management Perspectives") OR LIMIT-TO (EXACTSRCTITLE , "California Management Review") OR LIMIT-TO (EXACTSRCTITLE , "Research Policy") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of International Business Studies") OR LIMIT-TO (EXACTSRCTITLE , "Journal Of Product Innovation Management") OR LIMIT-TO (EXACTSRCTITLE , "Human Relations") OR LIMIT-TO (EXACTSRCTITLE , "Leadership Quarterly") OR LIMIT-TO (EXACTSRCTITLE , "Harvard Business Review") OR LIMIT-TO (EXACTSRCTITLE , "MIT Sloan Management Review") OR LIMIT-TO (EXACTSRCTITLE , "Academy of Management Discoveries") OR LIMIT-TO (EXACTSRCTITLE , "Organization Studies")) AND (LIMIT-TO (LANGUAGE , "English"))

La query iniziale risultava molto generale e superficiale. Il numero di articoli individuati infatti era di 1042. Per ridurre il numero di documenti da analizzare al fine di ricavare quelli più specifici per quanto riguarda l'oggetto della nostra ricerca, sono stati effettuati degli aggiornamenti della query inserendo nuove keywords con la funzione "AND" o eliminandone alcune inserite con la funzione "OR". L'aggiornamento ha portato all'individuazione di un numero ridotto di articoli e di questi sono stati analizzati titolo ed abstract al fine di ricavare nuove keywords più specifiche e importanti per il nostro studio.

Sulla base di queste sono state generate nuove query e aggiornate di volta in volta al fine di ricavare articoli sempre più inerenti all'oggetto della tesi.
Dopo vari cicli di ricerca sono stati identificati e analizzati circa novanta articoli (lo studio di questi ultimi è riportato in appendice). Il focus principale è stato quello di individuare nella storia della ricerca riguardante la conoscenza le tassonomie e le categorizzazioni di quest'ultima.
Lo step successivo è stato quello di sistematizzare i diversi attributi della conoscenza al fine di scegliere quelli che potessero essere utilizzati come variabili nella costruzione di un modello matriciale. Questa sistematizzazione è stata effettuata costruendo un foglio excel contenente tutte le tassonomie e tutti gli attributi ricavati. Nello specifico, la prima colonna è stata riempita con i vari attributi e, a partire dalla seconda colonna, la prima riga è stata riempita con le diverse categorie di conoscenza. A questo punto le celle sono state riempite con una "x" per indicare che un determinato attributo era stato accostato a quella particolare categoria di conoscenza. Nella figura sottostante è illustrato il procedimento descritto.

	A	B	C	D	E	F	G	H	I	J	
1		Knowledge	Tacit	Explicit	Knowledge of the firm	Information	Know-how	Individual knowledge	Group knowledge	Embrained knowledge	Embo
2	Cognitive	x	x							x	
3	Technical		x								
4	Procedural		x		x			x			
5	Discrete			x							
6	Digital			x							
7	Declarative			x	x	x					
8	Personal	x	x								
9	Crystalled		x								
10	Intangible		x								
11	Hard to communicate		x								
12	Easy to communicate			x							
13	Hard to formalize		x								
14	Rooted in action		x								
15	Transmittable in formal			x							
16	Observable				x						
17	Standardized					x					
18	Proprietary					x					
19	Verifiable										
20	Competitive					x					
21	Accumulated						x				
22	Trasferable				x	x					
23	Experiential	x	x		x						
24	Convertible										

Figura 1: Visuale Excel di alcuni attributi e alcune categorie di conoscenza

Analizzando poi le diverse categorizzazioni è stato possibile riassumerle distinguendo tra conoscenza esplicita e conoscenza tacita e tra conoscenza individuale e conoscenza collettiva. Si è giunti a questo risultato concentrandosi sulle categorie più ricche di attributi e radunando quelle che si riferivano a concetti molto simili sotto un'unica denominazione.
La scelta delle categorie ha permesso la costruzione di un framework costituito da un piano bidimensionale formato dalle seguenti variabili:

- grado di tacitness
- grado di individualità

La descrizione del framework è illustrata successivamente (nel paragrafo 2.3).

Una volta costruito il framework, esso è stato applicato ad un'azienda presa come caso di studio. Lo studio è iniziato dalla lettura e dall'analisi del documento INAPP (Istituto Nazionale per l'Analisi delle Politiche Pubbliche) relativo all'azienda considerata e si è articolata con documenti e interviste. Il framework è stato utilizzato per indagare le mutazioni di conoscenza (ad esempio, da tacita a esplicita e da collettiva a individuale) a seguito di un determinato processo di digitalizzazione. Questo ha consentito di ricavare le conclusioni esposte nel Capitolo 4.

2.2 Analisi letteratura

2.2.1 Tacita-esplicita

Polanyi sostiene che la conoscenza umana ha la caratteristica di essere tacita: tale conoscenza è spesso sviluppata in molti anni di istruzione, formazione ed esperienza, e in modi idiosincratici, compresa la sperimentazione, l'improvvisazione e l'apprendistato. Un'abile performance (per esempio nella scienza, nell'artigianato o nelle arti) coinvolge l'attività fisica, i cui molteplici aspetti devono essere appresi attraverso la pratica e non possono essere catturati completamente in istruzioni scritte o verbali. Polanyi (1962;1967) definisce come tacita la conoscenza che ha una qualità personale, esperienziale ed è difficile da formalizzare, codificare e comunicare agli altri. La conoscenza tacita implica un'interazione tra la partecipazione alla conoscenza focale (il compito su cui ci si concentra) e la conoscenza sussidiaria (la conoscenza complementare, spesso di base, su cui si fa affidamento per eseguire il compito focale). La conoscenza tacita include, quindi, non solo la conoscenza che non possiamo articolare, ma anche quella che è meglio lasciare non articolata e sussidiaria (cioè non focale) al fine di eseguire abilmente un'azione. La conoscenza che è stata articolata e codificata rimane tacita nella misura in cui funziona in modo sussidiario nello svolgimento dei compiti. Questa è inoltre radicata nell'azione ed evolve in un contesto specifico: gli individui acquisiscono la conoscenza tacita attraverso la pratica e le interazioni informali.

Nonaka (1994), partendo da questa definizione, distingue la conoscenza tacita in cognitiva e tecnica. La prima sottocategoria comprende quelli che Johnson-Laird (1983) chiama "schemi mentali", cioè i paradigmi, le credenze e i punti di vista dell'individuo. La seconda sottocategoria comprende le abilità e il know-how concreto. Accanto a queste due sottocategorie si aggiunge una terza. Infatti, Anderson (1983) definisce procedurale la conoscenza tacita che comprende le attività svolte in maniera mnemonica (come, ad esempio, andare in bici o suonare il pianoforte).

Polanyi (1962;1967) definisce come esplicita la conoscenza che può essere codificata e trasmessa in maniera formale attraverso un linguaggio sistematico e può subire un processo di storage dal

momento che può essere rappresentata in una qualche forma materiale. La sua esternalizzazione può avvenire attraverso l'utilizzo di simboli, oggetti e linguaggio in modo da consentire la trasmissione o la visualizzazione. Essa è esplicitata sotto forma di scienza o standard e pratiche sociali. Per Nonaka (1994), se essa è conservata in record passati come librerie o archivi è definita discreta, digitale se invece è conservata in database. Per Anderson (1983) la conoscenza esplicita è definita dichiarativa se è espressa sotto forma di proposizione.

Polanyi sosteneva inoltre che la conoscenza tacita non è mai completamente convertibile in conoscenza esplicita. Tuttavia, la presenza di una dimensione tacita della conoscenza non nega la possibilità di rendere esplicita una certa conoscenza tacita, sebbene la conversione rimanga incompleta. Dal momento che alcune forme di conoscenza possono essere codificate e articolate, ma altre no, la conoscenza può essere vista come residente sia dentro che fuori gli individui. Successivamente, Nonaka, insieme a Von Krogh e Voepel, pubblica due articoli nel 2006 e nel 2009 che ampliano la discussione e lo studio sulla conoscenza condotta in precedenza. La differenziazione tra conoscenza esplicita e tacita si arricchisce di attributi. La conoscenza tacita è legata ai sensi, alle abilità di movimento, alle esperienze tattili, ai modelli mentali non articolati, alle regole implicite e alle intuizioni. Questa è radicata nelle azioni, procedure, ruotine, idee, valori e nelle emozioni. Inoltre, è impossibile da comunicare ed è soggettiva, esperienziale e acquisita senza dirette istruzioni ed è creata "here and now" (Leonard e Sensiper 1998; Rämö 2004). Essa è principalmente acquisita svolgendo delle attività e quindi risiede nella pratica (Cook and Brown 1999, Hildreth and Kimble 2002, Tsoukas 2003, Ribeiro and Collins 2007).

Per Spender e Grant (1996) la conoscenza tacita è strategicamente importante perché è sia inimitabile che non appropriabile.

Mentre, esplicita è la conoscenza che può essere formulata in frasi e catturata attraverso la scrittura o disegni. Questa ha un carattere universale e può agire attraverso i contesti ed essere comunicata agli altri poiché può essere articolata. Inoltre, è una conoscenza oggettiva e razionale e creata "then and there" (Leonard e Sensiper 1998; Rämö 2004).

Per Spender (1996), la conoscenza esplicita è immagazzinata in database, procedure operative standard, manuali e si riferisce ad una conoscenza oggettificata. Quella tacita, per lo studioso, si distingue in tre sottotipi:

- automatic: conoscenza data per scontata;
- conscious: può essere codificata e potenzialmente è disponibile alle altre persone;
- collective: conoscenza tacita di un gruppo sociale.

Per Inkpen e Dinur (1998) la conoscenza tacita è poco trasferibile e può dissiparsi quando, ad esempio, la conoscenza è trasferita da una joint venture ad un partner. La conoscenza esplicita può

essere codificata e articolata in manuali, programmi per computer e training tool. Inoltre, è incarnata in specifici prodotti e processi. Zander e Kogut (1995) ritengono che la conoscenza esplicita sia imitabile.

Galunic e Rodan (1998) sostengono che la conoscenza tacita è difficile da trasferire e difficile da rilevare. Ci sono due tipologie di conoscenza tacita per gli studiosi:

- intrinsecamente tacita, poiché insita nelle abilità dell'individuo. Questa è costosa e difficile, se non impossibile, da esplicitare in documenti;
- tenuta in forma tacita, tipicamente come routine. Aumenta l'efficienza e l'affidabilità dei processi.

Per Garud e Nayyar (1994) la conoscenza tacita è incorporata nei processi cognitivi dell'individuo o è profondamente radicata nei processi di routine e non routine della cultura unica e dei valori dell'organizzazione (Daft e Lengel 1986). Ci sono inoltre ambiguità causali che la circondano (Szulanski 1996). La conoscenza esplicita può invece essere trasferita con relativa facilità.

Tsoukas nella sua review "A Dialogical Approach to the Creation of New Knowledge in Organizations" (2009) definisce la conoscenza prima sfruttando la definizione data da Nonaka e Takeuchi spiegando come questa sia creata dall'incontro tra tacita ed esplicita, dopodiché crea una propria definizione fornendo alcune caratterizzazioni delle singole conoscenze. Quella tacita viene censita come "inconsapevolezza focale", cioè quando non si ha una vera e propria conoscenza del background da cui deriva.

Allo stesso modo, Alvesson e Karreman (2001) definiscono la conoscenza tacita come invisibile, non facilmente trasmissibile e soprattutto "highly people-based" cioè legata alle persone, a coloro che la possiedono. Purvis, Sambamurthy e Zmud (2001), estendono questa definizione e, riprendendo Demsetz (1991), la definiscono indissolubilmente intrecciata con le esperienze ed i contesti situazionali entro i quali è stata generata. Al contrario quella esplicita è facilmente trasferibile e comunicabile in quanto codificabile e legata alle routine che coordinano gli sforzi legati al lavoro di professionisti ed esperti in un'organizzazione.

Una visione differente ma pur sempre coerente nasce dall'analisi di Turner e Makhija (2006) nella quale la conoscenza tacita, che viene spiegata (oltre alle precedenti definizioni) come non suddivisibile in componenti di più basso livello, viene contrapposta a quella codificabile, termine che non è più solo un aggettivo ma diventa una tipologia di conoscenza (comunque accostata a quella esplicita con riferimento all'articolo di Makhija & Ganesh del 1997). La conoscenza codificabile è rappresentata da qualcosa che può essere scomposta in parti più semplici.

Per Foss (1996), la conoscenza tacita è un deposito di conoscenza specializzata che è pienamente efficiente nell'uso solo all'interno di una determinata azienda che la possiede, dal momento che è difficile appropriarsene parzialmente.
Un'estensione viene chiaramente data da Gourlay (2006) il quale aggiunge aggettivi alla definizione di Nonaka della conoscenza tacita come: soggettiva, creata "here and now", basata sulla pratica, difficile da comunicare oggettivamente, della mente ed interessata alla teoria. Perez-Nordtvedt, Kedia, Datta e Rasheed (2008) affermano che la più grande differenza tra tacita ed esplicita è rappresentata dall'imitabilità. Mentre la conoscenza tacita non è facilmente imitabile, quella esplicita è ripetibile e facilmente traducibile dalla tecnologia.
Uno dei più grandi contributi viene dato da Leiponen (2006), il quale, oltre a riprendere le caratteristiche viste in precedenza, si distacca dalla visione comune. Egli parla della conoscenza esplicita come migliorativa dei servizi e proveniente dall'educazione. Poi ne definisce una misura, cioè il grado in cui l'azienda fa affidamento su soluzioni di servizio o di tecnologia codificata nelle loro operazioni. Allo stesso modo asserisce che la conoscenza tacita rappresenta un vantaggio competitivo sostenibile e che essa è misurata dal grado in cui la competitività dell'impresa dipende dalle conoscenze, o abilità, che risiedono in un team.
Nel campo della psicologia evolutiva e cognitiva si sostiene come i processi che richiedono ampie deliberazioni coscienti di molti fattori dipendono dalla conoscenza esplicita in misura maggiore rispetto ai processi che richiedono meno deliberazioni coscienti e meno fattori da considerare. D'altra parte, i processi operativi come le routine spesso includono pochi fattori e sono eseguiti automaticamente con poco o nessun pensiero cosciente e portano allo sviluppo e all'uso della conoscenza tacita.

2.2.2 Individuale-collettiva

Per Spender (1996) la conoscenza collettiva è incorporata nelle routine, norme e cultura dell'azienda ed è generata internamente. Questa costituisce la socializzazione e le attività sociali degli individui. La conoscenza individuale invece è associata alla propria identità collettiva e sociale.
Brown e Duguid (1998) affermano che la conoscenza collettiva è generata quando le persone lavorano insieme all'interno di un'azienda e quindi questa è profondamente radicata nella pratica. Questa è una conoscenza condivisa e parziale che gli individui hanno in virtù della loro appartenenza ad una "comunità di pratica". Attraverso queste "comunità di pratica", gruppi specializzati sono capaci di produrre conoscenza altamente specializzata e locale.

Per Cook e Brown (1999) la conoscenza di gruppo è una conoscenza di una specifica categoria di individui. I due studiosi prendono come esempio i nefrologi affermando che essi hanno la conoscenza di diagnosticare la nefrite e questa è una conoscenza che non è insita nel singolo individuo ma lo è in una specifica categoria di persone, indicate come nefrologi.
Per Cabrera A. e Cabrera EF. (2002) la conoscenza collettiva è difficilmente appropriabile perché ha un carattere sopra-individuale e perché è fatta di capacità co-specializzate (Nnda 1996). Inoltre, è difficile da imitare perché è ambigua in quanto è inserita in una complessa rete di relazioni interpersonali informali in un sistema di norme e credenze (Sanchez e Heene 1997).
Per De Long e Fahey (2000) la conoscenza umana (individuale) costituisce ciò che gli umani sanno e non sanno fare e può avere un orientamento culturale o astratto. La conoscenza sociale (collettiva) invece esiste nella relazione tra gli individui o all'interno dei gruppi. Questa è largamente costituita da norme culturali e la sua importanza si riflette nella capacità dell'individuo di collaborare e sviluppare relazioni transazionali.
Chomski (2002) afferma che la conoscenza individuale si sviluppa dall'interno o matura con un'influenza esterna relativamente minima o un'importanza causale ambientale.
Per Felin e Hesterly (2007) la conoscenza individuale non è interamente costruita socialmente o determinata dall'ambiente ma, piuttosto, c'è un nucleo del sé che può determinare in larga misura i risultati dell'apprendimento e della conoscenza.
Tsoukas in "A Dialogical Approach to the Creation of New Knowledge in Organizations" (2009) spiega come la conoscenza collettiva emerga da un'interazione sociale, dal dialogo (quindi dialogica) ed è trasferibile all'interno della comunità.

2.2.3 Composizione delle conoscenze

Collins (1993) propone una propria categorizzazione della conoscenza:

- Embrained knowledge: conoscenza dipendente da skill concettuali e abilità cognitive;
- Embodied knowledge: conoscenza orientata all'azione e radicata in contesti specifici;
- Encultured knowledge: conoscenza riferita ai processi di comprensioni condivise e dipende fortemente dal linguaggio;
- Embedded knowledge: conoscenza che risiede in routine sistematiche. Essa è analizzabile in termini di sistema e nelle relazioni tra tecnologie, ruoli, procedure formali e routine emergenti (Badaracco, 1991). Inoltre, è una conoscenza difficile da duplicare (Reich, 1991);
- Encoded knowledge: conoscenza convertita in simboli e segnali.

Nell'articolo "Knowledge-sharing dilemmas" (2002), Cabrera A. e Cabrera E.F. costruiscono sulla base della suddivisione di Collins quattro combinazioni di conoscenza:

- Individuale-Tacita: embodied knowledge
- Individuale-Esplicita: embrained knowledge
- Collettiva-Esplicita: encoded knowledge
- Collettiva-Tacita: encultured e embedded knowledge

Spender nell'articolo del 1996 "Making knowledge the basis of a dynamic theory of the firm", costruisce le stesse quattro combinazioni definendole nel seguente modo:

- Individuale-Tacita: Automatic
- Individuale-Esplicita: Conscious
- Social-Esplicita: Objectified
- Social-Tacita: Collective

2.3 Framework

Per costruire il framework è stato necessario identificare le variabili costituenti un piano bidimensionale su cui effettuare le inferenze riguardo l'evoluzione della conoscenza nelle diverse attività dell'impresa presa come caso di studio.

Le variabili sono state individuate analizzando le diverse tassonomie proposte dalla letteratura scientifica. Tali categorizzazioni proposte possono essere riassunte quindi distinguendo tra:

- conoscenza tacita e conoscenza esplicita
- conoscenza individuale e conoscenza collettiva

Sulla base di esse, sono state considerate come variabili di interesse:

- grado di "tacitness": indica quanto la conoscenza è più o meno tacita o esplicita. Muovendosi lungo l'asse di riferimento la conoscenza passa dall'essere altamente tacita all'essere altamente esplicita o viceversa;
- grado di individualità: indica quanto la conoscenza è più o meno individuale o collettiva. Muovendosi lungo l'asse di riferimento la conoscenza passa dall'essere altamente individuale all'essere altamente collettiva o viceversa.

Gli assi indicano quanto segue:

- asse orizzontale: indica quando la conoscenza sia più o meno tacita
- asse verticale: indica quanto la conoscenza sia più o meno individuale

L'intersezione dei due assi genera un piano dimensionale che permette di studiare le caratteristiche della conoscenza secondo le due variabili di grado di "tacitness" e grado di individualità. Il framework permette di identificare le trasformazioni della conoscenza quando viene posto in essere un processo di trasformazione digitale in determinate attività dell'impresa.

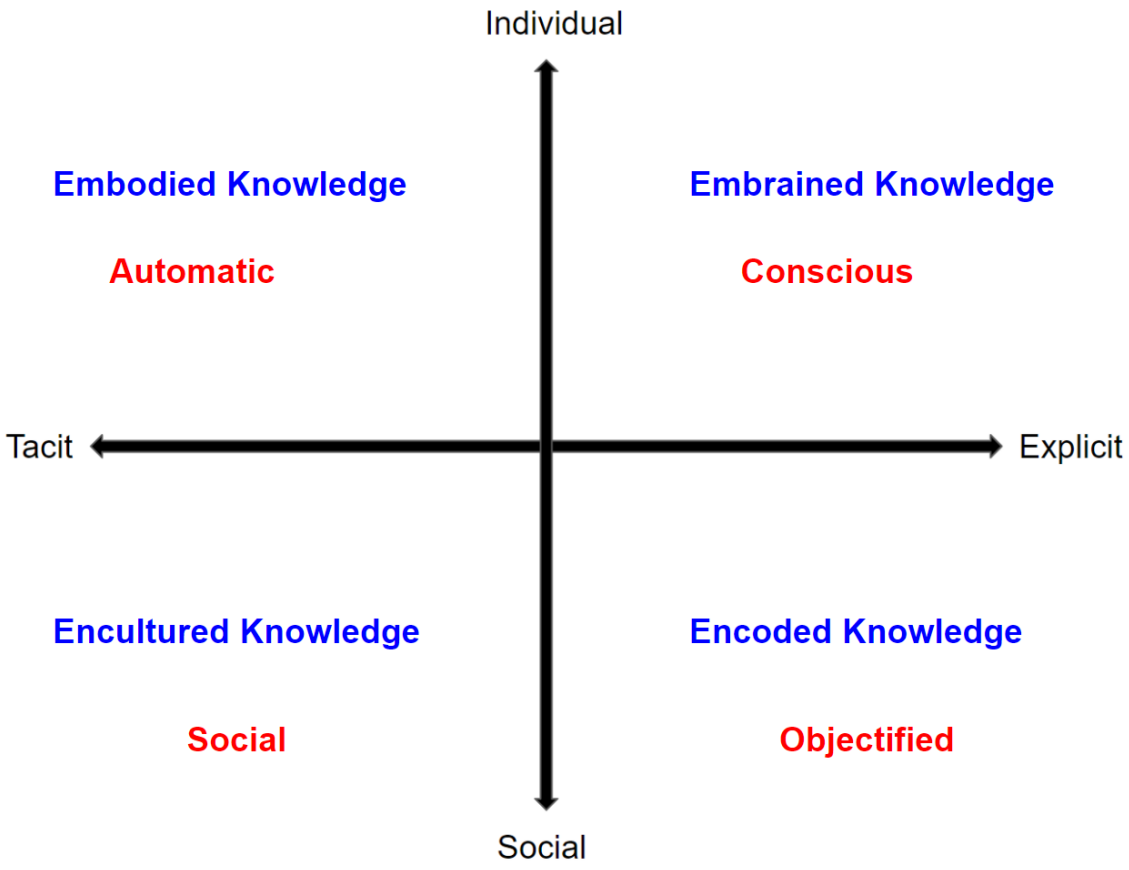


Figura 2: Framework

Il primo quadrante indica una conoscenza tacita e individuale (embodied knowledge): conoscenza che dipende dalla presenza fisica delle persone, da informazioni senzienti e sensoriali ed è radicata in contesti specifici (Zuboff). Ad esempio, le abilità artigiane sono delle conoscenze tacite e individuali in quanto nascono da fenomeni esperienziali, cambiano da artigiano ad artigiano e non possono essere formalizzate e comunicate.

Il secondo quadrante indica una conoscenza esplicita e individuale (embrained knowledge): conoscenza che dipende da skill concettuali e da abilità cognitive. Ad esempio, l'abilità di utilizzare in modo completo e strutturato un software (ad esempio, Excel) o la capacità di scrivere righe di codice secondo un determinato linguaggio informatico sono conoscenze individuali ed esplicite. Sono esplicite in quanto le diverse funzioni del software e le diverse sintassi del linguaggio informatico sono formalizzate e possono essere comunicate. La capacità di maneggiare in modo agevole le funzioni o il linguaggio dipende dal singolo individuo: dalla sua esperienza e dalla sua attitudine.

Il terzo quadrante indica una conoscenza esplicita e collettiva (encoded knowledge): conoscenza convertita in segnali e in simboli e quindi risulta formalizzabile e trasferibile a tutti coloro che possono comprendere la simbologia e formalizzazione. Le norme stradali sono un esempio di conoscenza esplicita e collettiva. Essa è una conoscenza formalizzabile e trasferibile e tutti coloro che conoscono le regole della strada possono comprenderne la simbologia. Inoltre, tutti si comportano nello stesso modo di fronte ad un cartello o ad un semaforo e per questo motivo è una conoscenza collettiva.

Il quarto quadrante indica una conoscenza tacita e collettiva (encultured knowledge): conoscenza raggiunta per comprensioni condivise. Tale conoscenza è profondamente legata ai processi di socializzazione e acculturazione. Ad esempio, le abilità dei vetrai di Murano relative al trattamento del vetro risultano non essere codificabili e nascono dalla cultura del luogo.

