



HAL
open science

Manufacturing knowledge management strategy

Duncan Shaw, John Edwards

► **To cite this version:**

Duncan Shaw, John Edwards. Manufacturing knowledge management strategy. International Journal of Production Research, 2006, 44 (10), pp.1905-1922. 10.1080/00207540500431339 . hal-00512875

HAL Id: hal-00512875

<https://hal.science/hal-00512875>

Submitted on 1 Sep 2010

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

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



Manufacturing knowledge management strategy

Journal:	<i>International Journal of Production Research</i>
Manuscript ID:	TPRS-2005-IJPR-0232
Manuscript Type:	Original Manuscript
Date Submitted by the Author:	15-Aug-2005
Complete List of Authors:	Shaw, Duncan; Aston Business School, OIM Edwards, John
Keywords:	MANUFACTURING STRATEGY, OPERATIONS STRATEGY
Keywords (user):	Knowledge management



1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

Manufacturing knowledge management strategy

Duncan Shaw*§

John S. Edwards

email: d.a.shaw@aston.ac.uk

email : j.s.edwards@aston.ac.uk

Aston Business School,
Aston University,
Birmingham,
B4 7ET,
U.K.

Tel : +44 (0)121 204 3231

Fax: +44 (0)121 204 5271

*§ corresponding author

Manufacturing knowledge management strategy

Abstract: The study sought to understand the components of knowledge management strategy from the perspective of staff in UK manufacturing organisations. To analyse this topic we took an empirical approach and collaborated with two manufacturing organisations. Our main finding centres on the key components of a knowledge management strategy, and the relationships between it and manufacturing strategy and corporate strategy. Other findings include: the nature of knowledge in manufacturing organisations; the relevance of (in)formal processes; top-down and bottom-up communication; taking ownership for information processes. We also make comments on the development of action plans for better knowledge management. The implications are that, for an integrated approach to knowledge management strategy in manufacturing organisations, involvement across the organisation and at all levels is necessary.

Keywords: Manufacturing strategy, operations, knowledge management, knowledge management strategy.

Manufacturing knowledge management strategy

1. Introduction

The focus of the research reported here is on knowledge management strategy. We explore what issues are important to representatives from two manufacturing organisations when designing action plans for better knowledge management in their organisation. One intention of the research was to establish what knowledge the representatives thought might benefit from being managed. Another was to examine how knowledge management strategy links to other aspects of strategy. The manufacturing literature (Hill 1987, Misterek *et al.* 1992) typically distinguishes between manufacturing strategy and corporate strategy. This distinction makes it easier to discuss the relationship to knowledge management strategy than for non-manufacturing organisations. Hence this paper concentrates on the two manufacturing organisations out of a larger group that were originally studied.

The gap in the literature which this paper addresses is illustrated by Bhatt (2000) who observes “a few studies have addressed knowledge strategies briefly, but these studies, at best, can be described as personal viewpoints and opinions as they lack theoretical rigor and practical applications”. This paper concentrates on practice, but aims to shed light on relevant theory. We provide insight from the developers and implementers of strategy as to the content of, and rationale behind, their knowledge management strategy. This strategy needed to encompass the delivery of different types of knowledge (formal or informal) in different formats (e.g. written, oral, electronic), involving different influences to support their owners’ co-operation. It also needed to address operations, manufacturing strategy and corporate strategy.

1
2
3
4
5
6
7 There are many ways of looking at knowledge management in abstract. This paper
8
9 adopts a process viewpoint. The term “process” is often used in two different ways in
10
11 the manufacturing strategy literature. One is for “a pattern or procedure in which
12
13 manufacturing strategy is developed and implemented” (Minor *et al.* 1994), by contrast
14
15 with the content of that strategy. The other is the process of manufacturing the product
16
17 itself. The process viewpoint adopted here embraces both of these meanings, and goes
18
19 further, to cover all the business processes in the organisation.
20
21
22
23
24
25