3 Pattern S.p.A.

3.1 Excursus storico

La fondazione di Pattern risale a fine anni 2000 nel torinese a opera di Fulvio Botto e Francesco Martorella, due imprenditori che decidono di utilizzare le conoscenze pregresse sviluppate presso Gruppo Finanziario Tessile (GFT) per dare la luce ad un'attività imprenditoriale che ha come obiettivo quello di innovare un settore altamente tradizionale come quello tessile. Oggi l'azienda si occupa della progettazione, dell'ingegneria, dello sviluppo, della prototipazione e della produzione di linee di abbigliamento di lusso per i principali player mondiali. La scelta di localizzare a Torino le attività di progettazione e sviluppo prodotto per il mondo della moda nasce dal fatto che a fine anni 90' la città era il centro di un importante cluster industriale tessile.

L'azienda nasce in concomitanza con una trasformazione del contesto competitivo del settore tessile. Nel 2000 grandi marchi (es. Burberry, Gucci, Armani) iniziano a spostare gran parte della produzione in paesi a basso costo del lavoro mantenendo al loro interno le fasi di progettazione e realizzazione delle collezioni per le sfilate. Questo ha portato però negli anni ad una perdita delle competenze e del know-how per quanto riguarda la progettazione, l'ingegnerizzazione e la produzione di abiti con la velocità richiesta dai nuovi cicli commerciali della moda, divenuti sempre più rapidi. A tal proposito i fondatori ricordano quanto segue:

> *"Con il 2000 tutti iniziano a fare outsourcing della prima serie perché è una parte della catena di creazione di valore dove, essendo la moda sempre più rapida, ogni tre mesi cambia tutto (ci sono la pre-collezione e poi la collezione); non riuscivano più a stare dietro ai tempi, quindi, avevano bisogno di qualcuno più specializzato che fosse molto più rapido, molto più polivalente."*

Nella propria fase embrionale, Pattern orienta le proprie attività alla consulenza in ambito modellistico e successivamente ad una piccola fase del processo di progettazione degli abiti per le sfilate. Nel 2006 viene creato dai fondatori un reparto di prototipazione "rapida" che utilizza per la prima volta il CAD 2D per l'automatizzazione delle fasi di taglio delle pezze. L'azienda inizia così a sviluppare un mix di competenze unico che comprende l'ingegnerizzazione e la produzione in tempi brevissimi di capi appartenenti a collezioni di altissima qualità che riflettono le richieste dei principali marchi del lusso.

Sono tre i valori su cui si sorregge l'azienda:

- Tecnologia: l'azienda ha sempre cercato di essere allineata con lo sviluppo tecnologico integrando sempre nuovi macchinari o sistemi digitali nel proprio processo produttivo, facendo quindi dell'innovazione tecnologica un proprio elemento cardine;
- Risorse umane: elemento fondante dell'azienda sono le risorse umane altamente specializzate;
- Sostenibilità aziendale: nel 2013 Pattern è la prima azienda italiana di confezionamento ad ottenere la Certificazione Internazionale SA8000 Social Accountability, conferita grazie all'implementazione di processi interni in linea con i principi di tutela dell'ambiente e alla sicurezza nella gestione delle Risorse Umane interne e della filiera. Questa certificazione ha rafforzato notevolmente la reputazione e il prestigio agli occhi dei grandi brand del lusso. Inoltre, dal 2015 l'impresa redige un "Bilancio di sostenibilità" che ha come obiettivi: essere "carbon neutral", perseguire sostenibilità economica e sociale e applicare logiche proprie della "circular economy" e "revalue waste"

Come afferma il CEO:

"I valori su cui abbiamo fondato l'azienda sono stati due. Il primo era la "tecnologia", già presente all'atto della fondazione: questo voleva dire essere i più avanzati sulla modellistica e sulla progettazione, avere i CAD di ultima generazione, ecc. Il secondo era quello di scegliere di avere le persone migliori, i più bravi modellisti e questi andavano cercati, identificati e convinti a lavorare per Pattern. Con il tempo su questi valori ne abbiamo innestato un terzo, quello della sostenibilità, dicendoci: "visto che sarà uno dei business del futuro, dobbiamo essere sostenibili da tutti i punti di vista".

Nel 2012, i fondatori decidono di assumere Luca Sburlati nel ruolo di Amministratore Delegato. Questo momento rappresenta un punto importante nella linea storica dell'azienda. Fino a quel momento, infatti, l'azienda risultava essere priva di una chiara organizzazione strategica e manageriale. Per prima cosa, nella fase dal 2012 al 2016, la società è stata dotata di una struttura organizzativa definita, sono state definite pratiche e procedure e sono stati ingegnerizzati i processi interni. Grazie all'AD, è stato possibile definire i lavori e allocarli alle rispettive aree di competenza, creare linee ingegnerizzate e dedicate al cliente, e designate alle persone in qualità di account manager. Inoltre, sono stati formalizzati i processi e le risorse hanno iniziato ad utilizzare in maniera consistente il sistema gestionale aziendale invece di utilizzare un misto di fogli excel e software aziendale come era accaduto fino a quel momento. Grazie agli aiuti ricevuti grazie al bando Fondimpresa, è stato possibile formare le risorse sulla progettazione 2D e 3D.

3.2 Merger & Acquisition

Per quanto riguarda l'aspetto di "Merger and Acquisition", nel 2014 Pattern acquisisce il marchio Esemplare. L'acquisizione nasce dalla volontà da parte dei fondatori di avviare un proprio marchio in modo tale da instaurare relazioni profonde con i retailer posizionati nel segmento del lusso. Pilastri del marchio sono la sostenibilità ambientale e sociale e l'innovazione tecnologica. I capispalla Esemplare devono utilizzare materie prime riciclate da materiale plastico e la produzione deve essere effettuata da fornitori certificati. Il marchio ottiene in pochi anni le certificazioni ISO relative alla sostenibilità sociale e ambientale e ottiene anche l'accesso a punti vendita storici e di elevato prestigio internazionale (Saks Fifth Avenue e Manhattan). Il marchio diventa un polo di sperimentazione tecnologica in cui vengono sperimentate soluzioni tecnologiche innovative come saldature a ultrasuoni, taglio laser, corrosioni controllate da fibre per generare nuove fantasie nei tessuti e unione di materiali tecnici (neoprene e nylon) con tessuti pregiati (cashmere).

Al fine di ampliare il portafoglio prodotti dell'azienda, nel 2017 viene acquisita Roscini Atelier, azienda umbra specializzata nello sviluppo prodotto di capispalla per il segmento donna. Si decide di rimanere localizzati in Umbria, sede di un importante cluster industriale del passato, e di mantenere i dipendenti in modo tale da consentire l'accesso a competenze specifiche e l'ingresso nel segmento "donna".

Il 2019 è segnato dalla quotazione sul mercato Euronext Growth Milan di Borsa Italiana e nello stesso anno l'azienda annuncia l'ingresso nel Gruppo del maglificio S.M.T. (Società Manifattura Tessile). Il maglificio S.M.T. è una storica società emiliana specializzata nella prototipazione e produzione di maglieria di lusso.

Negli anni successivi l'azienda annuncia l'ingresso nel Gruppo di altre due aziende che le permettono di entrare nel settore della maglieria e della pelletteria, segnando la nascita del Polo Italiano della progettazione del lusso. Nello specifico, il 2021 è l'anno dell'annuncio dell'ingresso di Idee Partners, azienda toscana specializzata nello Sviluppo Prodotto, Design e Produzione nel settore della pelletteria di lusso. Successivamente, nel 2022, viene annunciato l'ingresso del maglificio Zanni di Reggio Emilia, punto di riferimento nazionale ed europeo nella lavorazione Wholegarment (senza cuciture) della maglieria.

Figura 3: Localizzazione sedi del gruppo Pattern S.p.A.
(Source: https://www.pattern.it/pattern-torino-storia)

3.3 Processo di digitalizzazione

3.3.1 Evoluzione del sistema informativo

Con l'introduzione dei sistemi CAD, l'azienda ha dovuto iniziare a sviluppare parallelamente la struttura del sistema informativo. Nei primi anni di vita, l'azienda ha utilizzato un sistema gestionale standard per la gestione integrata del magazzino e per la contabilità generale.

Nel 2008 viene integrato un software (PGS) al fine di specificare in modo parametrico le diverse parti che compongono il capo, creando i modelli 2D nelle diverse taglie.

Nel 2009 viene introdotto MARKA, un software commerciale tipico del settore utile per l'incastro ottimale delle parti del modello quando viene posizionato su un tessuto, in modo da minimizzare il consumo del tessuto.

Nel 2011 inizia ad essere introdotto il PDM, software utilizzato per la gestione completa del prodotto finito, dalla sua ideazione alla realizzazione dei campioni con tutte le informazioni necessarie (ad esempio, la distinta base e il lancio degli ordini ai fornitori). Nello stesso anno viene avviato il progetto di cambio del sistema ERP che viene integrato al PDM per definire un unico flusso di lavoro dalla progettazione al lancio in produzione, includendo anche i dati di consegna dei capi finiti ai Clienti e la gestione del magazzino. Si decide di acquistare dei moduli software da integrare in base alle esigenze dell'azienda in quanto le attività richiedono flessibilità e funzioni specifiche che hanno bisogno di sviluppare personalizzazioni uniche e coerenti con la strategia e i processi aziendali.

Nel corso del 2013, attraverso un progetto pluriennale, si è operato il passaggio a versioni più evolute del CAD e del PDM, finalizzate a consentire l'utilizzo di strumenti più completi ed efficaci e a rendere possibile una più ampia armonizzazione con i sistemi di progettazione dei clienti. Questi miglioramenti hanno coinvolto le attività sia dell'Ufficio Modelli, sia quelle dell'ufficio CAD che si occupava di sviluppo taglie e piazzamento. I programmi CAD e PDM sono di proprietà dell'azienda Lectra, una delle compagnie leader nel settore di software per la moda. Siccome i vari software utilizzati sono stati acquisiti in momenti differenti, sebbene allineati allo stato dell'arte, ancora oggi non sono in grado di interfacciarsi tra loro direttamente per raccogliere tutte le informazioni utili e necessarie al corretto svolgimento del ciclo produttivo in relazione alle richieste del cliente.

Nel 2018 è iniziata una valutazione per cercare di comprendere come gestire le informazioni nella fase di creazione dei modelli dei capi attraverso l'utilizzo della grafica 3D da parte del software PGS.

Tale software sarebbe in grado di elaborare un insieme di modelli tridimensionali dei capi cercando di simulare il risultato finale. L'analisi ha evidenziato alcune carenze tecniche ed organizzative che rendono impossibile l'utilizzo concreto della suddetta funzionalità:

- la mancanza di una libreria di tessuti e dei relativi parametri specifici rende inadeguata la definizione dell'immagine del manichino e del tessuto;
- non è possibile progettare direttamente in 3D e al momento le modelliste non hanno la competenza tecnica di trasformare correttamente i disegni 2D dei modelli nella loro versione tridimensionale;
- la mancanza di una effettiva sincronizzazione tra versione 3D e disegno 2D del modello impedisce che le modifiche apportate ad una versione si propaghino all'altra. Una possibile soluzione sarebbe quella di cambiare il sistema CAD, passando a quello prodotto a CLO (https://www.clo3d.com/) ma questo porterebbe alla necessità di fare di nuovo training di tutti i dipendenti e riconsiderare l'integrazione con gli altri software utilizzati.

3.3.2 L'introduzione dei sistemi CAD

Alla nascita dell'azienda, i due fondatori avevano deciso che la tecnologia sarebbe stata uno dei tre valori fondati su cui innervare tutta la filosofia e il business dell'impresa. Essi erano convinti che la strumentazione digitale non avrebbe reso obsolete le competenze artigianali "del passato", ma anzi le avrebbe complementate generando una fonte di vantaggio competitivo. Pattern si trova ad affrontare sin dagli albori della propria nascita richieste altamente specifiche da parte dei clienti da svolgere in tempi brevissimi. Per questo motivo, risulta necessario rivedere le fasi di progettazione e di produzione in modo tale da gestire al meglio l'efficienza produttiva. L'azienda decide quindi di introdurre nella fase di prototipazione i sistemi CAD 2D. Con l'utilizzo di quest'ultimi, le modifiche dei capi dettate dalle esigenze dei clienti risultano essere gestite in maniera più rapida e agevole in quanto non è più necessario costruire un cartamodello ex-novo sulla base delle richieste dei clienti, ma basta effettuare modifiche marginali nel file CAD. Con l'introduzione dei sistemi CAD 2D, l'utilizzo del cartamodello tradizionale viene abbandonato e le modelliste vengono formate all'utilizzo dei nuovi strumenti creando una nuova figura professionale ibrida con elevate competenze di sartoria tradizionale e competenze di rappresentazione bidimensionale sui sistemi CAD delle parti del tradizionale cartamodello. L'introduzione di questi tool digitali ha permesso anche di automatizzare la fase di taglio delle pezze in quanto i macchinari possono ricevere in input un modello parametrizzato ed effettuare il taglio.

L’utilizzo del CAD 2D però non evita la realizzazione fisica di un nuovo prototipo di abito a seguito di nuove richieste da parte di un cliente. Lo strumento quindi riduce, ma non elimina, lo spreco di materiali e tessuti ma rende più rapida e precisa la realizzazione di varianti del capo di abbigliamento.

Un ulteriore limite del CAD 2D è rappresentato dal fatto che non è possibile rappresentare l’abito prima che questo venga prodotto. Per superare questo limite, è necessario il passaggio a sistemi CAD 3D che permettono di creare un prototipo virtuale (“digital twin”) contenente gran parte delle proprietà dell’oggetto fisico. Il digital twin consente la progettazione assistita della modellista con il cliente che può quindi fornire feedback che possono essere integrati nella progettazione del capo “in live”. Questo nuovo modo di progettare ha come conseguenze principali la riduzione degli sprechi e una maggiore aderenza e allineamento con le richieste e le volontà dei clienti.
Per fare questo, è tuttavia necessario la costruzione di un database contenente informazioni relative peso, trama, colore, tessuti utilizzati in modo tale da rendere la simulazione 3D il più fedele possibile al capo che sarà poi realizzato.

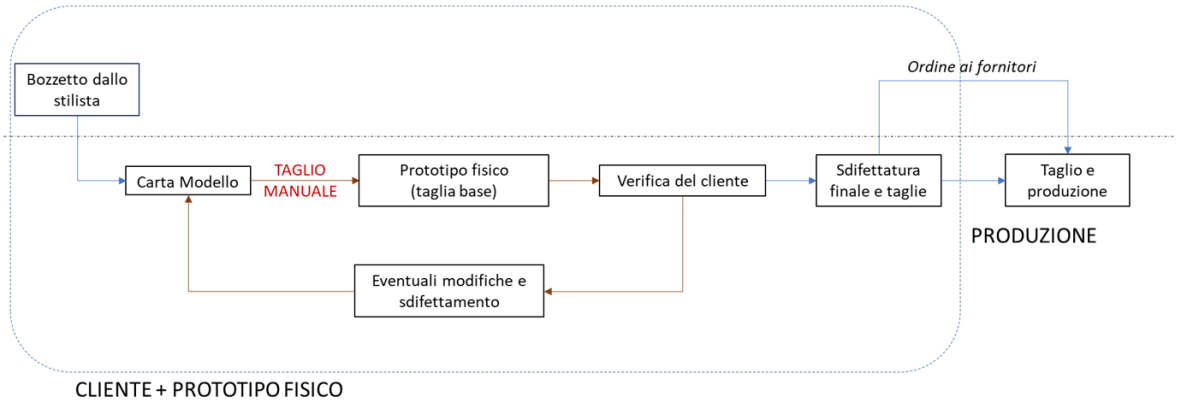


Figura 4: Ciclo delle attività con metodo di lavorazione tradizionale

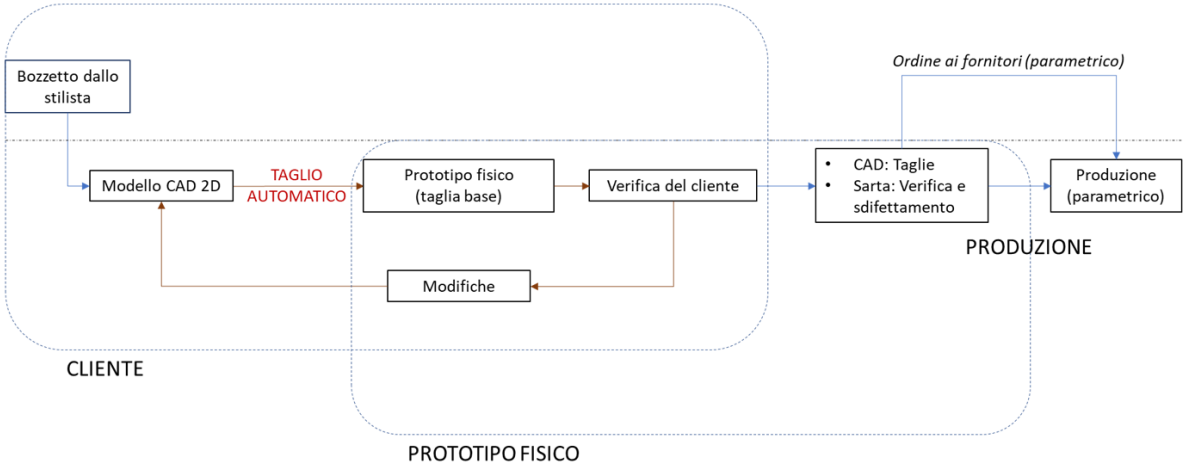


Figura 5: Ciclo delle attività con l'introduzione del CAD 2D

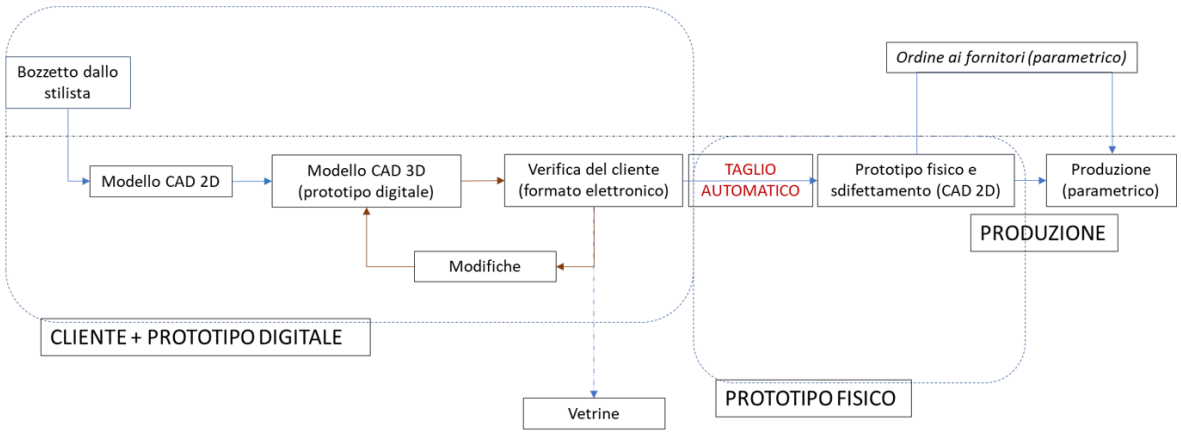


Figura 6: Ciclo delle attività con l'introduzione del CAD 3D

3.3.3 Analisi del processo di trasformazione digitale nelle fasi di lavorazione

Per studiare le trasformazioni della conoscenza a seguito del processo di trasformazione digitale posto in essere da Pattern, è stato applicato il framework illustrato nel Capitolo 2 alle diverse fasi di lavorazione dell'azienda.

Le fasi sono state individuate attraverso l'utilizzo della "Value Chain" di Michael Porter:

- Progettazione e schedulazione
- Taglio
- Cucitura e assemblaggio
- Controllo qualità (in entrata e in uscita)
- Supply chain management

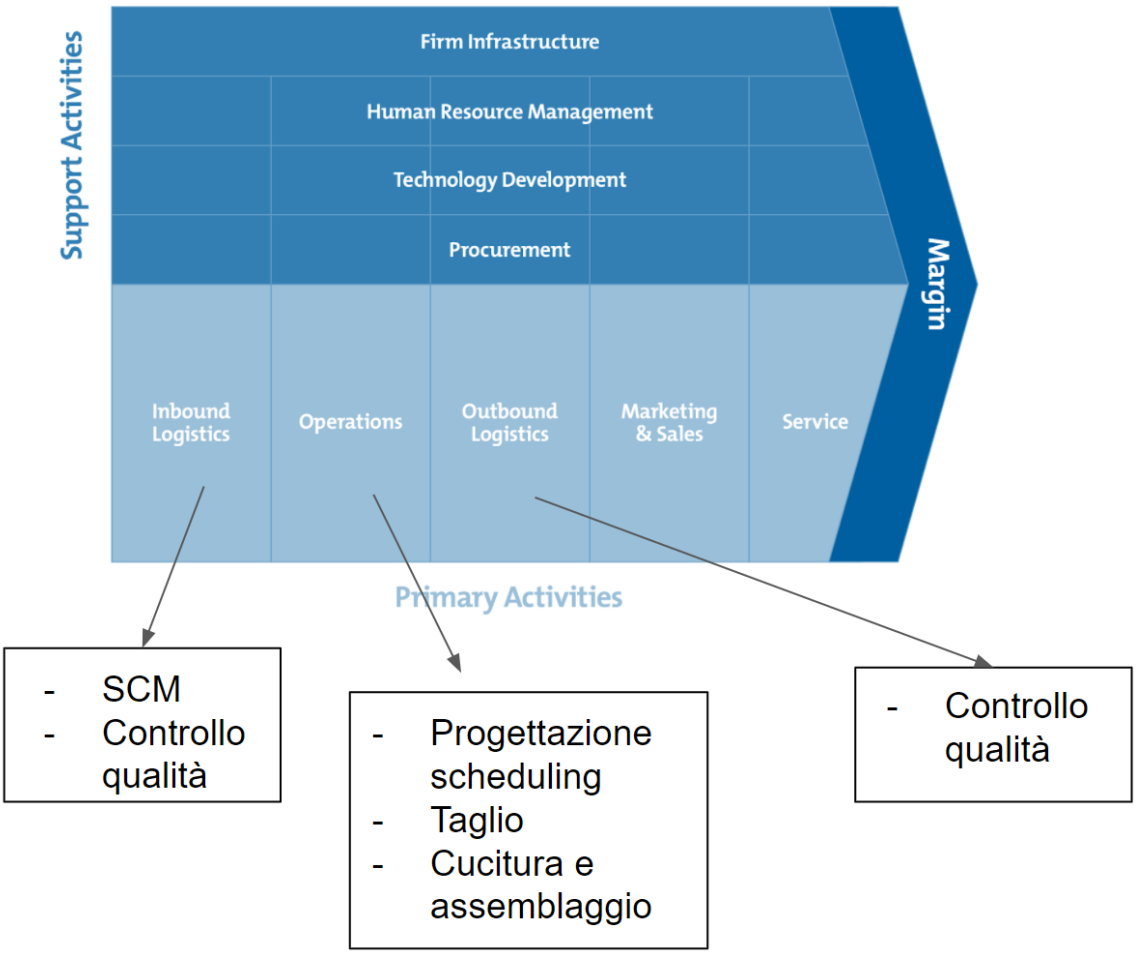


Figura 7: Value Chain di Poter con attività considerate

3.3.3.1 Processo di trasformazione digitale nella fase di progettazione

La progettazione inizia dai bozzetti proposti dagli stilisti del cliente che consentono poi la costruzione di un primo insieme di modelli da proporre. Attraverso l'interazione con il cliente, vengono scelti i modelli dei capi da realizzare, successivamente sono rivisti i vari prototipi e vengono "sdifettati" in modo tale da arrivare alla realizzazione di un capo allineato con le esigenze e richieste del cliente. Dopo l'approvazione definitiva, viene realizzato un "capo-staffetta" con lo scopo di verificare un'ultima volta il capo finito. L'attività di progettazione richiede una perfetta padronanza di conoscenze tecniche elevate per quanto riguarda i materiali, la concettualizzazione del prototipo e di taglio.

Tradizionalmente, le sarte modelliste trasformano i bozzetti degli stilisti in cartamodelli, che sono poi piazzati sulle pezze di tessuto che sono poi a loro volta tagliate e cucite fino ad arrivare al prototipo finale.