26 The theory of business processes distinguishes between core, support and management
27
28 processes (Earl 1994). The *core processes* are defined as the ones that make the
29
30 organisation what it is; the ones performed directly for the external customers whom the
31
32 organisation exists to serve. For a manufacturing organisation, the manufacturing
33
34 process – often called manufacturing operations – will certainly be one of the core
35
36 processes. *Support processes* are typically for internal customers, and often
37
38 “administrative” in nature. *Management processes*, such as strategy and planning, direct
39
40 and underpin the core and support processes. Thus the manufacturing strategy process
41
42 as defined by Minor *et al* is the management process that corresponds to the core
43
44 manufacturing process. This view is now becoming part of mainstream management
45
46 thinking. For example, the latest version of the ISO9000 family of standards for Quality
47
48 Management Systems also takes a process viewpoint, the ISO9000 term *realisation*
49
50 *process* being equivalent to Earl’s core process.
51
52
53
54
55
56
57
58
59
60

1
2
3
4 Assuming that the knowledge in an organisation is linked to its business processes, it
5 should to be helpful to make a similar distinction about the knowledge requirements
6
7 (see Edwards and Kidd (2003a) for a further discussion). By definition, core processes
8
9 need to be done as well as possible, since they actually produce the outputs for the
10
11 external customer. Any improvement in, or addition to the organisation's *core*
12
13 *knowledge* – the knowledge needed to perform the core processes – should therefore
14
15 produce a corresponding improvement in the organisation's overall performance. By
16
17 contrast, support processes only need to be done "well enough". Thus beyond a certain
18
19 point, improvements in or additions to the organisation's *support knowledge* will have
20
21 little or no effect. The importance of *management knowledge* will correspondingly
22
23 depend on whether it relates to the management of a core or support process.
24
25
26
27
28
29
30
31
32

33 The structure of the paper is as follows. We first position our work within the literature
34
35 on managing knowledge in manufacturing organisations. Next, we describe our research
36
37 approach, concentrating on the use of small group workshops for data capture. Then we
38
39 present the findings from two organisations and, finally, we discuss the transferable
40
41 results from this study.
42
43
44
45
46

47 **2. Categorising knowledge in manufacturing organisations**

48
49 The manufacturing strategy literature provides a useful foundation for categorising
50
51 knowledge in manufacturing organisations. Misterek et al (1992) clearly distinguish
52
53 manufacturing strategy from corporate strategy, the latter covering marketing and
54
55 finance, amongst other topics. Hayes and Wheelwright (1984) identified four stages of
56
57 progression in manufacturing strategy, from internally neutral to externally supportive,
58
59
60

1
2
3
4 during which the relationship between manufacturing strategy and corporate strategy
5 changes. Hill (1987) divided manufacturing strategy into two components, structure and
6
7 infrastructure. Structure covers process and technology – the design, development and
8
9 implementation of manufacturing strategy. Infrastructure refers to longer term aspects –
10
11 human resource policies, quality systems, organisational culture, IT. The infrastructure
12
13 supports the structure.
14
15
16
17

18
19
20
21 Combining these aspects, a suitable set of top level categories for the content of the
22
23 knowledge in a manufacturing organisation seems to be: manufacturing operations,
24
25 manufacturing strategy (subdivided into structure and infrastructure), and corporate
26
27 strategy.
28
29

30
31
32
33 Other ‘dimensions’ that will also be used in the later discussion are the division between
34
35 core and support processes explained earlier, and also the difference between formal
36
37 and informal mechanisms. An important linkage between the different dimensions is
38
39 that whilst the “structure” part of manufacturing strategy is by definition almost entirely
40
41 formal, a crucial informal mechanism, organisational culture, is part of Hill’s
42
43 infrastructure.
44
45
46
47
48

49 **3. Managing knowledge in manufacturing organisations**

50
51
52 There is a wealth of research which explains how manufacturing organisations can
53
54 improve knowledge management. Applied research on the management of knowledge
55
56 in manufacturing organisations has explored the link between knowledge management
57
58 and: organisational performance (Germain *et al.* 2001); information technology (Beckett
59
60

1
2
3
4 *et al.* 2000, Prasad 2000, Leseure and Brookes 2001); competitiveness (Paiva *et al.*
5
6 2002); the transfer of best practice (Collinson 1999); inter-organisational networking
7
8 (Robertson *et al.* 1996, Chaston and Mangles 2000); organisational learning (Mohanty
9
10 and Deshmukh 1999, Chaston *et al.* 2001, Ordonez de Pablos 2002, Robinson *et al.*
11
12 2003).