Per svolgere questo mestiere di modellizzazione, è necessario un know-how prezioso e difficile da costruire in quanto per formare queste figure è necessario una media di dieci anni di affiancamento a modellisti esperti. Questo accade perché le scuole di formazione risultano essere troppo generali e superficiali e questo causa un grande un gap tra ciò che viene insegnato e quello che è richiesto specificatamente dalle aziende. Questo è dovuto anche all'alta specializzazione del lavoro svolto dalle singole imprese che operano in questo settore. Nel primo decennio di vita l'azienda, quindi, assume numerosi progettisti e sarti industriali che avevano perso il lavoro a seguito della crisi del settore. Questi, grazie anche dal ruolo svolto dal territorio torinese che, come illustrato in precedenza, è stato un cluster industriale per il settore tessile, hanno reso disponibile all'azienda competenze manifatturiere di qualità e difficilmente replicabili e riproducibili.

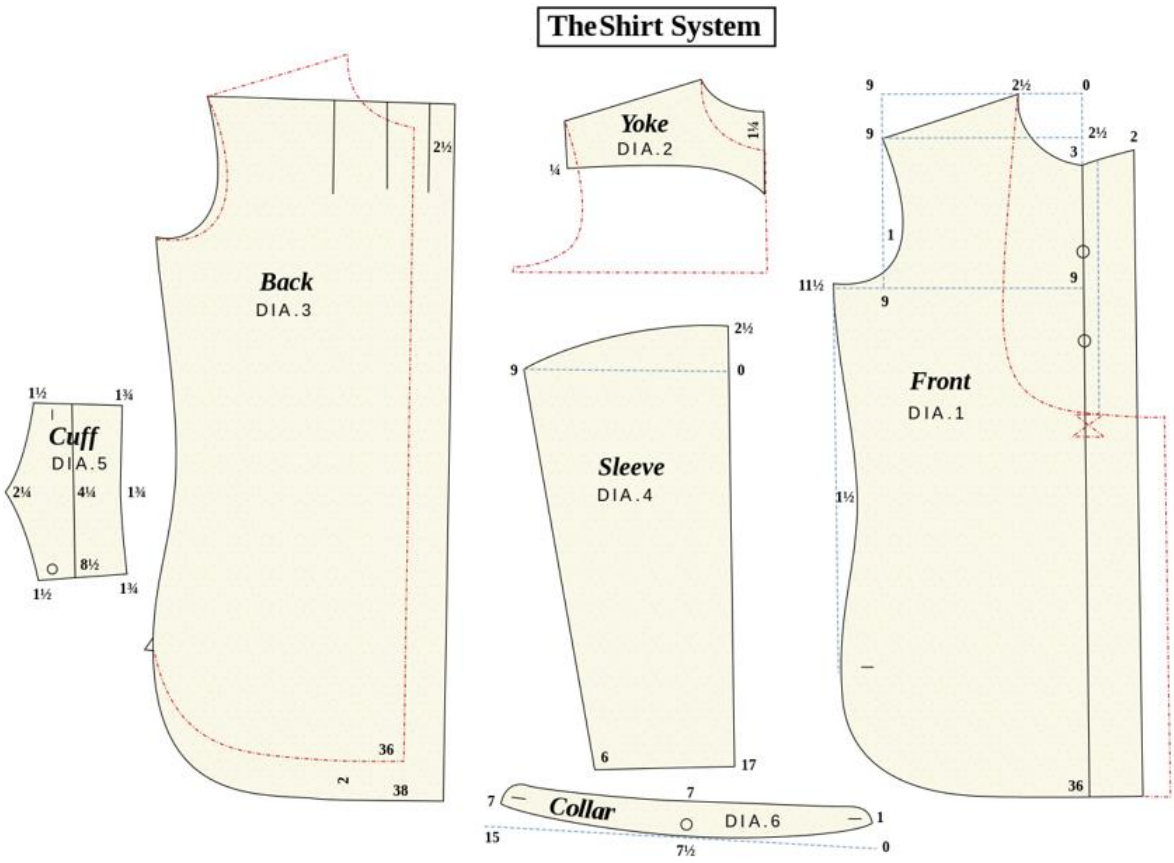


Figura 8: Cartamodello di una camicia
(Source: https://it.wikipedia.org/wiki/Cartamodello)

L'ammodernamento del lavoro del sarto è iniziato con l'introduzione del CAD 2D e la creazione della figura professionale ibrida descritta precedentemente. Il processo di trasformazione della figura del sarto è durato un paio di anni con qualche resistenza iniziale, ma superata dal momento che si trattava di disegnare in modo diverso gli stessi oggetti, prima su un foglio fisico mentre ora su un foglio digitale. L'ampliamento della gamma di competenze richieste ai modellisti è stato effettuato attraverso due modi differenti: promuovendo il re-skilling per mezzo di corsi di formazione e assumendo nuove risorse con competenze di progettazione digitale da formare invece dal punto di vista delle competenze artigianali tessili.

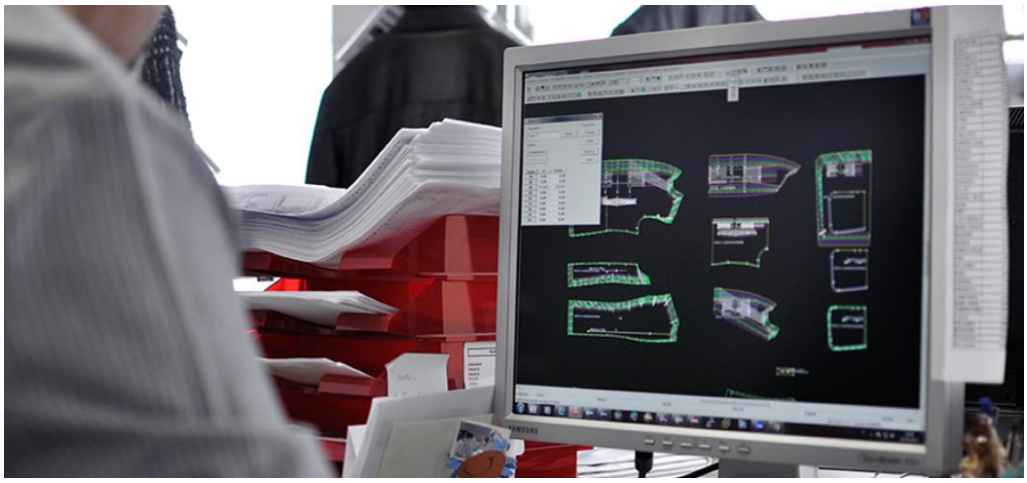


Figura 9: Progettazione in CAD 2D
(Source: https://www.pattern.it/pattern-torino-modellistica-ingegneria-capo)

Il passaggio successivo nell'evoluzione del mestiere è rappresentato dall'integrazione di sistemi CAD 3D per la creazione di un prototipo virtuale. Il passaggio al CAD 3D rende fondamentale una riorganizzazione del lavoro per team in quanto non è possibile formare le modelliste in esperte di CAD 3D come è stato fatto per il CAD 2D a causa della complessità delle conoscenze e delle competenze specifiche richieste. Il problema del passaggio ad un lavoro svolto per team formati da modelliste ed esperti CAD 3D è rappresentato dal fatto che le due figure hanno competenze e conoscenze diverse. Questo può causare quindi grandi problemi di comunicazione e rallentare la fase di progettazione.

Figura 10: Ciclo di realizzazione di un giubbotto utilizzando la modellizzazione 3D e 2D
(Source: https://www.pattern.it/pattern-torino-prototipazione-3d)

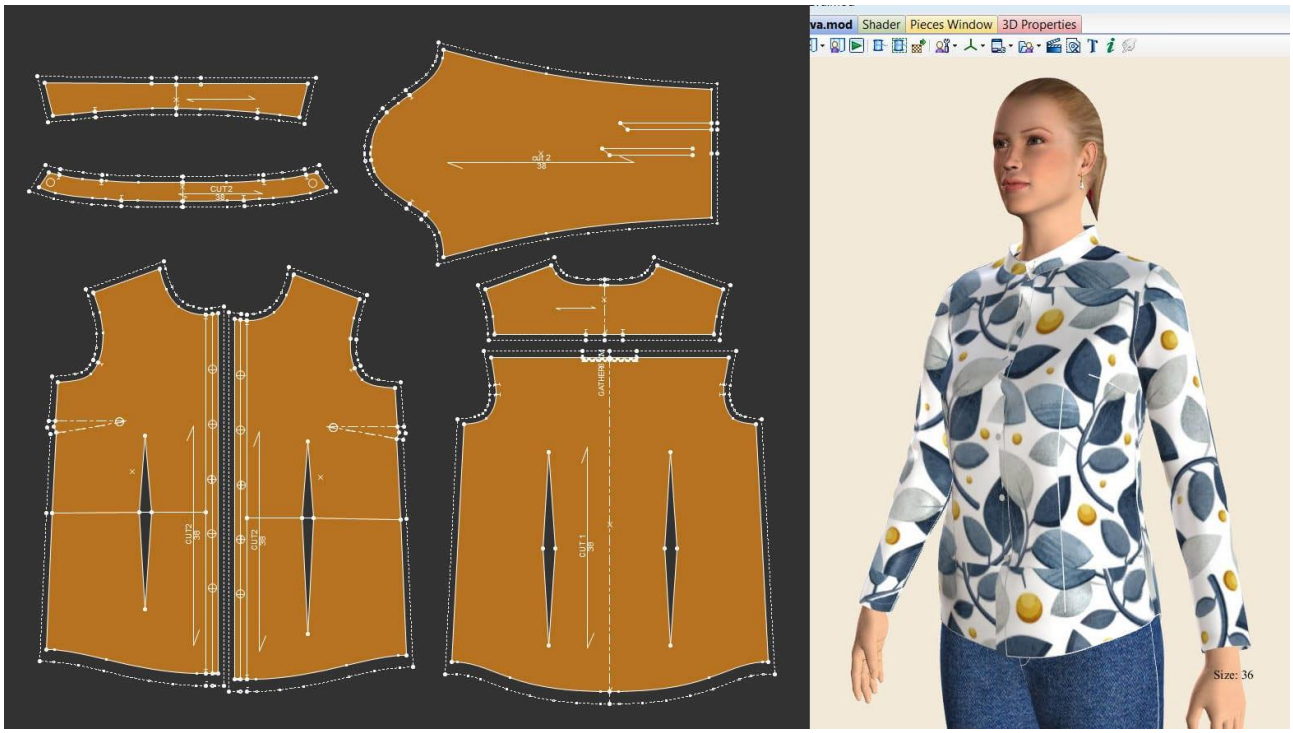


Figura 11: Vista di una modellizzazione in 3D
(Source: https://www.adpatternsinstitute.com/online-recorded-courses/optitex-cad-3d-pattern-simulation-online-recorded-course/)

3.3.3.1.1 Framework nella fase di progettazione: dal tradizionale al 2D

La trasformazione digitale messa in atto dall'azienda, che ha portato all'utilizzo di sistemi CAD 2D, ha modificato il processo di acquisizione e formazione delle risorse. Da un lato si è promosso un re-skilling grazie a corsi di formazione per insegnare l'utilizzo dei sistemi CAD 2D. Dall'altro lato l'azienda ha iniziato ad acquisire risorse con competenze in utilizzo di sistemi CAD e competenze linguistiche da poi formare internamente tramite affiancamento on the job.

In una prima fase, l'introduzione del CAD 2D porta ad una condivisione di conoscenza a causa del re-skilling del personale e della formazione interna on the job delle nuove risorse acquisite. In questa fase, le due diverse tipologie di conoscenze si complementano reciprocamente e la conoscenza passa quindi dall'essere individuale a collettiva. Successivamente, quando è stata completata la formazione, la conoscenza torna ad essere individuale in quanto non sono più presenti due figure differenti, progettista CAD e sarta modellista, ma una unica ibrida con entrambe le competenze.

L'introduzione del CAD 2D porta ad una codifica della precisione progettuale nella gestione delle lunghezze in quanto il sistema risulta essere più preciso rispetto ad un disegno manuale. Inoltre, l'integrazione del CAD 2D permette la gestione semi-automatica delle taglie: a partire dalla taglia

base, il software definisce il programma di taglio per ogni taglia voluta e lo invia alle macchine di taglio. Il compito delle modelliste in questo caso è quello di verificare la correttezza del modello generato perché in alcuni casi il software non tiene conto di parametri produttivi importanti. L'integrazione del CAD ha portato quindi ad una codifica della conoscenza progettuale per quanto riguarda la gestione delle lunghezze e la ri-proporzionalità del modello in base alle taglie anche se il supporto della sarta rimane importante per correggere gli eventuali errori effettuati dal software. La conoscenza passa dall'essere tacita all'essere esplicita.

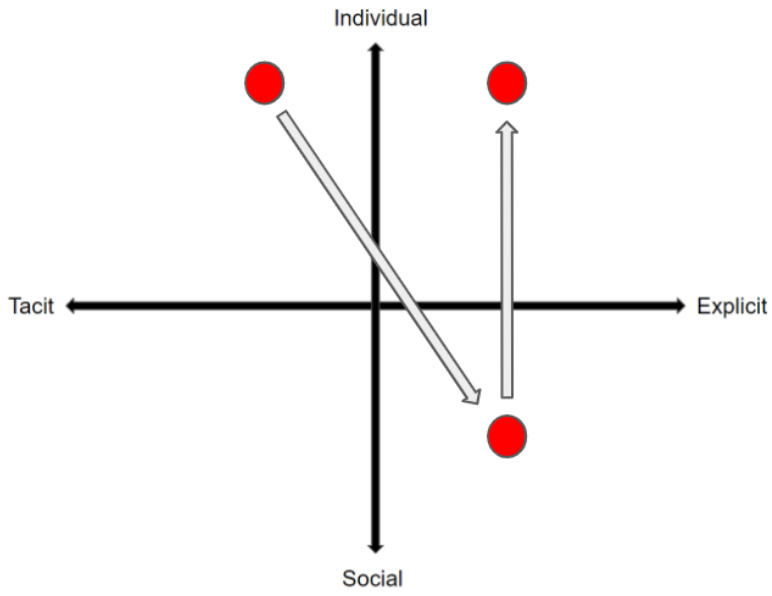


Figura 12: Framework applicato alla fase di progettazione: passaggio da tradizionale a CAD 2D

3.3.3.1.2 Framework nella fase di progettazione: dal 2D al 3D

Nel caso del passaggio da 2D a 3D, si osserva come non sia stato ancora possibile codificare l'intera conoscenza delle sarte e come questa sia stata solamente complementata dai sistemi CAD 3D. Le modellizzazioni 3D permettono di simulare colorazioni e tessuti ma è comunque necessaria una conoscenza profonda del prodotto e delle fasi di taglio e cucitura. La modellizzazione 3D deve essere accompagnata dalla conoscenza delle sarte anche in quanto il CAD 3D non riesce a definire bene le taglie (le modelliste devono ritoccare i modelli virtuali) e il passaggio al 2D richiede che le modelliste intervengano a correggere le imperfezioni che il software genera nella conversione.

La possibilità di lavorare a stretto contatto con il cliente e poter effettuare insieme a lui varie

simulazioni, ha reso fondamentali le soft skill come la capacità comunicativa e il teamworking, entrando in gioco conoscenze di tipo tacito ed individuali. La capacità di empatizzare e comunicare con il cliente sono aspetti della conoscenza fondamentali per gestire la progettazione assistita con il cliente. Un algoritmo non potrebbe mai svolgere efficientemente questo compito in quanto ad una determinata richiesta non attuabile da parte del cliente, l'algoritmo risponderebbe con "una notifica di errore" senza margine di discussione. La sarta, invece, utilizzando la propria esperienza, la propria capacità comunicativa e progettuale è capace di trovare un punto di incontro tra una richiesta apparentemente inattuabile da parte del cliente e i vincoli progettuali. Inoltre, risulta fondamentale anche gli aspetti della conoscenza riguardanti il gusto estetico e culturale che vengono maturati e si plasmano "respirando" le evoluzioni socioculturali umane nel corso degli anni. Un'intelligenza artificiale non è capace di assorbire queste evoluzioni umane e quindi non è capace di rimanere al passo con i tempi per quanto riguarda il gusto estetico, aspetto che risulta indispensabile per un settore, quello dell'abbigliamento di lusso, che è profondamente influenzato dai repentini cambiamenti culturali e di gusto estetico.

In conclusione, si può affermare che nel processo di trasformazione digitale nella fase di progettazione la conoscenza sia stata in piccola parte codificata (ad esempio nelle simulazioni dei colori e tessuti e visualizzazioni di proprietà fisiche) ma anche che sia rimasta una componente fortemente tacita (conoscenza del prodotto e delle successive fasi di taglio e cucitura, ritocchi per un corretto passaggio al 2D, senso estetico e capacità culturali e di teamworking).

L'utilizzo dei sistemi 3D porta ad una riorganizzazione del lavoro per team in quanto risulta difficile formare una sarta modellista sotto il punto di vista delle competenze specifiche richieste per l'utilizzo corretto dei sistemi 3D. Il lavoro svolto per team genera un inevitabile reciproco assorbimento delle conoscenze all'interno del team. Nonostante gli iniziali problemi di comunicazione, con il tempo le diverse figure all'interno del team iniziano a comprendere il lavoro delle altre figure. Quella che viene assorbita all'interno del team è però solo una conoscenza generale e superficiale a causa della complessità dei mestieri svolti (la sarta modellista conosce il lavoro del progettista CAD 3D ma non potrebbe mai svolgere il suo lavoro dettagliatamente e lo stesso discorso vale per il progettista CAD 3D e la conoscenza del lavoro della sarta). La conoscenza quindi tende a collettivarsi, ma la componente individuale rimane predominante.

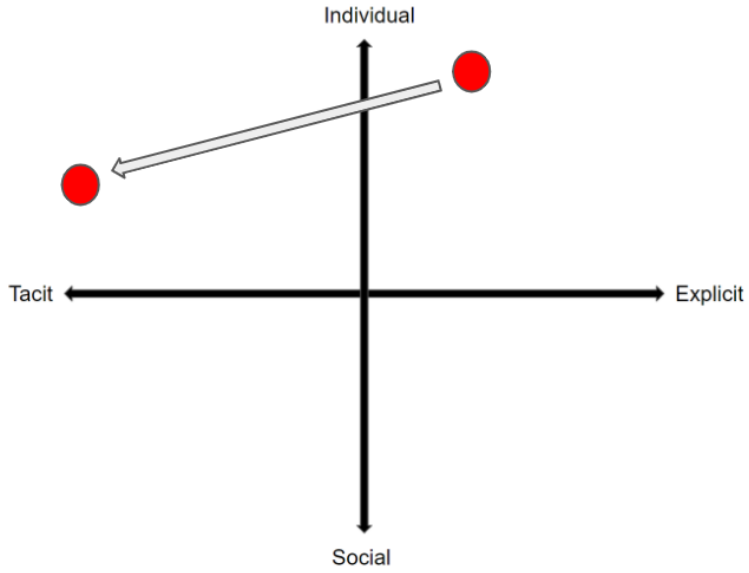


Figura 13: Framework applicato alla fase di progettazione: passaggio da CAD 2D a CAD 3D

3.3.3.1.3 Processo di trasformazione digitale nella schedulazione

Per quanto riguarda lo scheduling, non vengono utilizzati sistemi informativi per decidere le sequenze di produzione in quanto risulta impossibile formalizzare e standardizzare la schedulazione a causa dei cambiamenti “last minute” degli stilisti. Il processo di feedback loop non permette l’utilizzo di regole algoritmiche per prioritizzare in quanto è necessaria un’elevata flessibilità. Le priorità di produzione vengono quindi definite due volte la settimana da un team multifunzionale di addetti alla progettazione, produzione e vendite basandosi su conoscenze di tipo tacito ed individuali.

Per un breve periodo di tempo è stato provato ad integrare un sistema informativo che permettesse una prioritizzazione basata su algoritmi, ma è stato abbandonato repentinamente in quanto le regole risultavano estremamente vincolanti e non permettevano di effettuare dei cambi “last minute”. La digitalizzazione in questo caso risulta essere inefficiente e il giudizio e le conoscenze del team rimangono importanti per gestire la grande flessibilità data dai feedback loop e dai cambiamenti “last minute".

3.3.3.2 Processo di trasformazione digitale nella fase di taglio

Uno dei pilastri su cui Pattern ha sempre cercato di fare leva per differenziarsi dai competitors è la tecnologia. Infatti, l'azienda ha sempre cercato di integrare nel proprio sistema produttivo le soluzioni tecniche più innovative arrivando ad impiegare per la fase di taglio macchine di taglio laser.

Nella soluzione tradizionale il taglio era fatto tipicamente a mano e per tal ragione la precisione degli addetti al taglio era una competenza necessaria al fine di realizzare delle pezze come da progetto e ridurre al minimo gli sprechi di tessuto.

L'introduzione del CAD 2D ha permesso di inviare alle macchine in input un modello parametrizzato e sulla base di esso effettuare il taglio. La maggior precisione delle macchine di taglio ha permesso di ridurre errori e difetti, riducendo quindi anche gli sprechi di tessuto e materiale. Tuttavia, rimangono necessarie le attività di assistenza e controllo qualità in quanto è comunque fondamentale la conoscenza pregressa per quanto riguarda la conoscenza del prodotto.

Figura 14: Esempio di macchina di taglio laser (Modello: RAPTOR-HI-2.5)
(Source: http://www.cuttingtrading.it/prodotto/raptor/raptor-hi-2-5/)

3.3.3.2.1 Framework nella fase di taglio

La fase di taglio ha subito una grande industrializzazione, passando da un taglio manuale ad un taglio effettuato da macchine industriali rendendo l'attività quindi completamente automatizzata e la figura dell'addetto al taglio si è gradualmente trasformata in una figura preposta al controllo qualità. L'attività è stata semplificata grazie all'introduzione dei sistemi CAD e alla trasformazione semi-automatica del modello 3D in modello 2D. La conoscenza è passata dall'essere individuale a collettiva dal momento che per effettuare il taglio è necessario inserire dati di input forniti dalla parametrizzazione del modello.

Nel taglio manuale la precisione rappresentava una conoscenza tacita e individuale che si sviluppava e maturava grazie all'esperienze e ad azioni pratiche. Essa era un fattore critico di successo per evitare errori e/o sprechi e per produrre un prodotto da consegnare al cliente che fosse dal punto di vista del taglio perfetto e preciso. L'utilizzo di macchine industriali nella fase di taglio ha fatto sì che la precisione non fosse più un fattore critico di successo e la conoscenza è passata dall'essere tacita all'essere esplicita.

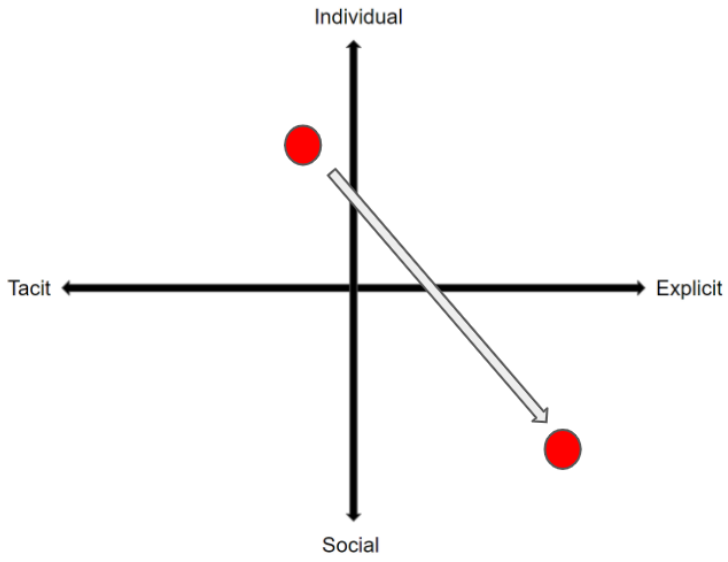


Figura 15: Framework applicato alla fase di taglio

3.3.3.3 Processo di trasformazione digitale nella fase di cucitura

La fase di cucitura ha visto un'evoluzione nelle macchine e negli strumenti preposti a tale fase. L'azienda ha integrato nel proprio sistema produttivo macchine di cucitura ad ultrasuoni e termosaldanti. Tuttavia, nonostante vengano integrate nuove soluzioni tecnologiche, la tecnica con la quale viene effettuata la fase di cucitura rimane invariata e quindi tutto il capo continua ad essere cucito a mano da manodopera qualificata.

Emblematiche le parole dei fondatori:

"In altri settori la tecnologia può essere acquistata ed utilizzata facilmente; nel nostro caso il semplice acquisto non serve a niente, a meno che non si abbia addetti che la sappiano utilizzare."

Figura 16: Esempio di macchina di cucitura ad ultrasuoni (Modello: TC-60)
(Source: https://www.setpoint.it/macchina-saldatrice-per-tessuti-tc-60/)

Figura 17: Esempio di macchina per termosaldatura tessile (Modello: AWE ARROW)
(Source: https://www.zparrow.it/termosaldatura-tessuti-macchine-per-termosaldatura-tessile-presse-giunzione-a-caldo/caratteristiche-tecniche-e-posizionamento/)

3.3.3.3.1 Framework nella fase di cucitura

Nonostante vengano adottate macchine tecnologicamente differenti, la tecnica rimane sempre la medesima e quindi la fase di cucitura deve essere effettuata da una risorsa con grande conoscenza tacita maturata grazie all'esperienza nel lavoro. La conoscenza quindi in questo caso non è stata esplicitata e codificata e continua ad essere individuale e tacita.

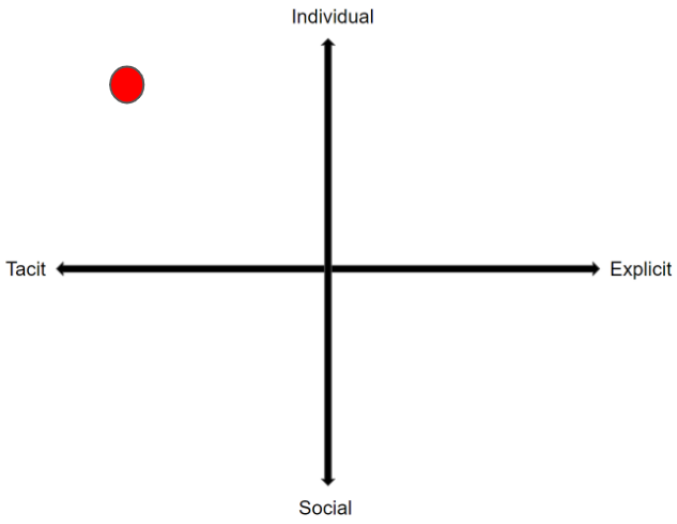


Figura 18: Framework applicato alla fase di cucitura

3.3.3.4 Processo di trasformazione digitale nel SCM

La digitalizzazione nella fase di supply chain management è stata promossa dall'integrazione e dall'utilizzo di una solida base dati raccolta in tempo reale. La mancanza di un software gestionale per la gestione del magazzino causava imprecisioni nella gestione delle giacenze, la loro imputazione al cliente di appartenenza e delle scorte presenti in magazzino. La grande imprecisione era causata anche dal fatto che in origine le giacenze erano tracciate manualmente e segnate su fogli Excel individuali rendendo le informazioni estremamente caotiche e dissipate all'interno dell'azienda.

Con il software gestionale è possibile tracciare le attività dell'intera filiera permettendo la comunicazione automatica tra le diverse linee e funzioni aziendali. L'implementazione anche di un nuovo warehouse management system permette inoltre di tenere traccia dei livelli dei diversi prodotti in modo integrato.

Le decisioni sono passate dall'essere prese dagli individui sulla base di conoscenze pregresse e esperienziali all'essere prese sulla base di dati oggettivi.

3.3.3.4.1 Framework nel SCM

Le decisioni prima dell'integrazione del software gestionale erano prese sulla base di conoscenze tacite ed individuali. L'integrazione del software gestionale ha permesso di prendere le decisioni sulla base di dati oggettivi e regole algoritmiche. La conoscenza, quindi, è stata esplicitata e codificata e resa alla portata di tutti.

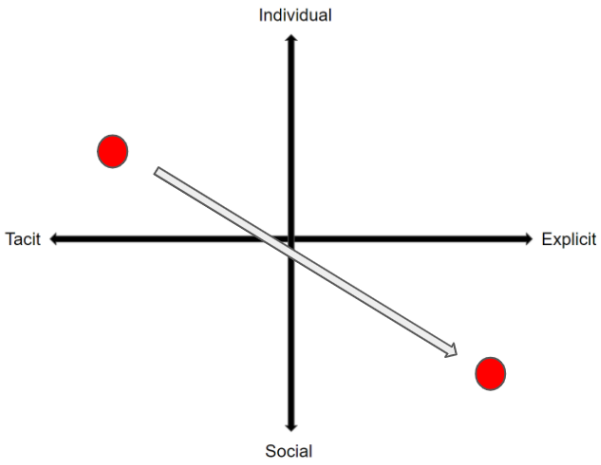


Figura 19: Framework applicato alla fase di SCM

3.3.3.5 Processo di trasformazione digitale nel controllo qualità

Il controllo qualità degli accessori ricevuti dai fornitori viene ancora svolta in maniera visiva e il controllo qualità sul taglio e sulla cucitura viene effettuato da persone qualificate che conoscono profondamente il prodotto. Nonostante le figure preposte alla fase di taglio siano state sostituite dalle macchine a taglio laser, la loro conoscenza risulta ancora fondamentale per l'intercettazione dei difetti e degli errori. La figura professionale ha subito quindi una mutazione nei compiti ma non è stata sostituita in quanto possiede conoscenze esperienziali pregresse sul prodotto.

La prima fase di controllo finale è esternalizzata e affidata a macchine sofisticate che valutano e analizzano in modo automatico diverse categorie di difetti (discromie, fori, impurità…). Il controllo in sé è però affidato visivamente ad una persona che individua i difetti mentre il tessuto le scorre davanti, registra il difetto e ne identifica la gravità.

3.3.3.5.1 Framework nel controllo qualità

Il controllo qualità all'interno dell'azienda è ancora affidato alle conoscenze tacite e individuali delle risorse. Infatti, il controllo degli accessori dei fornitori esterni è affidato ad un controllo visivo e il controllo sul taglio e cucitura a coloro che conoscono profondamente il prodotto e le successive fasi.

Il controllo finale è esternalizzato e affidato ad un'azienda che utilizza macchinari sofisticati per individuare difetti, impurità e discromie. Il macchinario fa scorrere il tessuto e un addetto controlla e individua i difetti. Anche in questo caso il lavoro è principalmente affidato alle conoscenze tacite e individuali degli addetti al controllo.

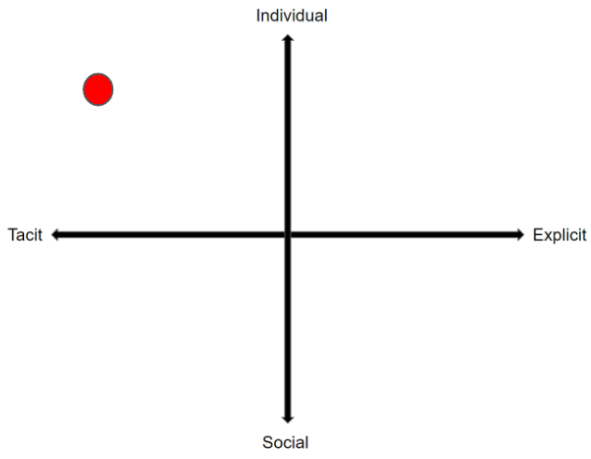


Figura 20: Framework applicato alla fase di controllo qualità

4 Conclusioni

Il presente lavoro di tesi ha cercato di dare un contributo alla comprensione del fenomeno di digitalizzazione della conoscenza organizzativa. L'obiettivo è stato quello di cercare di individuare gli aspetti idiosincratici della conoscenza che sfuggono alla digitalizzazione. Quindi, si è cercato di comprendere quali possano essere i limiti del processo di trasformazione digitale che sta colpendo un po' tutti i settori, anche quelli più tradizionali. Nel presente lavoro di tesi si è deciso di porre l'attenzione su Pattern S.p.A., azienda che opera in un settore fortemente tradizionale come quello tessile. L'azienda non è stata mai ostile nei confronti della digitalizzazione, tanto che uno dei pilastri su cui i fondatori hanno deciso di basare il proprio business è l'avanguardia tecnologica cercando sempre di integrare all'interno del proprio ciclo produttivo le soluzioni tecnologiche più innovative e recenti. L'azienda, quindi, rappresenta un perfetto caso di studio per raggiungere gli obiettivi preposti nel presente lavoro di tesi.

Analizzando le varie fasi del ciclo di produzione dell'azienda attraverso il framework illustrato nel Capitolo 2, è stato possibile individuare quali abbiano subito un completo o parziale processo di digitalizzazione e quali invece sono rimasti bloccati ad un lavoro prevalentemente "umano". Nello specifico si può osservare come le fasi di progettazione, cucitura e controllo qualità siano rimaste in mano ad una conoscenza fortemente tacita e individuale. Mentre, le fasi di taglio e di supply chain management hanno subito una maggiore digitalizzazione vedendo la conoscenza esplicitarsi.

La fase di progettazione, nonostante l'integrazione dei sistemi CAD 2D e 3D, rimane legata alla conoscenza della sarta modellista che non può essere sostituita da un algoritmo di intelligenza artificiale o da una macchina. Questo accade a causa dei seguenti aspetti della conoscenza che non possono essere digitalizzati:

- aspetti emozionali: con l'integrazione dei sistemi CAD 2D e 3D, le modifiche progettuali possono essere fatte con maggiore facilità e la progettazione può essere effettuata "in live" con il cliente. La capacità di saper comunicare ed empatizzare con il cliente diventa quindi fondamentale per cercare di comprendere le diverse richieste del cliente e trasformarle in un disegno progettuale che possa soddisfarlo. Le richieste del cliente risultano sempre confuse e ambigue in quanto risulta difficile tradurre a parole un modello mentale. Ci si trova di fronte quindi ad un problema di traduzione in quanto prima il cliente traduce il modello mentale in parole e poi la sarta modellista deve tradurre le parole in un modello 2D o 3D. Questo doppio

passaggio, da modello mentale a parole e da parole a modello 2D o 3D, fa sì che vengano perse inevitabilmente informazioni importanti. Il ruolo della sarta modellista è quindi anche quello di cercare di non far perdere più informazioni possibili quando il cliente effettua il primo passaggio della traduzione e trasformare le richieste in specifiche tecniche.

- flessibilità: la progettazione in "live" fa sì che vengano messe in luce alcune richieste da parte del cliente che non possono essere soddisfatte interamente a causa di limiti progettuali e a causa delle seguenti fasi del ciclo di produzione. La sarta modellista ha la capacità di cercare un compromesso con il cliente per cercare di progettare il modello in modo che si avvicini il più possibile al costrutto mentale del cliente. Questa è un'operazione che non potrebbe essere svolta da una macchina in quanto di fronte alle richieste impossibili del cliente genererebbe una schermata di errore senza possibilità di trovare un compromesso.
- gusto estetico: il gusto estetico è un aspetto della conoscenza fortemente basato sulla naturale evoluzione socioculturale. L'essere umano modifica il proprio gusto estetico nel tempo modificando quindi ciò che definisce "bello". Un algoritmo di intelligenza artificiale o una macchina non riesce a percepire questa evoluzione socioculturale umana e quindi non potrebbe rimanere al passo con i tempi con ciò che le persone definiscono "bello".
- conoscenza profonda del ciclo produttivo: una progettazione corretta è definita tale anche sulla base dell'applicabilità delle seguenti fasi del ciclo produttivo. Diventa quindi fondamentale la conoscenza profonda del ciclo di produzione in modo da tradurre le richieste del cliente in un modello progettuale che non solo soddisfi le sue richieste ma anche che le seguenti fasi possano essere facilmente svolte sulla base delle specifiche.

L'attività di schedulazione degli ordini ha fallito nell'integrare al proprio interno un sistema informativo che consentisse di prioritizzare in modo automatico e con regole algoritmiche. Il fallimento è stato dovuto al fatto che i vincoli e le regole risultavano troppo stringenti per gestire efficacemente il continuo aggiornamento delle priorità a seguito dei vari feedback loop e cambiamenti "last minute". Anche in questo caso si può affermare come la flessibilità sia un aspetto della conoscenza che non può essere digitalizzato.

Il motivo per il quale la cucitura non abbia subito una qualche forma di digitalizzazione o industrializzazione è dovuta al fatto che è una fase molto complessa che difficilmente può essere effettuata da una macchina in maniera automatica. Le innovazioni tecnologiche in questo senso non modificano il lavoro e la tecnica adottata rimane sempre la medesima.

Anche il controllo qualità non ha subito un processo di trasformazione digitale rimanendo delegata alla capacità degli addetti di individuare i difetti. Questo accade anche perché è difficile definire correttamente che cosa sia un difetto e quali siano le soglie di tolleranza. La decisione finale sul difetto rimane quindi in mano alla conoscenza tacita e individuale dell'addetto al controllo qualità.
Le innovazioni tecnologiche integrate in queste due ultime fasi hanno avuto un ruolo di supporto nelle decisioni che rimangono sempre in mano alle conoscenze dei singoli individui. La tecnologia ha complementato le conoscenze degli addetti al controllo e degli addetti al cucito ma non è stata in grado di sostituirsi ad essi.

La fase di taglio e la fase di supply chain management sono le fasi in cui la conoscenza ha subito la maggiore digitalizzazione portando le fasi ad essere svolte da macchine o algoritmi. La fase di taglio ha visto il passaggio da taglio manuale ad un taglio completamente automatizzato. La capacità di effettuare un taglio corretto è un'abilità che facilmente può essere meccanizzata in quanto risulta essere priva di un qualche fattore decisionale.
Stesso discorso riguarda la fase di SCM in quanto, monitorando i livelli di magazzino e definendo un algoritmo secondo il quale vengono effettuati gli ordini, la decisione umana può essere facilmente delegata.

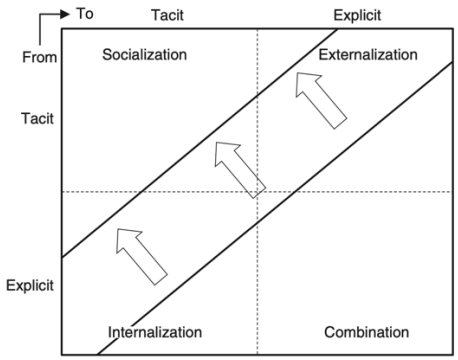
In conclusione, è possibile affermare che gli aspetti idiosincratici della conoscenza che non possono essere digitalizzati riguardano la capacità emozionale, il gusto estetico, la capacità di rispondere in maniera flessibile alle diverse situazioni, la conoscenza olistica del ciclo di produzione, la capacità di gestire manualmente operazioni complesse e la capacità intrinseca di definire che cosa sia o non sia un difetto. Secondo quanto detto, la digitalizzazione in questo contesto si fermerebbe ad abilità facilmente meccanizzabili che non necessitano di fattori decisionali.

5 Appendice

5.1 Analisi della letteratura

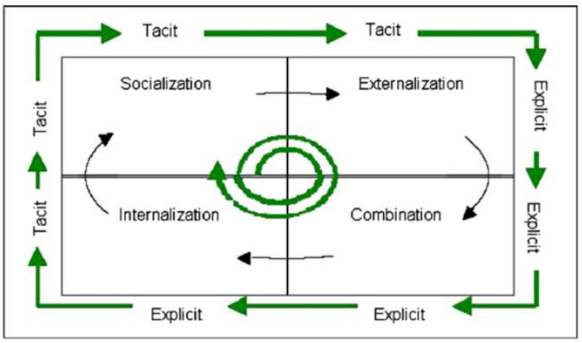
Authors	Article title	Source title	Document type	Publication year	Abstract	Types of Knowledge and Attributes
Neeley, TB; Leonardi, PM	Enacting knowledge strategy through social media: Passable trust and the paradox of nonwork interactions	Strategic management journal	Article	2018	Research Summary: Despite the recognition that knowledge sharing among employees is necessary to enact knowledge strategy, little is known about how to enable such sharing. Recent research suggests that social media may promote knowledge sharing because they allow social lubrication and the formation of trust. Our longitudinal and comparative analysis of social media usage at two large firms indicates that users who participate in nonwork interactions on social media catalyze a cycle of curiosity and passable trust that enables them to connect and share knowledge. Paradoxically, the very nonwork-related content that attracts users to social media and shapes passable trust can become a source of tension, thwarting a firm's ability to encapsulate knowledge in the form of routines and to use it to enact its strategy. Managerial Summary: Integrating knowledge from across a firm is a critical source of competitive advantage. Firms are increasingly implementing internal social media sites to promote knowledge sharing among their employees. Our analysis indicates that employees' curiosity about nonwork-related and work-related interactions motivate them to use the sites. The integration of nonwork and work content allows employees to identify people with valuable knowledge, and gauge the passable trust that they need to share knowledge on the sites or offline. Paradoxically, the nonwork-related content that attracts users to the sites can become a source of tension, thwarting the production of knowledge to enact firms' knowledge-based strategies. To foster work-related knowledge sharing, managers should accommodate nonwork-related interactions on social media.	**Stolen knowledge** The types of vicarious learning about other people's communications allows users of social media to learn by watching (Leonardi, 2014). Brown and Duguid (2000: 136) characterize such vicarious learning derived from practice as stolen knowledge

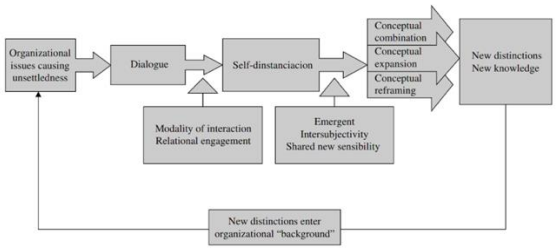
Barley, WC; Treem, JW; Kuhn, T	Valuing multiple trajectories of knowledge: A critical review and agenda for knowledge management research	Academy of management annals	Review	2018	Over the past three decades, scholars have increasingly come to view knowledge as one of the most important resources necessary for successful organization in the contemporary socioeconomic landscape. In our vigor to understand how organizations may harness the diverse knowledge available to them, however, we have produced a disparity in our theories of knowledge management (KM) processes. By reviewing 20 years of influential KM literature, we uncover a bias toward explaining knowledge integration over research exploring processes of knowledge differentiation. Through our review, we explain why such a pattern has emerged and build an argument for why understanding differentiation is an increasingly important charge for management and organizational scholars. We then advance three strategic directions for future KM scholarship, based on the notion that recognizing multiple knowledge trajectories can aid in addressing several significant lines of theorizing in management and organization studies.	**Organizational Knowledge** Knowledge can reside in multiple locations, including individuals, bodies, routines, technologies, and practices (Blackler, 1995; Collins, 1993; Nelson & Winter, 1982), which creates challenges when attempting to make sense of how knowledge operates in a specific organizational context. Furthermore, knowledge is managed through a variety of social and technical processes. Individuals can share and produce knowledge through interaction (Kuhn& Jackson, 2008; Tsoukas, 2009) and embody knowledge through virtual tools (Vaast & Walsham, 2005; Wasko & Faraj, 2005). **Knowledge can exist solely in the minds of individuals** (Alavi & Leidner, 2001; Gorman, 2002). Nonaka (1996): knowledge is "justified true belief." This view can position **knowledge as a commodity** that can be represented and shared with others (Grant, 1996). Knowledge can be characterized by their positions on three interrelated **attributes**: - whether knowledge is explicit - where knowledge resides - how knowledge is enacted **Explicit knowledge** It can be codified and represented in some material form. Explicit knowledge can be externalized from individuals through the use of symbols, objects, and language in a manner allowing transmission or display to others. **Tacit knowledge** It is intangible and tied to a specific context. It refers to that which people know and apply in action, yet find difficult to articulate and share (Polanyi, 1966). Tacit knowledge is developed through socialization, experience, and situated practice in a specific context—and individuals may not even be aware they are using this knowledge. Blackler (1995): - knowledge can be located in individuals' minds (**embrained knowledge)** - bodies (**embodied)** - organizational routines (**embedded**) - dialogue **(encultured)** - symbols (**encoded)** Nelson and Winter (1982):

						knowledge becomes located in the rules, routines, and procedures of organizations over time. Suddaby and Greenwood call **commodification**, occurs when knowledge "is abstracted from context and reduced to a transparent and generic format that can be more easily leveraged".
Faraj, S; von Krogh, G; Monteiro, E; Lakhani, KR	Special Section Introduction Online Community as Space for Knowledge Flows	Information systems research	Editorial material	2016	Online communities frequently create significant economic and relational value for community participants and beyond. It is widely accepted that the underlying source of such value is the collective flow of knowledge among community participants. We distinguish the conditions for flows of tacit and explicit knowledge in online communities and advance an unconventional theoretical conjecture: Online communities give rise to tacit knowledge flows between participants. The crucial condition for these flows is not the advent of novel, digital technology as often portrayed in the literature, but instead the technology's domestication by humanity and the sociality it affords. This conjecture holds profound implications for theory and research in the study of management and organization, as well as their relation to information technology.	All knowledge that involves humans has an underlying **tacit component** (Grene 1977), although not all knowledge necessitates human presence (Nonaka and von Krogh 2009). **Non-rivalry** and **non-excludability** of knowledge (e.g., safeguarded through creative commons licenses, free software/open source licenses). An **individual's tacit knowledge** is a crucial source of new explicit elements (Nonaka 1994), be they creative ideas, concepts, personal statements, lines of argument, systematized facts or algorithms. Polanyi (1962) argues that **tacit knowing** involves an interplay between attending to **focal knowledge** (the task focused on) and **subsidiary knowledge** (the complementary often background knowledge relied on in performing the focal task). **Figure 1 How Online Knowledge Creation Is Affected by Increased Sociality**  *Source.* Adapted from Nonaka (1994, p. 19).

Tippmann, E; Mangematin, V; Scott, PS	The Two Faces of Knowledge Search: New Solutions and Capability Development	Organization studies	Article	2013	Searching for knowledge to solve non-routine problems allows middle managers not only to design new solutions but also to develop organizational capabilities. We focus on knowledge search to develop our understanding of how individuals engage with organizational knowledge in practice, how they acquire and use knowledge, and the implications for organizational knowledge development. Investigating middle managers' knowledge search practices in response to non-routine events, we uncover four practices: isolating; overcoming knowledge distribution challenges; socializing; and mastering solution development. From these, we identify two aspects of knowledge search: not only can it produce new solutions but it can also have different effects in terms of developing organizational capabilities, either modifying existing routines or creating new ones. We argue that organizations with a knowledge use advantage, namely, an ability to mobilize accessible knowledge by organizing for knowledge circulation and a socialized search that deals with the organization's challenges of knowledge distribution in order to master solution development - especially at mid-level - can pursue capability development. We discuss the implications of our findings for the literature on organizational knowledge and middle managers' roles in organizational knowledge processes.	**Organizational knowledge** is less codified when business processes were embedded in software tools, so more knowledge remained tacit and embedded in organizational routines or individuals' expertise and skills.

Joshi, KD; Chi, L; Datta, A; Han, S	Changing the Competitive Landscape: Continuous Innovation Through IT-Enabled Knowledge Capabilities	Information systems research	Article	2010	We theoretically and empirically investigate the relationship between information technology (IT) and firm innovation. Invoking absorptive capacity (ACAP) theory, we introduce and develop the concepts of three types of IT-enabled knowledge capabilities. Firm innovation is examined through two observable innovation outcomes: patents, and new product and service introductions. These innovation outcomes are often labeled as competitive actions aggressively undertaken by firms to gain market share or to achieve profitability. We use secondary data about IT-enabled knowledge capabilities and innovation outcomes of 110 firms. Our data results provide strong support for our main assertion that knowledge capabilities that are enhanced through the use of IT contribute to firm innovation. The study's findings suggest that the three types of IT-enabled knowledge capabilities have differential effects on firm innovation. This study substantially contributes to the information systems (IS) research, methodology, and practice in multiple ways.	**IT-enabled knowledge capabilities:** firms' knowledge capabilities. **Outside knowledge** (Koza and Lewin 1998). **Knowledge:** preserved and embedded in IT systems to conduct organizational operations.
Reus, TH; Ranft, AL; Lamont, BT; Adams, GL	An interpretive systems view of knowledge investments	Academy of management review	Review	2009	Viewing organizations as open, knowledge-dependent interpretation systems and building on the knowledge-based view, we develop a theoretical model of knowledge investments and value creation. By emphasizing the interpretive nature of organizations and examining knowledge requirements. capabilities. and investments, our contribution provides a more complete understanding of why some organizations make certain types of knowledge investments more than others and why these investments may have positive or negative effects on value creation.	**Knowledge as Information** refers to facts and data that are standardized and can be understood and transmitted with limited cost (Kogut & Zander, 1992; Winter, 1987). **Knowledge as Know-how** is action based, rooted in practice, dependent upon the practical skills or expertise that is difficult to articulate and codify, and accumulated over time through a learning process (Cook & Brown, 1999; Polanyi, 1967; Zander & Kogut, 1995). **Knowledge acquisition capability** is the firm's ability to acquire external information or know-how **Knowledge transfer capabilities** is the firm's ability to transfer internal information or know-how.

Vaccaro, A; Veloso, F; Brusoni, S	The impact of virtual technologies on knowledge-based processes: An empirical study	Research policy	Article	2009	This study examines the organizational knowledge creation processes in two highly virtual teams involved in new product development projects in the automotive industry. Using Nonaka's model of knowledge creation, we explore how the virtualization of knowledge-based processes, i.e. the intensive exploitation of information and communication technologies (ICTs), has led to new forms of knowledge creation at both the individual and organizational levels. In contrast to previous studies that identify knowledge codification as the main contribution of ICTs, this study provides detailed micro-level evidence about the ability of virtual technologies to support the transfer and the creation of new knowledge - both explicit and tacit - and offers some implications for scholars and practitioners. (C) 2009 Elsevier B.V. All rights reserved.	 **Fig. 1.** Nonaka's model of knowledge creation. **Socialization** refers to the creation of new tacit knowledge by relying on tacit knowledge sources through social interaction. **Externalization** refers to the expression of tacit knowledge and its translation into explicit forms. **Combination** refers to the creation of new explicit knowledge by merging, categorizing, reclassifying and synthesizing existing explicit knowledge. **Internalization** enables the conversion of the organization's explicit knowledge into individual and group level tacit knowledge. **Super-tacit knowledge** is characterized by higher difficulty of translation into explicit form than the tacit knowledge developed when using non-ICT-supported working tools. The **codification of tacit knowledge** related to design practices could be achieved through the development of virtual design tutorials and/or demos.

Tsoukas, H	A Dialogical Approach to the Creation of New Knowledge in Organizations	Organization science	Review	2009	Despite several insightful empirical studies on how new knowledge is created in organizations, there is still no satisfactory answer to the question, how is new knowledge created in organizations? The purpose of this paper is to address this question by focusing on direct social interaction, adopting a dialogical approach. The following argument is advanced. From a dialogical perspective, new knowledge in organizations originates in the individual ability to draw new distinctions concerning a task at hand. New distinctions may be developed because practitioners experience their situations in terms of already constituted distinctions, which lend themselves to further articulation. Further articulation develops when organizational members engage in dialogical exchanges. When productive, dialogue leads to self-distanciation, namely, to individuals taking distance from their customary and unreflective ways of acting as practitioners. Dialogue is productive depending on the extent to which participants engage relationally with one another. When this happens, participants are more likely to actively take responsibility for both the joint tasks in which they are involved and for the relationships they have with others. Self-distanciation leads to new distinctions through three processes of conceptual change (conceptual combination, conceptual expansion, and conceptual reframing), which, when intersubjectively accepted, constitute new knowledge. Several organizational examples, as well as findings from organizational knowledge research, are reinterpreted to illustrate the above points.	**Knowledge**: it originates in the individual's ability to draw new distinctions regarding a task to be performed. **Organizational knowledge:** ***Latent, empirical*** **Tacit knowledge** ***Focal unawareness***: when you are not aware of the "background" like a scientist who is not aware of some rare plants of the Amazon. **Common knowledge**: conceptual combination, conceptual expansion and conceptual reformulation), a social interaction is created through which new knowledge emerges. ***Articulation***: a continuum process of making knowledge explicit and relevant to task at hand ***Dialogical***: emerging from dialogue ***Tactility, manipulability and transferability*** **Knowledge is created through the interaction between tacit and explicit knowledge "(Nonaka and Takeuchi 1995, p. 62)* 

Nonaka, I; Von Krogh, G	Tacit knowledge and knowledge conversion: Controversy and advancement in organizational knowledge creation theory	Organization science	Review	2009	Nonaka's paper [1994. A dynamic theory of organizational knowledge creation. Organ. Sci. 5(1) 14-37] contributed to the concepts of tacit knowledge and knowledge conversion in organization science. We present work that shaped the development of organizational knowledge creation theory and identify two premises upon which more than 15 years of extensive academic work has been conducted: (1) tacit and explicit knowledge can be conceptually distinguished along a continuum; (2) knowledge conversion explains, theoretically and empirically, the interaction between tacit and explicit knowledge. Recently, scholars have raised several issues regarding the understanding of tacit knowledge as well as the interaction between tacit and explicit knowledge in the theory. The purpose of this article is to introduce and comment on the debate about organizational knowledge creation theory. We aim to help scholars make sense of this debate by synthesizing six fundamental questions on organizational knowledge creation theory. Next, we seek to elaborate and advance the theory by responding to questions and incorporating new research. Finally, we discuss implications of our endeavor for organization science.	**Explicit knowledge**: formulated in sentences, and captured in drawings and writing. ***Universal:*** Explicit knowledge has a universal character, supporting the capacity to ***act across contexts***. ***Accessible*** through consciousness. Explicit knowledge is articulated, and therefore ***it can be communicated*** to others. ***Objective, rational*****,** and created in the "then and there" (Leonard and Sensiper 1998; see also Rämö 2004). **Tacit knowledge**: knowledge ***tied to the senses, tactile experiences, movement skills, intuition, unarticulated mental models, or implicit rules of thumb***. Tacit knowledge is ***rooted in action, procedures, routines, commitment, ideals, values, and emotions***. Tacit (implicit) knowledge as being ***inexpressible***, it cannot be converted into explicit knowledge because it can never be externalized and written down in an explicit form (Polanyi). Tacit knowledge is chiefly ***acquired through the social practice*** of solving tasks and, thus, resides in that practice (Cook and Brown 1999, Hildreth and Kimble 2002, Tsoukas 2003, Ribeiro and Collins 2007) Tacit knowledge/knowing is ***impossible to communicate*** to others through articulation and it ranges from knowledge for inherent physical functioning to the insights or inspiration needed for an act of creativity (Polanyi). ***Actionable, subjective, experiential***, and created in the "here and now" (Leonard and Sensiper 1998; see also Rämö 2004). ***Acquired with little or no direct instruction.*** ***Procedural***, and above all, ***practically useful*** (Sternberg et al. 1995). It cannot be fully articulated because much of it is ***embodied*** (Maturana and Varela 1987) and, therefore, ***intuitive, tied to the senses*****,** and escaping any formal analysis through self-introspection As Dreyfus and Dreyfus (1986) convincingly argue, **expert knowledge** can never be fully captured in computer software due to the tacit and embodied elements. Yet, expert knowledge is a basis for increasingly explicit knowledge on which to create automated processes.

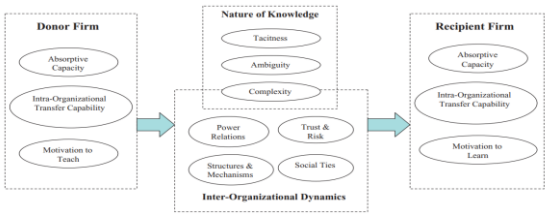
Boone, T; Ganeshan, R; Hicks, RL	Learning and knowledge depreciation in professional services	Management science	Article	2008	Organizational knowledge is a critical source of competitive advantage for professional service firms. Learning from experience and sustaining past knowledge are critical to the success of such knowledge-driven firms. We use learning curve theory to evaluate learning and depreciation in professional services. Our results, based on seven years of project data collected from an architectural engineering (A/E) firm, show that (a) professional services exhibit learning curves, (b) there is virtually no depreciation of knowledge and, (c) the rate of learning accelerates with experience.	**Codified knowledge** is something that professional service workers can share through formal education and training. (In many professional services, especially in Architecture/Engineering, there are mandated and well-documented standards, protocols, and procedures that must be followed for service delivery).

Miller, KD	Simon and Polanyi on rationality and knowledge	Organization studies	Review	2008	Organizational researchers cite Simon and Polanyi without adequately acknowledging and dealing with the disparities in their perspectives on rationality and knowledge. This study explains the views of Simon and Polanyi and traces their disparities to differing underlying philosophical perspectives. Simon's research emphasized cognition over action, explicit knowledge over tacit knowledge, mechanistic information processing over human judgment, and means over ends. Polanyi provides counterbalancing emphases for each of these orientations in his explanation of skillful performance. The latter portion of this study draws conclusions about the perspectives of Simon and Polanyi and identifies implications for research on rationality and knowledge management.	Simon sustains that knowledge is **cognitive** and **codifiable** For Polanyi knowledge is **praxial** and **tacit.** **Tacit knowledge** (Polanyi,1966) He employed the term 'tacit' to refer to the unarticulated elements of human knowledge. Skillful performance (e.g. in science, crafts, and arts) involves physical activity, aspects of which must be learned through practice and cannot be captured fully in written or verbal instructions. Knowledge can develop only within a '**fiduciary framework'**. In other words, our knowledge always relies on faith in untested beliefs. Polanyi viewed knowledge claims as **confessional** and **fiduciary:** - they are **confessional** in the sense that they acknowledge the evidence as compelling and, therefore, binding for oneself and others. - hey are **fiduciary** in that they rely on untested beliefs, and assumptions of which we remain unaware. Truth claims are made with universal intent (i.e. they generalize beyond the specific context in which they were discovered) and with recognition of our own fallibility (i.e. the possibility of falsification). **Tacit knowledge** is never fully convertible to explicit knowledge. However, the presence of a tacit dimension to knowledge does not negate the possibility of making some tacit knowledge explicit. **Tacit knowledge** includes not only knowledge that we cannot articulate but also that which is best left unarticulated and subsidiary (i.e. non focal) in order to perform skillfully. Knowledge that has been articulated and codified remains tacit to the extent that it functions subsidiarily in the performance of tasks.

Yayavaram, S; Ahuja, G	Decomposability in knowledge structures and its impact on the usefulness of inventions and knowledge-base malleability	Administrative science quarterly	Article	2008	We use patent data from the worldwide semiconductor industry from 1984 to 1994 to study the effect of the structure of organizational knowledge bases, or the patterns of coupling between their elements of technical knowledge, on the usefulness of inventions and knowledge-base malleability. We argue that organizational variations in coupling patterns between knowledge elements can be reflected in a spectrum of knowledge-base structures-varying from fully decomposable (the knowledge base is composed of distinct clusters of knowledge elements coupled together with no significant ties between clusters) through nearly decomposable (knowledge clusters are discernable but are connected through crosscluster couplings) to non-decomposable (no knowledge clusters emerge, as the couplings are pervasively distributed)-and that organizations may differ in the way they use their knowledge because of variations in their knowledge-base structure, rather than because of differences in the knowledge elements themselves. Results show that a nearly decomposable knowledge base increases the usefulness of the inventions generated from it, as measured by patent citations, and also the knowledge base's malleability or capacity for change.	**Decomposable knowledge** **Non-decomposable knowledge** A firm's **knowledge structure** resides in its ***routines (Nelson and Winter, 1982), communication patterns*** (Allen, 1977; Henderson and Clark, 1990), ***beliefs, and organizational structure.*** A firm's **knowledge structure** is also likely to be embedded in the beliefs that are shared across the firm about perceived interdependencies. Finally, the **organizational structure** of the research units can have a direct effect on how ***knowledge is structured.***

Perez-Nordtvedt, L; Kedia, BL; Datta, DK; Rasheed, AA	Effectiveness and efficiency of cross-border knowledge transfer: An empirical examination	Journal of management studies	Article	2008	Based on a sample of 102 US organizations, this study examines the impact of knowledge characteristics, recipient learning intent, source attractiveness, and relationship quality on the effectiveness and efficiency of knowledge transfer from the international business affiliates of these organizations. Findings indicate that recipient learning intent and source attractiveness positively impact the effectiveness of knowledge transfer. In addition, recipient learning intent was found to have a positive effect on knowledge transfer efficiency. In particular, results highlight the strong positive impact that the quality of the relationship between the source and the recipient has on both the efficiency and effectiveness of cross-border knowledge transfer. The study also indicates that knowledge value is positively associated with recipient learning intent and that knowledge value, rarity and non-substitutability influence source attractiveness. Finally, findings suggest that the relationship between knowledge characteristics and knowledge transfer is partially mediated by recipient learning intent and source attractiveness.	**Interorganizational knowledge:** ***knowledge*** (value, rareness, inimitable and non-substitutability). Tacit, as opposed to explicit, knowledge. ***Knowledge*** can be viewed as being 'valuable' if it enables an organization to formulate strategies that enable effective and efficient outcomes and 'rare' when it is possessed by a limited number of players (Barney, 1991). In addition, knowledge is 'inimitable' if it is based on complex organizational routines. Tacitness (McEvily and Chakravarthy, 2002), ambiguity (Simonin, 1999), complexity (Inkpen, 2000), codifiability (Schulz, 2001) and unobservability (Håkanson and Nobel, 2000) of the lack of knowledge also contribute to imperfect imitability. Finally, knowledge as a resource is 'non-substitutable' in the absence of a strategically equivalent resource. ***Knowledge*** is difficult to imitate.
Dosi, G; Faillo, M; Marengo, L	Organizational capabilities, patterns of knowledge accumulation and governance structures in business firms: An introduction	Organization studies	Article	2008	The capability-based view of the firm is based on the assumption that firms know how to do things. Assuming the existence of a thing called 'organizational knowledge', in the first part of the paper we identify its main building blocks and we provide a description of its inner structure. This results in an analysis of the relationships among key concepts like organizational routines, organizational competencies and skills. In the second part, we consider some empirical implications of the adoption of a capability-based view of the firm in dealing with issues like horizontal and vertical boundaries of the firm, innovation and corporate performance. Some implications for strategic management are also discussed.	**Organizational knowledge** is a fundamental link between some collective pool of knowledge, skills, incentives and opportunities, on the one hand, and the rates, directions and economic effectiveness of this exploration, development and exploitation, on the other. **Organizational knowledge** is a set of routines, a set of material artefacts that shape intra-organizational relations and individual behaviors. **Knowledge is conceived as know-how.**

Schulze, A; Hoegl, M	Organizational knowledge creation and the generation of new product ideas: A behavioral approach	Research policy	Article	2008	In this paper, we address the pre-project phase of idea generation in the product innovation process, where the effective generation of new product ideas still remains an issue of high relevance for both management scholars and practitioners. We relate Nonaka and colleagues' four knowledge creation modes of socialization, externalization, combination, and internalization to the novelty of product ideas generated. Taking a behavioral perspective on the four modes, we posit positive relationships between socialization as well as internalization and the novelty of product ideas, whereas we postulate negative relationships for externalization as well as combination. Using data from multiple respondents in 33 companies, our results confirm the proposed linkages. (C) 2008 Elsevier B.V. All rights reserved.	**Organizational knowledge**: socialization (tacit to tacit), externalization (tacit to explicit), combination (explicit to explicit), and internalization (explicit to tacit).
Van Wijk, R; Jansen, JJP; Lyles, MA	Inter- and intra-organizational knowledge transfer: A meta-analytic review and assessment of its antecedents and consequences	Journal of management studies	Review	2008	Research on organizational knowledge transfer is burgeoning, and yet our understanding of its antecedents and consequences remains rather unclear. Although conceptual and qualitative reviews of the organizational knowledge transfer literature have emerged, no study has attempted to summarize previous quantitative empirical findings. As a first step towards that goal, we use meta-analytic techniques to examine how knowledge, organization and network level antecedents differentially impact organizational knowledge transfer. Additionally, we consolidate research on the relationship between knowledge transfer and its consequences. We also demonstrate how the intra- and inter-organizational context, the directionality of knowledge transfers, and measurement characteristics moderate the relationships studied. By aggregating and consolidating existing research, our study not only reveals new insights into the levers and outcomes of organizational knowledge transfer, but also provides meaningful directions for future research.	**Organization knowledge** ***Ambiguity*** is one of the most important predictors of organizational knowledge transfer (e.g., Levin and Cross, 2004; Simonin, 1999; Szulanski et al., 2004). Knowledge ambiguity refers to the inherent and irreducible uncertainty as to precisely what the underlying knowledge components and sources are and how they interact. It emerges from the simultaneous effects of ***tacitness***, ***specificity and complexity*** of the underlying knowledge to be transferred (Reed and DeFilippi, 1990). It also hinders knowledge transfer within and between organizations (Coff et al., 2006). However, knowledge ambiguity also has strategic significance because it makes knowledge hard for competitors to imitate. Organizational knowledge transfer depends on how easily the underlying knowledge sources can be ***communicated, interpreted, and absorbed*** (Kogut and Zander, 1992).

Easterby-Smith, M; Lyles, MA; Tsang, EWK	Inter-organizational knowledge transfer: Current themes and future prospects	Journal of management studies	Article	2008	Many papers have been published recently in the fields of strategy and international business research incorporating the role of organizational knowledge as a basis of firm competitive advantage. While such knowledge is normally developed within the firm, it is important that firms possess the ability to learn from others in order to meet the increasing pace of competition. Knowledge transfer, defined here as an event through which one organization learns from the experience of another, has thus become an important research area within the broader domain of organizational learning and knowledge management. This paper presents a theoretical framework, identifies key themes covered by the six articles included in the Special Issue on Inter-Organizational Knowledge Transfer, and then discusses priorities for future research.	 The recipient firm's absorptive capacity is in turn influenced by its past experiences, culture, and knowledge retention capabilities (Lane and Lubatkin, 1998). The donor needs absorptive capacity to appreciate the potential value of knowledge for passing to the recipient, and needs intra-organizational transfer capability if the information is to be made available to the recipient in an efficient manner. The nature of the **knowledge** being transferred, such as the degree of ***tacitness, ambiguity***, or ***complexity***, will also impact knowledge transfer. According to Simonin (2004), for example, the ambiguity of knowledge is directly and negatively related to knowledge transfer, and ambiguity is associated more with **tacit** knowledge than with **explicit** knowledge. **Strategically important knowledge** is often ***embedded in the firm*** and ***supported by the corporate culture***, but its meaning may be distorted and usefulness diminished when it is transferred to a different corporate culture. Van Wijk et al. (2008) find that cultural distance particularly hinders knowledge transfer in terms of intraorganizational knowledge transfer, and they recommend that more research is needed for assessing why it is less detrimental in inter-organizational knowledge transfer.

<table>
<tr>
<td>Ewenstein, B; Whyte, J</td>
<td>Beyond words: Aesthetic knowledge and knowing in organizations</td>
<td>Organization studies</td>
<td>Article</td>
<td>2007</td>
<td>Aesthetic knowledge comes from practitioners understanding the took, feel, smell, taste and sound of things. It is vital to work in many organizational contexts. In this paper, we explore aesthetic knowledge and knowing in organizations through detailed observation of design work in the architectural practice Edward Cullinan Architects. Through our research, we explore aesthetic knowledge in the context of architectural work, we unpack what it is, how it is generated, and how it is applied in design projects, shared between practitioners and developed at the level of the organization. Our analysis suggests that aesthetic knowledge plays an important part in organizational practice, not only as the symbolic context for work, but as an integral part of the work that people do. It suggests that aesthetic reflexivity, which involves an opening up and questioning of what is known, is experienced as part of practice as well as a 'time out' from practice.</td>
<td>
Aesthetic knowledge

It comes from practitioners understanding the look, feel, smell, taste and sound of things. Aesthetic knowledge is derived from the senses and particular situations and experiences.

Aesthetic knowledge is embodied.

Where aesthetic knowledge is expressed through the fluency and literacy with signs, it is symbolic in nature. This symbolic dimension includes non-verbal systems of symbolization and aesthetic communication such as visual and musical languages.

Where aesthetic knowledge is expressed through feeling and corporeal experience, it is experiential in nature. The competence to make such professional judgements is rooted in experiential forms of aesthetic knowledge.

Aesthetic Reflexivity is the ability of individuals and communities to reflect knowingly upon the social conditions of their existence.
<table>
<tr><th></th><th>Aesthetic knowledge</th><th>Aesthetic reflexivity</th></tr>
<tr><td>Symbolic</td><td>Aesthetic knowledge as style, constituted in semiological terms and grounded in a specific vocabulary and syntax; includes expression through non-verbal signifiers, referents and signs.</td><td>Aesthetic reflexivity as reflection, involves sensing, symbol-processing, interpreting, intuiting and ‘thinking’ with aesthetic knowledge.</td></tr>
<tr><td>Experiential</td><td>Aesthetic knowledge as competency, constituted in phenomenological terms and involves feeling, sensitivity and corporeal experience.</td><td>Aesthetic reflexivity as practice, constitutes a reflex-like interaction with a changing material context, informed by aesthetic knowledge.</td></tr>
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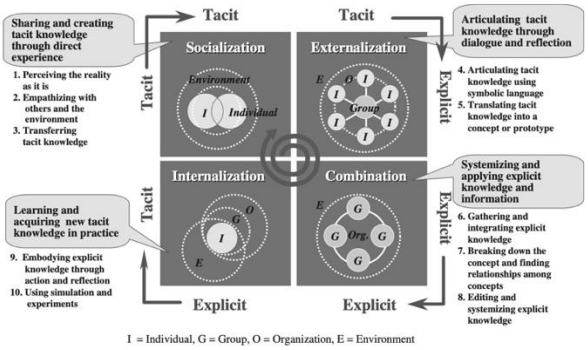
Peltokorpi, V; Peltokorpi, V; Nonaka, I; Kodama, M	NTT DoCoMo's launch of i-mode in the Japanese mobile phone market: A knowledge creation perspective	Journal of management studies	Article	2007	While innovation and knowledge creation processes and context are interlinked in the real world, scholars frequently ignore or separate context from knowing due to an entrenched sense of ontological and analytical dualism. This paper builds on the organizational knowledge creation theory (Nonaka, 1994) to provide a holistic view of contextual innovation and knowledge creation processes. The phenomenon is demonstrated by a longitudinal case description of i-mode mobile Internet innovation at NTT DoCoMo, a Japanese mobile communications company. This case explains how three key managers created and organized an interlinked system of shared contexts, called ba, that enabled the combination and open flow of diverse knowledge and led to the creation and launch of the i-mode mobile Internet, which unites novel technologies and services. Managerial implications and limitations are discussed.	**Tacit Knowledge** is **hard to externalize** and **context-specific**; individuals acquire tacit knowledge through practice and informal interactions. **Explicit Knowledge** is more readily expressed, codified, and thus transferred with relative ease (Polanyi, 1952). 
Williams, C	Transfer in context: Replication and adaptation in knowledge transfer relationships	Strategic management journal	Article	2007	This paper explores the role of replication and adaptation in knowledge transfer relationships. I develop a model of knowledge transfer in which firms replicate because knowledge is ambiguous and adapt because knowledge depends on context. In the model, firms replicate more when knowledge is discrete and adapt more when they understand the interactions between different areas of knowledge. Replication and adaptation lead to successful knowledge transfer, which leads to improved performance of the receiving unit. The predictions are tested using a survey of cross-border knowledge transfer relationships among firms in the telecommunications industry. The results are largely consistent with the model and point to potential areas for future research, such as the drivers of replication, the depreciation rate of knowledge, and the role of understanding in organizational knowledge. Copyright (C) 2007 John Wiley & Sons, Ltd.	**Knowledge** is ***ambiguous*** and adapt because knowledge ***depends on context.*** **Organizational knowledge** is ***tacit and ambiguous*** (Kogut and Zander, 1992; Nelson and Winter, 1982). ***Context-dependent*** nature of knowledge in organizations (Argote and Ingram, 2000; Kostova and Roth, 2002; Prahalad and Doz, 1987). A firm's **knowledge is more *discrete*** when it is more self-contained, with fewer connections to actors outside the firm, such as customers, suppliers, or local institutions and infrastructure. **When knowledge is complex and causally ambiguous.** **Winter proposes that knowledge is a strategic asset (Winter, 1987) and a source of rents for firms (Winter, 1995).*

Felin, T; Hesterly, WS	The knowledge-based view, nested heterogeneity, and new value creation: Philosophical considerations on the locus of	Academy of management review	Review	2007	At what level is new value created, or, put differently, what is the locus of knowledge? While knowledge and capabilities-based researchers argue that the locus of new value and knowledge lies at the firm level, we challenge this conceptualization and theoretically build toward more individualist foundations. We explicate the underlying philosophical assumptions of extant knowledge and capabilities-based work and discuss attributional problems. Nested (individual-level. a priori) heterogeneity may provide a better explanation of collective heterogeneity.	From the collectivist perspective, **knowledge** is fundamentally a ***social phenomenon*** that is different from the aggregation of individuals (Nahapiet & Ghoshal, 1998: 246). **Individual knowledge**: the organization only learns based on the individuals that it is composed of, or based on its lower-level supervenience base (Simon, 1991). Individual knowledge ***develops from within or grows or matures with relatively minimal external influence or environmental causal importance*** (Chomsky, 2002). Individual knowledge is ***not wholly socially constructed*** or ***environmentally determined*** but, rather, there is a core self, which may to a large degree determine learning and knowledge outcomes.
Hsiao, RL; Tsai, SDH; Lee, CF	The problems of embeddedness: Knowledge transfer, coordination and reuse in information systems	Organization studies	Article	2006	This research examines the knowledge management challenge underlying technology use. It proposes to examine the key question: how can knowledge management problems and technology adoption difficulties be analyzed through experts' practices embedded in their work contexts? The problems of knowledge transfer, coordination and reuse are investigated by examining experts' practices and work contexts. The inquiry is grounded in a qualitative case study of a knowledge management system designed to support maintenance work performed by two groups of engineers in a semiconductor-fabrication equipment company. The findings illustrate two contrasting outcomes: the equipment engineers found the system to be useful; the field engineers considered it to be irrelevant to their work contexts. An analysis of the fabrication process (the technical context), engineers' professional communities (the social context), and the pace of product/process innovation (the innovative context) helps us to understand the main problems underlying knowledge transfer, coordination and reuse. Significantly, we propose a specific definition of knowledge and suggest a way to examine practices and work contexts that can help to uncover new difficulties in knowledge management system adoption. The theoretical and practical implications of the study are discussed.	**Knowledge as object** knowledge as tangible objects that can be converted and transferred directly to users. However, the major problem of transferring knowledge-as-object is conversion (Nonaka 1994). For example, effective knowledge transfer requires the use of different codification techniques to make tacit knowledge explicit. **Knowledge as cognition** **r**egards knowledge as experts' cognitions socially distributed in human networks (Tsoukas 1996). In sharing knowledge, for example, a strong social network may be better than one that is weak, as the building of trustful relationships is achieved more easily (Pickering and King 1995). **Knowledge as capability** considers knowledge as capability generated from experts' work activities (Barley 1996). It is also referred to as '**situated knowledge'** because experts must acquire such knowledge by participating in different working situations (Lave and Wenger 1991; Tyre and von Hippel 1997). **Cognitive knowledge** has three generic types**: device**, **procedural** and **strategic** knowledge (Gott et al. 1993). For example - through **device knowledge** engineers learn how to maintain circuitry-related problems in a machine; - through **procedural knowledge** engineers learn how to follow a troubleshooting process; - through **strategic knowledge** engineers learn how to make decisions, what to do and when to do it.

Turner, KL; Makhija, MV	the role of organizational controls in managing knowledge	Academy of management review	Article	2006	We present a model demonstrating the role of organizational controls in managing organizational knowledge characterized by different combinations of knowledge attributes. Specifically, we show how particular controls (outcome, process, and clan) differ in their ability to acquire, transfer. interpret, and, finally, use knowledge. We argue that the use of different controls therefore creates distinguishably different knowledge management processes within the firm.	**Knowledge** is inherently **unobservable** (Argote & Ingram, 2000). **Organizational knowledge:** ***Codifiability:*** it can be broken down into specific components that are easily understood and articulated (Kogut & Zander, 1992). Highly codifiable knowledge is also known as ***explicit knowledge*** (Makhija & Ganesh, 1997). In contrast**,** ***tacit knowledge***, or that which is not easily codified, cannot be broken down into component parts. ***Completeness:*** the notion of completeness refers to the degree to which the knowledge for making decisions or completing tasks is entirely sufficient and available for the decision maker's use. Knowledge is less likely to be complete when decision situations are not stable or predictable (Gresov, 1990). When the attributes of the decision-making situation vary over time, the knowledge required to make effective decisions correspondingly changes (Snell & Youndt, 1995). ***Incomplete knowledge:*** when knowledge relating to processes is incomplete, the means or procedures for accomplishing tasks are not completely known or understood. ***Diversity:*** hich reflects both the amount and relatedness of information required to characterize the knowledge in question (Galunic & Rodan, 1998; Winter, 1987). Knowledge that is highly diverse has numerous (Kogut & Zander, 1992) as well as varied (Szulan ski, 1996) parameters associated with it. Highly diverse knowledge may emanate from distinct and multiple functional areas or disciplines (Kusunoki et al., 1998; Zander & Kogut, 1995). According to Bartunek, Gordon, and Weathersby (1983), such "complex" knowledge incorporates multiple complementary perspectives in relation to decision situations. **Knowledge is "sticky**": the more it is embedded in individuals, contexts, or locations (Szulanski, 2000). **Process-related knowledge:** linked to the process in question. ***Standard operating procedures and rules, clearly established routines, specialized job descriptions, hierarchical super visor-subordinate relationships, and highly structured groupings and settings*** (Jaeger & Ba liga, 1985; Nonaka & Takeuchi, 1995; Sitkin & Roth, 1993). **Outcome related knowledge,** knowledge associated with outcome controls. Outcome controls are those mechanisms that focus on the outcomes of tasks or the specific outputs desired by the organization.

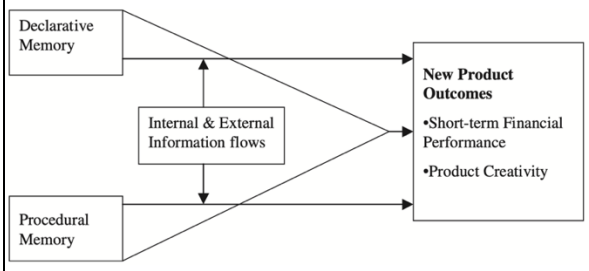
Gourlay, S	Conceptualizing knowledge creation: A critique of Nonaka's theory	Journal of management studies	Review	2006	Nonaka's proposition that knowledge is created through the interaction of tacit and explicit knowledge involving four modes of knowledge conversion is flawed. Three of the modes appear plausible but none are supported by evidence that cannot be explained more simply. The conceptual framework omits inherently tacit knowledge, and uses a radically subjective definition of knowledge: knowledge is in effect created by managers. A new framework is proposed suggesting that different kinds of knowledge are created by different kinds of behaviour. Following Dewey, non-reflectional behaviour is distinguished from reflective behaviour, the former being associated with tacit knowledge, and the latter with explicit knowledge. Some of the implications for academic and managerial practice are considered.	**Tacit and explicit knowledge** (Nonaka definition). ***Declarative knowledge*:** another name for explicit knowledge. (Nonaka) **organizational knowledge** is created through the continuous social interaction of ***tacit and explicit knowledge*** involving four sequential modes of knowledge conversion: ***socialization, externalization, combination and internalization.*** **Technical tacit knowledge** (concrete know-how and skills). Is**: *subjective, bodily, of the here and now, and practice-based, hard to communicate.*** **Cognitive tacit knowledge** (mental models of the world). Is ***objective, of the mind, and the there and then, and concerned with theory.*** **Propositional knowledge'**, as used by epistemologists, means knowledge as 'true, warranted belief' (Klein, 1998). **They concluded that knowledge is a loose, ambiguous, and rich concept that precludes reduction to simple sets of distinctions (see also Blackler, 2002, p. 54; Wilson, 2002).* **Processual knowledge** (Kakihara and Sørensen, 2002, pp. 51–4). **Knowledge as interpretation, knowledge as process, and knowledge as relationship (Kakihara and Sørensen, 2002, pp.* *then 'individual' **tacit knowledge** is simultaneously 'collective' at least to the extent of being shared 'forms of life' (Collins, 2001b; Tsoukas, 2003).* Table I. Knowledge types and names *Discipline* / *Knowledge-how* / *Knowledge-that* Philosophy[1] — Knowledge-how; procedural knowledge; abilities — Knowledge-that; propositional knowledge Philosophy (Polanyi)[2] — Tacit knowing — Explicit knowledge Psychology[2] — Implicit knowledge; tacit abilities; skills — Explicit knowledge; declarative knowledge Artificial intelligence[1] — Procedural knowledge — Declarative knowledge Neuroscience[3] — Covert knowledge — Overt knowledge Management studies[4]; education[5] — Tacit knowledge — Explicit knowledge IT studies[6] — Knowledge as process — Knowledge as object Knowledge management[7] — Know-how — Know-what Sociology of science[8] — Tacit; encultured (forms of life) — Explicit/symbolic *Source:* [1] Sahdra and Thagard (2003, p. 479); [2] Gourlay (2004); [3] Weiskrantz (1997, p. 256); [4] Nonaka and Takeuchi (1995); [5] Alexander et al. (1991); [6] Kakihara and Sørensen (2002); [7] Whitehill (1997); [8] Collins (1993, 2001b).

Leiponen, A	Managing knowledge for innovation: The case of business-to-business services	Journal of product innovation management	Article	2006	The present study builds a typology of organizational knowledge in business services and empirically examines the effects of knowledge on innovation performance. It is suggested that firms differ with respect to their knowledge creation approaches and that these approaches have implications for firms' innovation activities. A conceptual framework of knowledge assets with degrees of tacitness and collectiveness as the principal axes is used to ground the empirical analysis. The organizational knowledge framework is empirically operationalized using survey data from 167 business service firms and supplementary case study evidence from 16 other firms. It is found that business service improvements and new service introductions are significantly associated with collectively held knowledge, such as codified service solutions or team-based competences and procedures. In contrast, relying solely on tacit knowledge held by individuals may hamper innovation. The results also suggest that tacit collective knowledge is more closely associated with new service introductions, whereas explicit collective knowledge is associated with service improvements. Tacit collective knowledge is thus conducive. A managerial implication is that new service introductions necessitate team competences and routines, whereas incremental service improvements are more likely if procedures are in place to codify services into explicit solutions or technologies. Thus, the knowledge management approach should depend on the strategic orientation of the service firm toward continuous improvement of existing services or development of completely new services.	**Explicit collective knowledge** is associated with service improvements. **Organizational knowledge** emphasizes the distinction between tacit and codified forms of knowledge (Levitt and March, 1988; Nelson and Winter, 1982; Nonaka, 1994) **Codified knowledge** is ***easier to exploit*** in an organization because of its transferability, but therein also lies a danger of leakage. **Tacit knowledge** may be ***easier to appropriate***, and thus it may provide more sustainable competitive advantage (Spender, 1996; Winter, 1987). **Codifiable and teachable knowledge**, in contrast, also can be transmitted across organizational boundaries (Kogut and Zander, 1993; Zander and Kogut, 1995). **Individual explicit knowledge** is measured by higher education attainment. **Individual tacit knowledge** is measured by the degree to which the firm relies on individual experts as the basis of service delivery. **Organizational explicit knowledge** is measured as the degree to which the firm relies on service solutions or codified technology in their operations. **Organizational tacit knowledge** is measured by the degree to which competitiveness of the firm depends on knowledge, or skills, residing in teams. **[a]**

	Individual	Collective/organizational
Tacit	Expertise, skills *Automatic knowledge*	Joint routines, processes *Collective knowledge*
Explicit	Education, professional knowledge *Conscious knowledge*	Intellectual property, products, services *Objectified knowledge*

[a]Adapted from Cook and Brown (1999) and Spender (1996).

Nonaka, I; Von Krogh, G; Voelpel, S	Organizational knowledge creation theory: Evolutionary paths and future advances	Organization studies	Review	2006	Organizational knowledge creation is the process of making available and amplifying knowledge created by individuals as well as crystallizing and connecting it to an organization's knowledge system. In other words, what individuals come to know in their (work-)life benefits their colleagues and, eventually, the larger organization. The theory explaining this process - the organizational knowledge creation theory has developed rapidly in academia and been broadly diffused in management practice over the last 15 years. This article reviews the theory's central elements and identifies the evolving paths taken by academic work that uses the theory as a point of departure. The article furthermore proposes areas in which future research can advance the theory of organizational knowledge creation.	**Knowledge** is ***embodied in the individual***, and is therefore ***history dependent, context sensitive, specific*** and aimed at problem definition rather than problem depiction, and problem solving (Varela et al. 1991). Justified true belief: individuals justify the truthfulness of their observations based on their observations of the world. Justification therefore hinges on unique viewpoints, ***personal sensibility and experience*** (Nonaka and Takeuchi 1995). **Knowledge** is the capacity to define a situation and act accordingly (Stehr 1992, 1994; von Krogh et al. 2000). **Explicit knowledge** can be uttered, formulated in sentences, captured in drawings and writing. **Tacit knowledge** tied to the senses, movement skills, physical experiences, intuition or implicit rules of thumb (Polanyi 1966). **Individual knowledge** often fails to benefit others in the organization and vice versa (von Krogh and Grand 1999; von Krogh 2002).
Inkpen, AC; Tsang, EWK	Social capital, network, and knowledge transafer	Academy of management review	Review	2005	We examine how social capital dimensions of networks affect the transfer of knowledge between network members. We distinguish among three common network types: intracorporate networks, strategic alliances, and industrial districts. Using a social capital framework. we identify structural, cognitive, and relational dimensions for the three network types. We then link these social capital dimensions to the conditions that facilitate knowledge transfer. In doing so. we propose a set of conditions that promote knowledge transfer for the different network types.	**Knowledge transfer** (Argote & Ingram, 2000): is the process through which one network member is affected by the experience of another **Knowledge of the firm**: ***Transferable*** (Gupta e Govindarajan, 2000): "the primary reason why MNCs exist is because of their ability to transfer and exploit knowledge more effectively and efficiently in the Intracorporate context than through external market mechanisms". ***Constructed***: combining the economic, cultural, and technological resources of the industrial district, firms can lead to joint knowledge creation. ***Cultural***: cultural diversity should be beneficial to knowledge transfer.

Kyriakopoulos, K; de Ruyter, K	Knowledge stocks and information flows in New product development	Journal of management studies	Article	2004	Although firms increasingly invest in systems (e.g. ISO, knowledge centers, IT systems) for utilizing stored knowledge and acquiring market information during new product development, few manage to benefit from these investments. To explore this issue, we suggest that firms rely on two distinct types of knowledge stocks-procedural and declarative memory - that affect new product short-term financial performance and creativity in distinct ways. Additionally, we suggest that internal or external information flows can have distinct moderating impact on the memory types-product outcomes relationship. Our empirical study of product development activities indicates that there is an inverted U-shaped relationship between procedural memory and product outcomes as well as a positive relationship between declarative memory and financial performance. Also procedural and declarative memory may work in a complementary fashion enhancing both outcomes. Finally, procedural memory is found to reduce the value of internal or external information flows for product creativity. These findings have important implications for the organizational knowledge, capabilities, and product development literatures as well as for practice and they open ways for future research.	**Procedural memory** It is routine knowledge. This refers to memory "for how things are done" (Cohen and Bacdayan, 1994, p. 404) or "things you can do" (Berliner, 1994, p. 102), and is also known as **motor memory** (Cohen, 1991). It takes the form of skills related to the particular domain in which they are practiced (Moorman and Miner, 1998a). For example, in the context of new product development, it includes routines for team cooperation. Second, it is **automatic** and **inarticulate** (Cohen and Bacdayan, 1994), that is, procedural memory is often available to its users even without the underlying noun knowledge (Tsoukas and Vladimirou, 2001). **Declarative memory** It is knowledge of facts. Declarative memory is "memory for facts, events, or propositions" (Anderson, 1983; Cohen, 1991, p. 137). For example, procedural memory of riding a bicycle can be contrasted with declarative memory of the principles of mechanics underlying bicycle riding (Cohen, 1991). Unlike procedural memory, declarative memory is **general** i.e., not committed to a specific use and allows one to see cause and effect, draw similarities to past events, and choose an appropriate response to the problem (Moorman and Miner, 1998b). **Stock knowledge** (Procedural and Declarative) are types of stored knowledge 

Bloodgood, JM; Morrow, JL	Strategic organizational change: Exploring the roles of environmental structure, internal conscious awareness and knowledge	Journal of management studies	Article	2003	We argue that strategic organizational change is best viewed as a multidimensional phenomenon consisting of various degrees of environmental structure and internal conscious awareness. And, by combining this conceptualization of change with a model of organizational knowledge transfer developed by Nonaka and Takeuchi (1995), we gain a better understanding of the types of change strategies that firms will pursue, the processes they should use to implement these strategies and the likely performance outcomes from these strategies. Specifically, we suggest that the levels of tacit and explicit knowledge needed to implement the new strategies are key determinants of firm performance following strategic organizational change.	**Tacit knowledge** is knowledge that cannot be codified and expressed to others (Polanyi, 1967). The knowledge needed to ride a bicycle is an example of tacit knowledge. Tacit knowledge is developed from personal and direct experience in a situation (Polanyi, 1967). **Explicit knowledge** is knowledge that can be codified and expressed to others. The knowledge of mathematics is an example of explicit knowledge. Processes that require extensive conscious deliberations of many factors depend on explicit knowledge to a greater degree than do processes that require less conscious deliberations and fewer factors to consider. On the other hand, operational processes such as **routines** often include few factors and are performed automatically with little or no conscious thought and lead to the development and use of **tacit knowledge** (e.g., Cohen et al., 1996; Grant, 1996).

Hargadon, A; Fanelli, A	Action and possibility: Reconciling dual perspectives of knowledge in organizations	Organization science	Article	2002	At times knowledge can be seen as the source of organizational innovation and change-at other times, however, it can be the very constraint on that change. This conflicted role offers insights into why the phenomenon of organizational knowledge has been interpreted by researchers in multiple and possibly conflicting ways. Some theories depict knowledge as an empirical phenomenon, residing in action and becoming organizational in the acquisition. diffusion, and replication of those actions throughout the organization. Others consider it a latent phenomenon, residing in the possibility for constructing novel organizational actions. This paper argues that while each of these qualities-empirical and latent-are intrinsic to knowledge in organizations. our understanding of organizational phenomena is essentially incomplete until the relationship between them is considered. Building on structuration theory. we propose a complementary perspective that views organizational knowledge as the product of an ongoing and recursive interaction between empirical and latent knowledge. between knowledge as action and knowledge as possibility. We ground this complementary model of knowledge in evidence from the field study of two firms whose innovation practices provide unique insights into how knowledge simultaneously enables and constrains behavior in organizations. We then discuss how a complementary perspective avoids the reification of knowledge by depicting it instead as an ongoing and social process and offers an alternative distinction between individual and collective knowledge.	**Knowledge** as an empirical phenomenon, residing in action and becoming "*organizational*" in the acquisition, diffusion, and replication of those actions throughout the organization. ***Empirical*** (representing the potential for acquiring and replicating existing actions) ***and latent*** (representing the potential for generating novel actions). It is enabling in allowing individuals (and ultimately organizations) to deviate from existing patterns of action within a particular situation through the imagination of new possibilities)**.** **Knowledge of action and knowledge of possibility** (see Boland and Tenkasi 1995, Sevon 1996). In essence, the knowledge of possibilities constitutes action and the knowledge of action constitutes possibility.

Cabrera, A; Cabrera, EF	Knowledge-sharing dilemmas	Organization studies	Article	2002	The exchange of information among organizational employees is a vital component of the knowledge-management process. Modern information and telecommunication technology is available to support such exchanges across time and distance barriers. However, organizations investing in this type of technology often face difficulties in encouraging their employees to use the system to share their ideas. This paper elaborates on previous research, suggesting that sharing personal insights with one's co-workers may carry a cost for some individuals which may yield, at the aggregate level, a cooperation dilemma, similar to a public-good dilemma. A review of the research on different types of public-good dilemmas provides some indications of the specific interventions that may help organizations encourage the kind of social dynamics that will increase overall knowledge sharing. These interventions can be classified into three categories: interventions aimed at restructuring the pay-offs for contributing, those that try to increase efficiency perceptions, and those that make employees' sense of group: identity and personal responsibility more salient.	**Organizational knowledge** It is ***Rare and unique.*** ***Path dependent:*** there are no two organizations that have undergone exactly the same history of learning experience. Other authors (Cook and Brown, 1999; Tsoukas, 1996; Blackler, 1995) have defended alternative views of organizational knowledge that emphasize its situated, ***socially constructed, contextualized and dynamic character.*** Its value grows when it is ***shared:*** As one shares knowledge with other units, not only do those units gain information; they share it with others and feedback questions, amplifications, and modifications that add further value for the original sender, creating exponential total growth (Quinn et al, 1996). **Collective knowledge** ***Hard to appropriate*** by third parties because of its supra-individual character and because it is made up of co-specialized capabilities (Nnda, 1996). ***Difficult to imitate*** because it is ***causally ambiguous:*** it is embedded in a complex network of formal and informal interpersonal relationships and in a shared and often unspoken system of norms and beliefs (Sanchez and Heene, 1997). The following taxonomy is based on several studies (Spender, 1996; Nonaka and Takeuchi, 1994; Blacker, 1995; Lam, 2000). **Tacit knowledge:** includes hard-to-communicate skills, know-how or practical knowledge. **Explicit knowledge:** refers to forms of knowledge that can easily be communicated to others. **Individual knowledge:** pieces of knowledge that are held by one person. **Collective knowledge:** knowledge embedded in the interactions among a group of people. **Individual-tacit:** embodied knowledge **Individual-explicit:** embrained knowledge **Collective-explicit:** encoded knowledge **Collective-tacit:** encultured and embedded knowledge

Bhagat, RS; Kedia, BL; Harveston, PD; Triandis, HC	Cultural variations in the cross- border transfer of organizational knowledge: An integrative framework	Academy of management review	Article; proceedings paper	2002	Little is known about the effectiveness of cross-border transfer of organizational knowledge involving dissimilar cultural contexts. We propose a theoretical framework for understanding the significance of four transacting cultural patterns, defined in terms of the dimensions of individualism-collectivism and verticalness-horizontally, for their potential in moderating the effectiveness of cross-border transfer of organizational knowledge. Drawing foundational support for this new framework from recent research advances in the area of knowledge transfer, we explore implications for future research.	**Knowledge** is ***broader, deeper, and richer*** than data or information. Knowledge (Davenport and Prusak, 1998): is a fluid mix of framed experience, important values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It ***originates from unique experiences*** and ***organizational learning*** by key constituents, and it often remains ***embedded, not only in written documents but also in the routines, tasks, processes, practices, norms, and values of organizations.*** ***Knowledge is created, restructured, or changed from related and unrelated pieces of information***, to the extent that the information has the right kinds of signals that, in the mind of the receiver, are conducive to the creation of knowledge. Nonaka (1994) and Nonaka and Takeuchi (1995) note that knowledge is ***created, organized, and transferred by the commitment and belief pattern of its holders and its recipients***, who transmit their culture-specific sets of values and frames of reference. Knowledge is often highly ***personal*** in nature, ***difficult to communicate*** (Polanyi, 1958), ***highly specialized***, ***and not always valued or easily traded in the external marketplace*** (Ghemawat, 1991). Garud and Nayyar (1994): **Complex knowledge** evokes more causal uncertainties, and, therefore, the amount of factual information required to completely and accurately convey such types of knowledge is greater than would be the case with simple types of knowledge. **Simple knowledge** can be captured with little information and is, therefore, relatively easy to transfer. **Tacit knowledge** requires more than just codification. Often, it is embedded within individuals' cognitive processes or is deeply ingrained in the routine and non-routine processes of an organization's unique culture and values (Daft & Lengel, 1986), and there are considerable causal ambiguities surrounding it (Szulanski, 1996). Causal ambiguity is present when the knowledge cannot be easily reduced to a precise list of factors in the reproduction and implementation of knowledge. **Explicit knowledge** can be codified and is transferred with relative ease. **Independent knowledge** can be described by itself. **Systemic knowledge** must be described in relation to a body of knowledge existing in the transferring organization. De Long and Fahey (2000): **Human knowledge** constitutes what individuals know or know how to do, is manifested in important skills, and usually comprises both explicit and tacit knowledge. It could be ***conceptual*** or ***abstract in orientation.*** **Social knowledge** exists in relationships among individuals or within groups. Social or collective knowledge is largely ***tacit***, composed of cultural norms that exist as a result of working together, and its salience is reflected in our ability to collaborate and develop transactional relationships. Social knowledge can be either ***simple or complex*** and is largely ***tacit*** and ***systemic*** in character. **Structured knowledge** is embedded in organizational

						systems, processes, rules, and routines. According to De Long and Fahey, this kind of knowledge is ***explicit*** and ***rule based*** and can exist independently of the human knowers (Glazer, 1998). Structured knowledge is either ***simple or complex***, is usually more ***explicit*** than tacit, and is largely ***systemic*** in character. **"Sticky" knowledge** (Szulanski, 1996): is more ***complex, tacit, and systemic***, is more ***difficult to transfer, regardless of cultural difference.***
Becker, MC	Managing dispersed knowledge: Organizational problems, managerial strategies, and their effectiveness	Journal of management studies	Article	2001	While there has been much progress in understanding organizational knowledge and knowledge management practices, some questions still remain unresolved. This paper argues that at least one important driver of knowledge-related organizational problems has been rather neglected so far: that is, the dispersed nature of organizational knowledge. The paper analyses the organizational problems and managerial responses arising from dispersed knowledge. It identifies three drivers by which the dispersedness of knowledge leads to management problems: namely, it creates large numbers, asymmetries, and uncertainty. A number of managerial strategies for dealing with the different components of the problems created by the dispersedness of knowledge are identified and their effectiveness analysed, thereby informing managers as to how best to deal with dispersed knowledge. The analysis of uncertainty-related implications of dispersed knowledge uncovers an overlooked distinction that is helpful for understanding dispersed knowledge and its managerial implications. This is the distinction between uncertainty and ambiguity, i.e. a strong form of uncertainty that cannot be remedied by the standard strategy of increasing the information available.	**Dispersed Knowledge** The key characteristic of dispersed knowledge is that 'dispersed knowledge is essentially dispersed, and cannot possibly be gathered together and conveyed to an authority charged with the task of deliberately creating order' (Hayek, 1988, p. 77). Dispersed knowledge can never be given to a single mind (cf. Hayek, 1945, p. 519) and thus 'never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess'.

Lanzara, GF; Patriotta, G	Technology and the courtroom: An inquiry into knowledge making in organizations	Journal of management studies	Article	2001	Recent theories of knowledge management have offered a functionalist understanding of knowledge creating dynamics in organizations. Their focus is on the role of knowledge assets as a determinant of competitive performance. However, the presupposition that knowledge can be managed or treated as an objective commodity seems to overlook the highly interactive, provisional and controversial nature of knowledge-oriented phenomena in organizations. By deviating from the mainstream, we conduct a phenomenological inquiry into knowledge making within the setting of courtroom trials. Evidence is provided by in-depth case studies carried out in six Italian courtrooms adopting videocassette recording (VCR) technology as a tool for recording and storing the proceedings of criminal trials. The behavioural responses of courtroom actors confronted by the intrusion of an alien technology in a highly institutionalized and resilient setting are particularly relevant for the study of knowledge in organizations. They reveal the highly controversial, pasted up and medium-specific features of organizational and professional knowledge systems. Rather than being the product of smooth conversion processes, knowledge in organizations is the outcome of inquiry, controversy and bricolage, resilient as a whole, but subject to local disputes, experiments and reassembling. Based on the findings of the cases, our account points towards a view of organizational knowledge as a dynamic, heterogeneous 'assemblage' characterized by ongoing transformations and reconfigurations.	**Knowledge as commodity** that can be placed at the service of the organization. The commodification of knowledge is instrumental in suggesting a causal relationship between organizational knowledge and competitive performance, and prescriptions to improve the way organizations manage their patrimony of knowledge.

Alvesson, M; Karreman, D	Odd couple: Making sense of the curious concept of knowledge management	Journal of management studies	Article	2001	The idea of knowledge management draws currently much attention,, both among practitioners and scholars. Advocates of the term argue that knowledge management points to a new set of phenomena and practices for managers to learn and master. In particular knowledge management focuses on the creation and distribution of knowledge in organizations through technological novelties such as the internet, intranets, and e-mail, although there are also streams concentrating on social relations and interactions. This paper examines several possible conceptualizations of the idea of knowledge management. It is argued that knowledge is an ambiguous, unspecific and dynamic phenomenon, intrinsically related to meaning, understanding and process, and therefore difficult to manage. There is thus a contradiction between knowledge and management. Drawing from a literature review and a case study, it is suggested that knowledge management is as likely, if not more so, to operate as a practice of managing people or information than as a practice attuned towards facilitating knowledge creation.	**Knowledge is an ambiguous, unspecific and dynamic phenomenon**, intrinsically related to meaning, understanding and process, and therefore difficult to manage. **knowledge is highly people-based.** **knowledge is what is objectively known:** an intellectual property, attached to a name or a group of names and certified by copyright or some other form of recognition (e.g. publication). (Cited in McGrath, 2000, p. 32). **Knowledge is a subset of information.** ***It is subjective***: it is linked to meaningful behavior; and it has tacit elements born of experience. (Leonard and Sensiper, 1998, p. 113). **Knowledge** is **always recreated in the present moment**: most of us cannot articulate what we know. It is **largely invisible** and often comes to mind when we need it to answer a question or solve a problem. (McDermott, 1999). **vagueness;** researchers seem to have difficulties in saying something distinct about the specific content of the knowledge that presumably is so central in their work (e.g. Grant, 1996). **an all-embracing and somewhat empty view on.** **knowledge:** Wide-ranging concepts tend to be rather empty: they may cover everything and nothing. **functionalism**: The problem is that 'knowledge' is not necessarily functional, useful, and a generally good thing. **Knowledge** may be **encyclopedic:** concerning facts about the world. **It may be procedural:** telling how to accomplish certain effects. **It may be social:** telling us when to use encyclopedic and procedural knowledge.

						It may be explanatory: telling us why. **Cited **TACIT and EXPLICIT***
Purvis, RL; Sambamurthy, V; Zmud, RW	The assimilation of knowledge platforms in organizations: An empirical investigation	Organization science	Article	2001	The ability to integrate dispersed pockets of expertise and institute an organizational repository of knowledge is considered to be vital for sustained effectiveness in contemporary business environments. Information technologies provide cost-effective functionalities for building knowledge platforms through systematic acquisition, storage, and dissemination of organizational knowledge. However, in order to gain the value-adding potential of organizational knowledge, it is not sufficient to simply adopt and deploy IT-enabled knowledge platforms. These platforms must be assimilated into the ongoing work processes in organizations. Yet, theories of technology innovation and use suggest that a variety of institutional, social, and political factors blend together in influencing the extent to which complex information technologies are actually assimilated into organizational practice. Therefore, this research addresses a significant question: What forces influence the assimilation of knowledge platforms in organization? Given the significant gap between the adoption and actual assimilation of complex technologies into organizations, this is an important question. Empirical evidence is generated by examining the forces influencing the assimilation of CASE technologies in systems development projects in organizations. CASE is considered to be one of the most mature knowledge platforms in contemporary organizations. The empirical evidence sheds light on the role of institutional forces that influence the rate of assimilation of the technology. The findings have significant implications for further research and practice.	**Organizational knowledge:** (is created and expanded through social interaction between tacit knowledge and explicit knowledge') ***Knowledge explicit:*** easy to communicate and transfer because it can be codified ***Knowledge tacit:*** more difficult to transfer and communicate because it is inextricably woven with the experiences and situational contexts within which it was generated/is codified into explicit instructions (Demsetz 1991, Grant 1996a, 1996b). ***Refined knowledge:*** (tacit and explicit) incorporating into the sequencing of production rules associated with work processes. ***Routine knowledge:*** s that coordinate the work-related efforts of professionals and experts in an organization (Nelson and Winter 1982, Grant 1996b). Routines facilitate knowledge integration in two ways: They habituate automated or practiced patterns of interaction and hence allow for the integration of knowledge required for task performance (Gersick and Hackman 1990, Weick and Roberts 1993), and they allow the improvisation of a varied repertoire of interactions as individuals confront the tasks facing them (Pentland and Reuter 1994). ***Knowledge with the use of teams and meetings*** (Van de Ven et al. 1976).

Tsoukas, H; Vladimirou, E	What is organizational knowledge?	Journal of management studies	Article; proceedings paper	2001	Organizational knowledge is much talked about but little understood. In this paper we set out to conceptualize organizational knowledge and explore its implications for knowledge management. We take on board Polanyi's insight concerning the personal character of knowledge and fuse it with Wittgenstein's insight that all knowledge is, in a fundamental way, collective. We do this in order to show, on the one hand, how individuals appropriate knowledge and expand their knowledge repertoires, and, on the other hand, how knowledge, in organized contexts, becomes organizational. Our claim is that knowledge is the individual capability to draw distinctions, within a domain of action, based on an appreciation of context or theory, or both. Organizational knowledge is the capability members of an organization have developed to draw distinctions in the process of carrying out their work, in particular concrete contexts, by enacting sets of generalizations whose application depends on historically evolved collective understandings. Following our theoretical exploration of organizational knowledge, we report the findings of a case study carried out at a call center in Panafon, in Greece. Finally, we explore the implications of our argument by focusing on the links between knowledge and action on the one hand, and the management of organizational knowledge on the other. We argue that practical mastery needs to be supplemented by a quasi-theoretical understanding of what individuals are doing when they exercise that mastery, and this is what knowledge management should be aiming at. Knowledge management, we suggest, is the dynamic process of turning an unreflective practice into a reflective one by elucidating the rules guiding the activities of the practice, by helping give a particular shape to collective understandings, and by facilitating the emergence of heuristic knowledge.	**Information** is a flow of messages, while **knowledge** is created by that very flow of information, anchored in the beliefs and commitment of its holder. This understanding emphasizes that knowledge is essentially ***related to human action*** (Nonaka and Takeuchi, 1995). **Knowledge** is a flux mix of framed experiences, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. **In organizations**, it often becomes ***embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms***. (Davenport and Prusak, 1998). Knowledge presupposes values and beliefs, and is ***closely connected with action***. **Data:** For Bell is an ordered sequence of given items or events. **Information** is a context-based arrangement of items whereby relations between them are shown. And knowledge is the judgment of the significance of events and items which comes from a particular context and/or theory. **Knowledge** is the capacity to exercise judgment on the part of an individual, which is either based on an appreciation of context or is derived from theory, or both (ibid. 1999). Knowledge is the individual ability to draw distinctions within a collective domain of action, based on an appreciation of context or theory, or both. In Polanyi's view **practical knowledge** has two features. First, it is inevitably and irreducibly ***personal***, since it involves personal participation in its generation. And second, for knowledge to be effectively applied it needs to be ***instrumentalized*** to be used as a tool. **Organizational knowledge** is the capability members of an organization have developed to draw distinctions in the process of carrying out their work, in particular concrete contexts, by enacting sets of generalizations (propositional statements) whose application ***depends on historically evolved collective understandings and experiences***. **Informal knowledge** is generated in action. This type of knowledge (what Collins (1990) calls **'heuristic knowledge'**) is gained only through the improvisation employees undertake while carrying out their tasks. Heuristic knowledge resides both in individuals' minds and in stories shared in communities of practice. Such knowledge may be formally captured and, through its casting into propositional statements, may be turned into organizational knowledge. Heuristic knowledge ***is not accidental but a necessary outcome of the interpretative act.***

Andrews, KM; Delahaye, BL	Influences on knowledge processes in organizational learning: The psychosocial filter	Journal of management studies	Article	2000	This paper reports a segment of broader theory-building case study research exploring organizational learning and knowledge processes in a bio-medical consortium. Its focus is the individual-level factors that influence knowledge processes associated with organizational learning. As we explored how organizational learning occurred, the underlying knowledge processes came forward as complex and idiosyncratic. In an unanticipated finding, micro-processes emerged as highly influential, with individual perceptions of approachability, credibility and trustworthiness mediating knowledge importing and knowledge sharing activities. We introduce a model - the psychosocial filter - to describe the cluster of micro-processes that were brought forward in the study. Firstly, scientists filtered knowledge importing by deciding whom they would approach for information and from whom they would accept input. The individual's confidence to initiate information requests (which we termed social confidence) and the perceived credibility of knowledge suppliers both mediated knowledge importing. Secondly, scientists mediated knowledge sharing by actively deciding with whom they would share their own knowledge. Perceived trustworthiness - based on perceptions of what colleagues were likely to do with sensitive information - was the factor that influenced knowledge-sharing decisions. Significantly, the psychosocial filter seemed to constitute a heedful process with high functionality. Its effect was not to block knowledge circulation, but instead to ensure that knowledge-sharing decisions were made in a thoughtful and deliberate way. The psychosocial filter suggests an initial framework for conceptualizing the role that individual-level processes play in organizational knowledge sharing. Building on this, the model provides a platform for more focused exploration of knowledge processes and social relationships in organizational learning.	**Organizational knowledge** is now accepted as a central, rather than peripheral organizational variable, with its competitive value widely recognized (Dodgson, 1993; Hamel and Prahalad, 1994; Miner and Mezias, 1996; Quinn, 1992). **Knowledge-importing:** knowledge which the scientist obtained from an external source). **Knowledge-sharing:** personal knowledge which a scientist shared with someone else. **Credibility of the knowledge:** factor that appeared to impact on knowledge importing was the credibility of the information source.

Huff, AS	Changes in organizational knowledge production	Academy of management review	Article	2000	The explosion of knowledge production within business and other organizations poses a critical challenge to current modes of teaching and research within our business schools. We need to consider new strategic positions closer to the knowledge production being carried on within the organizations we study, without assuming that immediate relevance is our primary objective. The academic advantage, in my opinion, still lies in generalization and abstraction.	**Knowledge:** can be summarized as the pursuit of "scientific truth" by "scientists." **Knowledge from application.** It is group based, rather than focused on the work of individuals. ***more timely, more practical, more democratic.***
de Boer, M; Van den Bosch, FAJ; Volberda, HW	Managing organizational knowledge integration in the emerging multimedia complex	Journal of management studies	Article	1999	Due to technological convergence, complexes of interrelated industries are emerging. This paper presents a conceptual framework of the role different organizational forms and combinative capabilities play in the management of organizational knowledge integration in this context. The focus is on firms previously operating in one of the relatively stable constituting industries. We argue that a firm's organizational form has to be matched with appropriate combinative capabilities in order to integrate component knowledge into architectural knowledge that consequently serves as a platform for generating new product-market combinations. The framework is empirically illustrated using the example of two Dutch publishing firms moving into the multimedia complex, which is currently emerging around information and communication technologies. The empirical analysis shows that the framework offers strong potential for improving the understanding of the complex process of organizational knowledge integration, as the prerequisite for developing new business in an emerging industrial complex.	**Organizational renewal** in the context of an emerging industrial complex should to a large extent be aimed at creating new ***architectural knowledge,*** which is a matter of reconfiguring existing component knowledge. **Component knowledge** is defined as knowledge already existing somewhere within the original industries constituting an industrial complex. **Architectural knowledge** is defined as the innovation a firm creates by combining, or integrating different types of component knowledge into a new configuration. **Personal knowledge** ***Knowledge related to the enrichment of information content*** (i.e., product knowledge). ***Knowledge related to the process of*** **information** gathering, processing, refining, updating, storing, and distributing (i.e., production process knowledge). ***knowledge related to the anticipation,*** interpretation, understanding, and stimulation of customers' need for information (i.e., market knowledge).

Cook, SDN; Brown, JS	Bridging epistemologies: The generative dance between organizational knowledge and organizational knowing	Organization science	Article	1999	Much current work on organizational knowledge, intellectual capital, knowledge-creating organizations, knowledge work, and the like rests on a single, traditional understanding of the nature of knowledge. We call this understanding the epistemology of possession, since it treats knowledge as something people possess. Yet, this epistemology cannot account for the knowledge found in individual and group practice. Knowing as an action calls for an epistemology of practice. Moreover, the epistemology of possession tends to privilege explicit over tacit knowledge, and knowledge possessed by individuals over that possessed by groups. Current work on organizations is limited by this privileging and by the scant attention given to knowing in its own right. Organizations are better understood if explicit, tacit, individual and group knowledge are treated as four distinct and coequal forms of knowledge (each doing work the others cannot), and if knowledge and knowing are seen as mutually enabling (not competing). We hold that knowledge is a tool of knowing, that knowing is an aspect of our interaction with the social and physical world, and that the interplay of knowledge and knowing can generate new knowledge and new ways of knowing. We believe this generative dance between knowledge and knowing is a powerful source of organizational innovation. Harnessing this innovation calls for organizational and technological infrastructures that support the interplay of knowledge and knowing. Ultimately, these concepts make possible a more robust framing of such epistemologically-centered concerns as core competencies, the management of intellectual capital, etc. We explore these views through three brief case studies drawn from recent research.	**Knowledge** ***Static:*** possessing it does not require that it be always in use. ***Abstract:*** Knowledge is something that is *about* but not *in* the tangible world. **Explicit:** Polanyi's definition ***[Not transformable in tacit knowledge]*** ***[Generable from tacit knowledge]*** **Tacit:** Polanyi's definition ***[Not transformable in explicit knowledge]*** ***[Generable from explicit knowledge]*** **Group knowledge:** knowledge of a specific category of individuals (I.e., Nephrologist know how to diagnose nephrite).

DeCarolis, DM; Deeds, DL	The impact of stocks and flows of organizational knowledge on firm performance: An empirical investigation of the biotechnology industry	Strategic management journal	Article	1999	The knowledge-based view of the firm is a recent approach to understanding the relationship between Jinn capabilities and firm performance. Specifically, this approach suggests that knowledge generation, accumulation and application may be the source of superior performance. Other research hers conceptualized organizational knowledge in terms of stocks of accumulated knowledge in the firm and flows of knowledge into the firm. This paper tests the relationship between stocks and flows of organizational knowledge and firm performance in the biotechnology industry. We suggest that a firm's geographic location, alliances with other institutions and organizations and R&D expenditures are representative of knowledge flows, while products in the pipeline, firm citations and patents are indicative of knowledge stocks. Through factor analysis, rye develops an aggregated measure of location from several variables. A regression model suggests that location is a significant predictor of firm performance as are products in the pipeline and firm citations. A major contribution of this investigation is the operationalization of geographic location and its statistically significant link to firm performance. Copyright (C) 1999 John Wiley & Sons, Ltd.	**Stocks of knowledge** (Dierickx and Cool, 1989): are accumulated knowledge assets which are internal to the firm. Patents may be considered as representative of stocks of organizational knowledge. They are ***physical, codifiable manifestations of innovative ideas, techniques, and products*** that embody the knowledge of one or several employees. Knowledge accumulation then is the ***result not only of internal development*** but also of ***assimilation of external knowledge.*** Products in the pipeline may in fact be considered ***physical manifestations*** of a company's stock of accumulated knowledge **Flows of knowledge** (Dierickx and Cool, 1989): are represented by knowledge streams into the firm or various parts of the firm which may be assimilated and developed into stocks of knowledge. ***[Supported by geographic location and proximity to other knowledge actors (suppliers, skilled workers, investors)]***: Recent work by Audretsch and Feldman (1996) provides evidence that in industries where new knowledge is important firms cluster together to take advantage of knowledge spillovers. When an innovation community is centered in a geographic area, the concentration of successful firms, qualified suppliers, skilled workers, informed investors, idea generators and shared resource arrangements will be partly responsible for an increasing proportion of industry innovations (Pouder and St. John, 1996). Within a geographic cluster there are ample opportunities for inter-organizational knowledge flows and communications. ***[Limited to geographic clusters]:*** Managers and other professional employees will seek jobs within the same geographic area rather than move to other locales (Angel, 1989). Thus, organizational knowledge will "move" from one firm to another through a mobile labor pool, which moves within the cluster. A firm located in a geographic area with high munificence (a high concentration of similar firms, specialized suppliers, such as research universities, and a large pool of trained labor) will have access to knowledge flows which may be unavailable or difficult to attain by similar firms which are geographically isolated. **Organization knowledge** It is a firm specific asset which ***is not easily imitated and non-tradeable*** (Barney, 1986). People are endowed with firm-specific skills and values, which are accumulated through on the job training and learning. The idiosyncratic nature of firm-specific assets makes them non-tradeable. These assets are not only ***non-tradeable*** but they are also ***accumulated internally*** through a number of mechanisms over time.

Cohen, D	Toward a knowledge context: Report on the First Annual UC Berkeley Forum on Knowledge and the Firm	California management review	Editorial material	1998	At the U.C. Berkeley Forum on Knowledge and the Firm, leading academics and knowledge practitioners from Japan, the U.S, and Europe discussed their understandings of organizational knowledge and how firms can influence its creation and use. The meeting brought to the surface a diversity of goals, assumptions, and vocabularies-most notably a contrast between the aim of nurturing the process of knowledge creation and that of managing and measuring knowledge use. By exploring both common ground and differences, participants began to weave a knowledge context: a fabric of varied and mutually illuminating ideas about knowledge. Given the complexity of knowledge, this kind of rich context should provide a better framework for answering questions about how to approach and value knowledge work than any single point of view could provide.	The noun "**knowledge**" implies that knowledge is a thing that can be located and manipulated as an independent **object** or **stock**. It seems possible to "capture" knowledge, to "distribute," "measure," and "manage" it. Nonaka calls "originating ba," the ba of knowledge creation. No single formula defines the look or feel of originating ba, but it is a place where barriers between self and others are removed, where socialization encourages the sharing and exploration of ideas that generate new ideas. It is the milieu of tacit-to-tacit knowledge exchange. **"Interacting ba"** is the place where tacit knowledge is made explicit. "**Cyber ba**" is the place where new explicit knowledge is combined with existing explicit knowledge and is organized, stored, and shared through the organization. "**Exercising ba**" is where explicit knowledge is converted to tacit knowledge through mentoring and the learning that comes from action. Brown defines knowledge as "**justified or 'warranted**' beliefs relative to a framework." The framework (or shared context) is created by the shared practice of a community drawn together by work.

Lado, AA; Zhang, MJ	Expert systems, knowledge development and utilization, and sustained competitive advantage: A resource-based model	Journal of management	Review	1998	In this paper, we propose a resource-based model to explain how expert systems generate sustained competitive advantage for a firm. Specifically, we analyze the extent to which expert systems (ESs) exhibit the attributes of value, rareness, imperfect imitability, and nonsubstitutability associated with a rent-generating resource (e.g., Barney 1991). Then, we discuss how expert systems yield sustainable competitive advantage through fostering organizational knowledge development and utilization. Finally, we examine the role of ESs in engendering a reciprocal, mutually enhancing relationship with organizational competencies, leading to sustained competitive advantage. Propositions are offered to facilitate future research.	**Knowledge** Bell (1979) defined knowledge as an organized set of facts or ideas, presenting a reasoned judgment or experimental result, that is transmitted to others through some communication medium in some systematic form. Spender (1993) identified four types of knowledge: - **scientific knowledge** which is universally verifiable; - **communal knowledge** which is taken for granted, tacit and is specific to a particular social system; - **conscious knowledge** which is person specific, codifiable and verifiable; - **automatic knowledge**, which is non codifiable, taken for granted, and person specific. Kogut and Zander (1992) distinguished between: - **Information,** referring to "knowledge which can be transmitted without loss of integrity once the syntactical rules required for deciphering it are known," - **How-how**, which describes "the accumulated practical skill or expertise that allows one to do something smoothly and efficiently" (von Hippel, 1988: 76). **Human knowledge** It has the characteristic of **tacitness** (Polanyi, 1967; Winter, 1987); such knowledge is often developed over many years of education, training, and experience, and in idiosyncratic ways, including experimentation, improvisation, and apprenticeship (March, 1991; Weick, 1991). Thus, it is often difficult for individuals other than experts themselves to codify, articulate, explain or even understand the expertise before it is captured in ESs (Beerel, 1987).

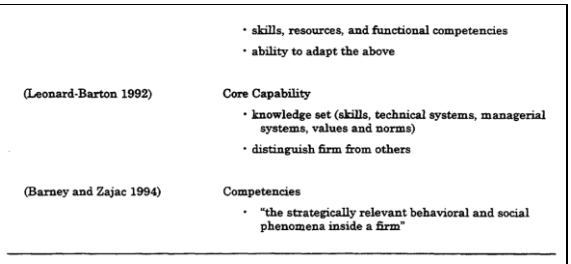
Brown, JS; Duguid, P	Organizing knowledge	California management review	Article; proceedings paper	1998	Countering claims that cyberspace will bring the end of organizations in general and of the firm in particular, this article points to the role organizations play in fostering the production and synergistic development of knowledge. Formal organizations help turn the partial, situated insights of individuals and communities into robust, organizational knowledge. To organize knowledge in this way requires acknowledging the boundaries inevitably erected within organizations through the division of labor and the division of knowledge. Infrastructure for organizing knowledge must overcome these boundaries. Assuming that knowledge is a frictionless commodity possessed by individuals makes communications technologies and social organization curious antagonists. This article argues instead for compatible organizational and technological architectures that respond to and enhance the social production of knowledge.	**Organizational knowledge** It provides a synergistic advantage ***not replicable in the marketplace***. While knowledge is often thought to be the property of individuals, a great deal of knowledge is both ***produced and held collectively***. Such knowledge is readily ***generated when people work together*** in the tightly knit groups known as "communities of practice. ***Explicit*** knowledge which may be ***shared by several.*** **Know-How** Know-how, by contrast, ***embedded in work practice*** (usually collective work practice) is sui generis and thus relatively ***easy to protect***. Conversely, however, it can be ***hard to spread, coordinate, benchmark, or change.*** Know-how is critical in making knowledge actionable and operational. Know-how is to a great extent the ***product of experience and the tacit insights*** experience provides. Most dispositional knowledge is intriguingly ***collective,*** less held by individuals than ***shared by work groups.*** Socially embedded knowledge is ***deeply rooted in practice***. **Individual knowledge** What people have by virtue of membership in a community of practice, however, is ***not so much personal***, ***modular knowledge as shared, partial knowledge.*** **Specialized knowledge** Specialized groups are capable of producing highly specialized knowledge. The tasks undertaken by communities of practice develop ***particular, local, and highly specialized knowledge*** within the community. This knowledge is as ***divided*** as the labor that produced it.

Inkpen, AC; Dinur, A	Knowledge management processes and international joint ventures	Organization science	Article	1998	The management and processing of organizational knowledge are increasingly being viewed as critical to organizational success. By exploring how firms access and exploit alliance-based knowledge, the authors provide evidence to support the argument that the firm is a dynamic system of processes involving different types of knowledge. Using data from a longitudinal study of North American-based joint ventures (JVs) between North American and Japanese firms, they address three related research questions: (1) what processes do JV partners use to gain access to alliance knowledge; (2) what types of knowledge are associated with the different processes and how should that knowledge be classified; and (3) what is the relationship between organizational levels, knowledge types, and the transfer of knowledge? Although many generalizations have been drawn about the merits of knowledge-based resources and the creation of knowledge, few efforts have been made to establish systematically how firms acquire and manage new knowledge. Moreover, prior alliance research has not addressed in detail the nature of alliance knowledge and how knowledge is managed in the alliance context. The authors examine the processes used by alliance partners to transfer knowledge from an alliance context to a partner context. They identify four key processes-technology sharing, alliance-parent interaction, personnel transfers, and strategic integration-that share a conceptual underpinning and represent a knowledge connection between parent and alliance. Each of the four processes is shown to provide an avenue for managers to gain exposure to knowledge and ideas outside their traditional organizational boundaries and to create a connection for individual managers to communicate their alliance experiences to others. Although all of the knowledge management processes are potentially effective, the different processes involve different types of knowledge and different organizational levels. The primary types of knowledge associated with each process are identified and then Linked with the organizational level affected by the transfer process. From those linkages, several propositions about organizational knowledge transfer and management are developed. The results suggest that although a variety of knowledge management strategies can be viable, some strategies lead to more effective knowledge transfer than others.	**Tacit knowledge** ***Nonverbalizable, intuitive, and unarticulated*** (Polanyi, 1962). Knowledge that has ***not yet been abstracted from practice*** (Spender, 1996). It is knowledge that has been transformed into habit and made traditional in the sense that it becomes "the way things are done around here" (Spender 1996). ***Highly context specific*** and ***has a personal quality***, which makes it ***difficult to formalize and communicate*** (Nonaka 1994). ***[Can be dissipated]:*** The risk, particularly with tacit knowledge, is that knowledge transferred from a JV to a parent will dissipate as it spirals up to the organization level. ***[Little transferable]:*** More tacit the knowledge, the lower the organizational level through which successful transfers will occur. Highly tacit knowledge is ***intuitive, nonverbalizable, and related to individual experiences.*** Tacit knowledge is ***acquired through experience and use and embodied in individual cognition and organization routines.*** **Explicit knowledge** ***Transmittable in formal, systematic language and may include explicit facts, axiomatic propositions, and symbols*** (Kogut and Zander 1992). It can be ***codified*** or ***articulated in manuals, computer programs, training tools, and so on.*** ***Imitable:*** Zander and Kogut (1995) discussed the tradeoff between the need to share and transfer knowledge internally and the risk of exposing the knowledge to imitation. Explicit knowledge ***embodied in specific products and processes.*** Winter (1987) identified other taxonomic dimensions of knowledge, including **complex versus simple, not teachable versus teachable, and not observable in use versus observable in use.** **Individual knowledge** (Spender, 1996) It is ***Practical.*** Individual knowledge is inherently "***fragile***" and therefore, without knowledge connections, new knowledge may be ignored or viewed as irrelevant (Von Krogh et al. 1994). Individual knowledge and perspectives remain personal unless they are amplified and articulated through social interaction (Nonaka 1994). **Social knowledge** (Spender, 1996): Knowledge that constitutes the socialization and social activities of the individuals within them. **Explicit knowledge** (Spender, 1996): stored in databases, standard operating procedures, manuals, and so on is referred to as objectified knowledge. **Tacit knowledge** (Spender, 1996): is separated into three subtypes: conscious, automatic, and collective. Individual tacit knowledge can be either conscious or automatic. **Automatic knowledge** is implicit knowledge that "happens by itself" and is often taken for granted. **Conscious knowledge** may be ***codified***, perhaps as a set of notes, and is potentially ***available to other people***. **Collective knowledge** is tacit knowledge of a social or communal nature.

Knowledge Management Processes	Types of Knowledge	Examples of Knowledge Potentially Useful to American JV Parents
Technology sharing	Explicit/objectified	Quality control processes Product designs Scheduling systems
JV-Parent interactions	Explicit/objectified	Specific human resource practices
	Tacit/collective	Quality Commitment
Personnel transfers	Tacit/collective	Continuous improvement objectives Commitment to customer satisfaction
	Tacit/conscious	Meaning of quality from Japanese partner perspective
Strategic integration	Explicit/objectified	Market intelligence Partner's keiretsu relationships
	Tacit/collective	JV competitive advantage
	Tacit/conscious	Visions for the future Implications of the partner's keiretsu relationships

Classification based on Spencer (1996)

Galunic, DC; Rodan, S	Resource recombinations in the firm: Knowledge structures and the potential for Schumpeterian innovation	Strategic management journal	Article	1998	Building on the resource-based view of the firm, this paper explores the notion of 'resource recombinations' within the firm. We suggest such recombinations can occur when competencies within the firm (which are interpreted as organized clusters of firm resources) either combine to synthesize novel competencies (synthesis-based recombinations) or experience a reconfiguration or relinking with other competencies (reconfiguration-based recombinations). Central to this paper is an examination of the antecedents necessary for such innovation to occur and in particular the nature of knowledge in the Jinn. We argue that several characteristics of knowledge (tacitness, context specificity, dispersion) and its social organization (the way competencies come to be formed and institutionalized) will have important consequences on the likelihoods of resource recombinations. Our paper develops a model of resource recombination likelihoods and propositions. (C) 1998 John Wiley & Sons, Ltd.	**Information** refers to the data, facts, or symbols that can be exchanged between parties, that is for which there are standard syntactical rules for exchange and interpretation. In essence, this form of knowledge is ***declarative***: it tells us what something is. ***Easy to codify.*** **Know-how**, on the other hand, refers to the accumulated knowledge of how to do something, that is it is ***processual*** in nature. It essentially adds meaning to information, linking items in a cause effect relationship. Know-how includes knowledge of causal relationships, skills, routines and habits, standard operating procedures, organizational norms and values, and heedful interactions between individuals. It has a ***much greater tacit component.*** **Understanding** denotes the comprehension or at least a theory of the underlying mechanisms for observed causal relationships. ***Highly tacit***. **Tacitness** describes the extent to which knowledge ***is or is not codifiable.*** ***Difficult to transfer.*** ***Difficult to detect.*** Tacit knowledge can be transferred by immersing individuals who want to acquire that particular skill in a context where they are exposed to it and/or have to undertake the skill-laden operation themselves. Two types of tacit knowledge: - that which is **inherently tacit**, such as that ***embodied in an individual's skills.*** ***Difficult and costly, if not impossible, to explicitly document.*** - that which is **held in tacit form**, typically as routines, as a means of increasing efficiency and reliability of processes. ***May be transferred*** by making it explicit for the purposes of the transfer. Knowledge can be distinguished according to its dispersion. **Concentrated:** It can be tightly held in the minds of individuals, such as in the case of the tenor. **Diffuse:** It can also be widely dispersed, residing in the collective organizational mind, for example in patterns of heedful interactions (Weick and Roberts 1993). Concentrated knowledge ***may be moved much more easily*** than diffuse knowledge, even when the knowledge is explicit. Knowledge is often ***context specific.*** Reference / Definition (Hamel and Prahalad 1994) Competencies... • "current skills" of the firm • "accumulation of intellectual capital" • firm as portfolio of competencies (Prahalad 1990) Core Competencies... • those that offer competitive advantage (Teece and Pisano 1994) Capability

						 **Competence**: defined in the Concise Oxford dictionary as "ability (to do; for a task)", implies the presence of knowledge, both know-how and information, and the input resources on which the knowledge may act. Generally, organized clusters of various know-hows act on the basic input resources in the firm. Competencies are collections of the three levels of knowledge. An important feature of competencies is their ***potential to exhibit institutional qualities*** (cf. Leonard-Barton 1992). Competencies tend to ***have histories***: competencies seldom form overnight, rather they accumulate various underlying resources and behaviors through a gradual, "interweaving" process.
Foss, NJ	Knowledge-based approaches to the theory of the firm: Some critical comments	Organization science	Article	1996	It is argued that Kogut and Zander (1992) and Conner (1991) erred in the specific way in which they claimed that a distinct theory of the multi-person firm can be constructed on the basis of a theory of organizational knowledge or from resource-based insights. It is not possible to tell very much of a story about why there should be firms in lieu of notions such as "opportunism" or "moral hazard." However, properly interpreted, knowledge-based theories may help shed light on issues relating to the boundaries and internal organization of the firm.	**Organizational knowledge:** ***Social knowledge:*** the web of contractual the web of contractual incentives that they will invest in accumulating useful social knowledge, and thereby create a "social community of voluntarist action" (Kogut and Zander 1992) ***Tacit knowledge*:** The firm, we have seen, is a repository of specialized and tacit knowledge that is fully efficient in use only within that firm, since it is difficult to take a piece-whatever that would mean of the stock of firm-specific tacit and social knowledge out of the firm and successfully apply it in a different firm. **This is more or less what Marshall (1925, 271) meant when he talked about "the industrial district," in which "the mysteries of the trade become no mysteries; but are as it were in the air." The paradigmatic modern example of co-specialized knowledge streams emerging across market interfaces would be firm-networks in Silicon Valley.*

Spender, JC	Making knowledge the basis of a dynamic theory of the firm	Strategic management journal	Review	1996	Knowledge is too problematic a concept to make the task of building a dynamic knowledge-based theory of the firm easy. We must also distinguish the theory from the resource-based and evolutionary views. The paper begins with a multitype epistemology which admits both the pre- and subconscious modes of human knowing and, reframing the concept of the cognizing individual, the collective knowledge of social groups. While both Nelson and Winter, and Nonaka and Takeuchi, successfully sketch theories of the dynamic interactions of these types of organizational knowledge, neither indicates how they are to be contained. Callon and Latour suggest knowledge itself is dynamic and contained within actor networks, so moving us from knowledge as a resource toward knowledge as a process. To simplify this approach, we revisit sociotechnical systems theory, adopt three heuristics from the social constructionist literature, and make a distinction between the systemic and component attributes of the actor network. The result is a very different mode of theorizing, less an objective statement about the nature of firms 'out there' than a tool to help managers discover their place in the firm as a dynamic knowledge-based activity system.	**Organizational Knowledge**: ***Sharable*** (Nonaka e Takeuchi, 1995:62, 239): organizational knowledge is the knowledge shared by individuals, albeit transformed and amplified. Organizations learn and have knowledge only to the extent that their members are malleable beings whose sense of self is **influenced by the organization's evolving social identity**. The **social types of knowledge** are either publicly available or collective and **embedded in the firm's routines, norms and culture**. Since the latter are **generated internally** and remain "of the firm". **Individual knowledge:** **[*Transferable*]** Much of their tacit knowledge can be **associated with their social or collective identity.** **Knowledge based on experience**: when we get data (empirism). **Knowledge based on the exercise of reason**: when we analyze it in a logically rigorous manner (rationalism). **Knowledge about** (James, 950:1221): the result of the systematic thought that eliminates the subjective and contextual contingencies of experience and extracts the principles that lie behind the 'knowledge of acquaintance'. **Knowledge of acquaintance** (James, 1950): experience provides immediate 'knowledge of acquaintance'. **Explicit knowledge** (Polanyi, 1962:1967): is like 'knowledge about'. Explicit **objectified** knowledge, whether that be science or established standards and practices. **Tacit knowledge** (Polanyi, 1962:1967): associated with experience. **Cultural knowledge**: habitual use of a routine embeds it in the 'taken-for-granted' cultural knowledge of the firm (Nelson e Winter).

						<table><tr><td></td><td>*Individual*</td><td>*Social*</td></tr><tr><td>*Explicit*</td><td>Conscious</td><td>Objectified</td></tr><tr><td>*Implicit*</td><td>Automatic</td><td>Collective</td></tr></table>
Spender, JC; Grant, RM	Knowledge and the firm: Overview	Strategic management journal	Editorial material	1996	The explosion of interest in knowledge and its management reflects the trend towards 'knowledge work' and the information Age, and recognition of knowledge as the principal source of economic rent. The papers in this Special Issue represent an attempt by strategy scholars (and some outside our traditional field) to come to terms with the implications of knowledge for the theory of the firm and its management. They are the product of a convergence of several streams of research which have addressed management implications of knowledge, including the management of technology, the economics of innovation and information, resource-based theory, and organizational learning. At the theoretical level, knowledge-centered approaches of Penrose, Arrow, Hayek and others have been enriched by contributions from evolutionary economists (notably Nelson and Winter) and epistemologists (notably M. Polanyi). At the empirical level, research into innovation and its diffusion originated by Mansfield, Griliches and others has been extended through studies which investigate tacit as well as explicit knowledge, and explore knowledge transfer within as well as across firms.	**[Tacit] Knowledge:** is embodied in individual and organizational practices and ***cannot be articulated*** (Polanyi, Nelson and Winter). Such knowledge is of critical strategic importance because, unlike explicit knowledge, it is both ***inimitable*** and ***appropriable***.

Blackler, F	Knowledge, knowledge work and organizations: An overview and interpretation	Organization studies	Article	1995	There is current interest in the competitive advantage that knowledge may provide for organizations and in the significance of knowledge workers, organizational competencies and knowledge-intensive firms. Yet the concept of knowledge is complex and its relevance to organization theory has been insufficiently developed. The paper offers a review and critique of current approaches, and outlines an alternative. First, common images of knowledge in the organizational Literature as embodied, embedded, embrained, encultured and encoded are identified and, to summarize popular writings on knowledge work, a typology of organizations and knowledge types is constructed. However, traditional assumptions about knowledge, upon which most current speculation about organizational knowledge is based, offer a compartmentalized and static approach to the subject. Drawing from recent studies of the impact of new technologies and from debates in philosophy, linguistics, social theory and cognitive science, the second part of the paper introduces an alternative. Knowledge (or, more appropriately, knowing) is analyzed as an active process that is mediated, situated, provisional, pragmatic and contested. Rather than documenting the types of knowledge that capitalism currently demands, the approach suggests that attention should be focused on the (culturally located) systems through which people achieve their knowledge, on the changes that are occurring within such systems, and on the processes through which new knowledge may be generated.	Knowledge types suggested by Collins (1993): **Embrained knowledge**: is knowledge that is dependent on conceptual skills and cognitive abilities. **Embodied knowledge**: is action oriented and is likely to be only partly explicit. Zuboff (1988) says, depends on peoples' physical presence, on sentient and sensory information, physical cues and face-to-face discussions, is acquired by doing, and is ***rooted in specific contexts*** (for example, artisans' ability). Zuboff's studies, for example, document in detail how action oriented skills (embodied knowledge) are being displaced by computer technologies (encoded knowledge). **Encultured knowledge**: refers to the process of achieving shared understandings. Cultural meaning systems are intimately related to the processes of socialization and acculturation; such understandings are likely to ***depend heavily on language, and hence to be socially constructed*** and open to negotiation. **Embedded knowledge**: is knowledge which resides in systemic routines. ***Analyzable*** in systems terms, in the relationships between, for example, technologies, roles, formal procedures, and emergent routines. (Badaracco, 1991). ***Difficult to duplicate*** (Reich, 1991): The skills of what Reich calls 'symbolic analytic' workers are varied. They command high rewards, he believes, because they are difficult to duplicate. Such skills include problem solving (research, product design, fabrication), problem identification (marketing, advertising, customer consulting), and brokerage (financing, searching, contracting). **Encoded knowledge**: is information conveyed by signs and symbols. The new media of encoded knowledge not only affect embodied knowledge, but may also affect the nature and significance of embrained knowledge (as information becomes ever more accessible and expert computer systems are developed), encultured knowledge (as new communication systems are introduced to support group working between individuals who are separated in time and space), and embedded knowledge (through, for example, the development of integrated manufacturing systems). ***Highly selective***: Zuboff (1988) says that information encoded by decontextualized, abstract symbols is inevitably highly selective in the representations it can convey.

						Knowledge applied to tools, processes and products: in the terminology introduced above, this involved the development of new approaches to the study of embodied knowledge, (i.e., craft skills, supported by the granting of patents to inventors and entrepreneurs) (Drucker, 1993). **knowledge applied to human work**: in the terminology used above this involved the systematic development of systems of embedded knowledge (Ducker, 1993). **Know-how** (Sveiby e Lloyd, 1987): Defining knowhow as ’value added information’ they suggested that ’know-how companies’ provide a non-standard, creative, problem-solving service. To be successful, know-how companies must, Sveiby and Lloyd suggested, be high on what they called professional skills, yet in itself this would be insufficient. The new breed of know-how organizations also needs a high level of ’managerial skills’.

Nonaka, I	A dynamic theory of organizational knowledge creation	Organization science	Article	1994	This paper proposes a paradigm for managing the dynamic aspects of organizational knowledge creating processes. Its central theme is that organizational knowledge is created through a continuous dialogue between tacit and explicit knowledge. The nature of this dialogue is examined and four patterns of interaction involving tacit and explicit knowledge are identified. It is argued that while new knowledge is developed by individuals, organizations play a critical role in articulating and amplifying that knowledge. A theoretical framework is developed which provides an analytical perspective on the constituent dimensions of knowledge creation. This framework is then applied in two operational models for facilitating the dynamic creation of appropriate organizational knowledge.	**Tacit** (Polanyi): has a personal quality, which makes it hard to formalize and communicate. Tacit knowledge is deeply rooted in action, commitment, and involvement in a specific context. Tacit knowledge is a continuous activity of knowing and embodies what Bateson (1973) has referred to as an "analogue" quality. In this context, communication between individuals may be seen as an analogue process that aims to share tacit knowledge to build mutual understanding. ***Cognitive:*** the cognitive elements center on what Johnson-Laird (1983) called "mental models" in which human beings form working models of the world by creating and manipulating analogies in their minds. These working models include schemata, paradigms, beliefs, and viewpoints that provide "perspectives" that help individuals to perceive and define their world. ***Technical*****:** covers concrete know-how, crafts, and skills that apply to specific contexts. ***Procedural*** (Anderson,1983): is used in such activities as remembering how to ride a bicycle or play the piano. **Experience:** the key to acquiring tacit knowledge is experience. **Explicit** (Polanyi)**:** refers to knowledge that is transmittable in formal, systematic language. It is captured in records of the past such as libraries, archives, and databases and is assessed on a sequential basis. ***Discrete*****:** Explicit Knowledge is captured in records in the past such as libraries or archives. ***Digital*****:** Explicit Knowledge is captured in records in the past such as databases. ***Declarative*** (Anderson,1983): is expressed in the form of proposition. **Knowledge of experience:** is an embodiment of knowledge through a deep personal commitment into bodily experience. **Knowledge of rationality:** it is a rational ability to reflect on experience. **Crystalled:** the knowledge created in an interactive field by members of a self-organizing team has to be crystallized into some concrete "form" such as a product or a system. Because the instrumental skill, a part of tacit knowledge, is exploited in this process, a new process of knowledge creation is triggered by crystallization.

Lyles, MA; Schwenk, CR	Top management, strategy and organizational knowledge structures	Journal of management studies	Article	1992	The cognitive aspects of strategic management and organizational learning have been receiving increasing interest from researchers (Fahey and Narayanan, 1986; Prahalad and Bettis, 1986). Researchers have called for more detailed descriptions of the ways that individual-level cognitions contribute to organizational-level strategies (Daft and Weick, 1984; Smircich and Stubbart, 1985). In this article, a theory of organizational knowledge structures which include core and peripheral features is presented. From this theory propositions are suggested to guide future research on organizational learning.	**Organizational knowledge:** described as a general knowledge structure that can store a shared dominant general management logic. **Individual-level knowledge.** **Organizational knowledge:** ***encoding, storage, elaboration, forgetting, retrieval, modelling, modification of structures, adding new structures, and complexity of structures*** (Daft and Weick, 1984; Gioia and Manz, 1985; Lord and Foti, 1986) **Organizational knowledge structure**. It consists of the beliefs on which there is the most consensus among organizational members. ***The peripheral knowledge*** structure seems to contain knowledge about sub goals **(**e.g. business-level goals or ends) and about behaviors appropriate for achieving them. ***Complexity:*** we mean the degree to which cognitive units are interrelated, creating a complex internal structure/'large knowledge structures must be encoded hierarchically, with smaller cognitive units embedded in larger ones. ***Relatedness:*** represents the interrelationships between the core knowledge structure and the peripheral set.
Sackmann, SA	Culture and subcultures - an analysis of organizational knowledge	Administrative science quarterly	Article	1992	This study investigated the potential existence and formation of subcultures in organizations, using an inductive research methodology to study the extent to which four different types of knowledge were shared by organization members. Fifty-two interviews were conducted in three different divisions of the same firm. These were content-analyzed and compared with data obtained from observations and written documents. A number of cultural subgroupings were found to exist in regard to two kinds of cultural knowledge, while an organization-wide cultural overlay was identified for a different kind of cultural knowledge. The implications for the concept of culture in organizational settings and future research on this topic are discussed.	**Cultural knowledge** ***Dictionary knowledge:*** comprises commonly held descriptions, including labels and sets of words or definitions that are used in a particular organization. ***Directory knowledge*****:** refers to commonly held practices knowledge about chains of events and about their cause-and-effect relationships. ***Is descriptive rather than evaluative.*** ***Recipe knowledge*** based on judgments, refers to prescriptions for repair and improvement strategies. It expresses "shoulds" and recommends certain actions, how a particular problem should be solved or what a person should do to be promoted. contains prescriptive recipes for survival and success, is closely related to norms, and is similar to Argyris and Schon's espoused theory. ***Axiomatic knowledge*** refers to reasons and explanations of the final causes perceived to underlie a particular event. Axiomatic knowledge is about the "why".

Kogut, B; Zander, U	Knowledge of the firm, combinative capabilities, and the replication of technology	Organization science	Article	1992	How should we understand why firms exist? A prevailing view has been that they serve to keep in check the transaction costs arising from the self-interested motivations of individuals. We develop in this article the argument that what firms do better than markets is the sharing and transfer of the knowledge of individuals and groups within an organization. This knowledge consists of information (e.g., who knows what) and of know-how (e.g., how to organize a research team). What is central to our argument is that knowledge is held by individuals, but is also expressed in regularities by which members cooperate in a social community (i.e., group, organization, or network). If knowledge is only held at the individual level, then firms could change simply by employee turnover. Because we know that hiring new workers is not equivalent to changing the skills of a firm, an analysis of what firms can do must understand knowledge as embedded in the organizing principles by which people cooperate within organizations. Based on this discussion, a paradox is identified: efforts by a firm to grow by the replication of its technology enhances the potential for imitation. By considering how firms can deter imitation by innovation, we develop a more dynamic view of how firms create new knowledge. We build up this dynamic perspective by suggesting that firms learn new skills by recombining their current capabilities. Because new ways of cooperating cannot be easily acquired, growth occurs by building on the social relationships that currently exist in a firm. What a firm has done before tends to predict what it can do in the future. In this sense, the cumulative knowledge of the firm provides options to expand in new but uncertain markets in the future. We discuss at length the example of the make/buy decision and propose several testable hypotheses regarding the boundaries of the firm, without appealing to the notion of opportunism.	**Knowledge of the firm** ***Observable:*** operating rules, manufacturing technologies, and customer data banks are tangible representations of this knowledge. **Information** ("knowing what something means"): knowledge which can be transmitted without loss of integrity once the syntactical rules required for deciphering it are known. Information includes facts, axiomatic propositions, and symbols. ***Standardized:*** in order to be understood at minimal cost to those with the requisite training. ***Proprietary:*** Firms maintain accounting data for external use and for managerial decisions and evaluation. ***Competitive:*** for example, the value of information to traders of financial securities or the data acquired by grocery stores on consumer expenditures. **Know-how** ("knowing how to do something"): is the accumulated practical skill or expertise that allows one to do something smoothly and efficiently" (von Hippel 1988). ***Accumulated:*** know-how must be learned and acquired. **Declarative**: consists of a statement that provides a state description (ex. inventory is equal to a 100 books). **Procedural**: consists of statements that describe a process (ex. a method by which inventory is minimized). **Codifiability:** refers to the ability of the firm to structure knowledge into a set of identifiable rules and relationships that can be easily communicated. ***Alienable*** from the individual who wrote the code. **Complexity:** From a computer science perspective, it can be defined as the number of operations (or CPU time) required to solve a task.

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