13
14
15
16
17
18 However, from the above list only two papers are closely related with our work: those
19
20 of Collinson (1999) and Mohanty and Deshmukh (1999). Collinson examined the
21
22 transfer of best practice between two manufacturing organisations – the aim of the
23
24 companies was to improve their manufacturing processes. He describes the changes to
25
26 working practices made in the recipient company. These include: process control;
27
28 quality monitoring; process enhancement groups; cross-functional working; improved
29
30 communication; a customer focus. These changes contributed to improvements in
31
32 defects rate and yield. As may be seen, these covered both the core manufacturing
33
34 process and its related management process. While his study has important similarities
35
36 with ours (we are all interested in improving manufacturing processes), his study differs
37
38 from ours in many ways, most importantly that his focus was the transfer of best
39
40 practice between two companies. Our focus is the development of knowledge
41
42 management strategy by the staff in two companies, where often they had no best
43
44 practice to transfer and they have to generate practice from new.
45
46
47
48
49
50
51
52
53

54 Mohanty and Deshmukh (1999) evaluate manufacturing strategy for the selection and
55
56 evaluation of advanced manufacturing technology, their focus being organisation
57
58 learning. They suggest a “group-based participatory evaluation process ... to provide a
59
60

1
2
3
4 prioritised list of strategic initiatives”, page 314-5. They use group decision support
5
6 approaches to facilitate the evaluation of strategic alternatives by a group of decision-
7
8 makers. Their study differs from ours in that their focus is on the evaluation of strategic
9
10 alternatives for manufacturing strategy, while ours is on the design and negotiation of
11
12 strategic action plans for knowledge management strategy.
13
14

15
16
17
18 The paper by Mohanty and Deshmukh (1999) also helps to confirm the suitability of
19
20 group working for exploring aspects of strategy in manufacturing organisations. Perhaps
21
22 the most widely-known example of this kind is the work of Platts and Gregory (1992).
23
24 They devised a process for developing manufacturing strategy, several of whose stages
25
26 rely heavily on facilitated participative workshops. Nevertheless, we are not aware of
27
28 any previous work on knowledge management strategy in manufacturing organisations
29
30 that has taken a workshop approach.
31
32
33

34
35
36
37 We will now introduce our research methodology, including the knowledge
38
39 management workshops, in preparation for reviewing their results.
40
41
42

43 44 45 **4. Research methodology**

46
47 The overall research methodology used in this study was as set out below. Note that the
48
49 term “client” refers to the main contact in that organisation. For each organisation, the
50
51 steps proceeded as follows:
52

- 53
54 - Design and agreement of workshop agenda to address the organisation’s concerns
55
56 (with the client and then the participants).
- 57
58 - The workshop.
59
60

- Oral de-briefing of client.
- Post-workshop data analysis (of maps, exit questionnaires, researcher observations).
- Written report to client and participants.
- Client/participant feedback on report.
- Identification of generic and specific themes.

5. Workshop format

Both workshops were an entire day in length for a single organisation. We will refer to the two organisations as “HighTechManuf” and “ManufIndProd” to preserve their anonymity. We suggested there should be 6-10 organisational members in the workshop: too few participants, and the range of views represented would be narrow; too many participants, and the group dynamics become more complex for the facilitator. In the event, 7 attended from HighTechManuf and 10 from ManufIndProd.

The workshops were conducted according to an approach named Journey Making (Eden and Ackermann 1998). To build commitment to an action plan, *JOURNEY* Making suggests that key stakeholders should share and *JOintly Understand* each others' views during a group workshop. They should *Reflect* on the diverse nature of those views and *NEgotiate a strategY* which all the stakeholders want (in our case) to improve knowledge management.

The workshops used a facilitated computer-supported group decision support system. Pairs of participants shared a laptop computer which was running a brainstorming software package and was networked to the facilitator's computer. To share their views

1
2
3
4 on knowledge management in their organisation, participants typed them into their
5 laptop (using only a few words to indicate the view – so views could be understandable
6 to others). The view would be transmitted to the facilitator’s computer which was linked
7 to a projector. There the facilitator loosely clustered the views by content to position
8 similar views beside one another and thereby help the participants to absorb the views.
9 After participants finished sharing all their views, all the clusters were projected onto a
10 screen in map form (see Figures 1 and 2). Participants then read the map of clusters and
11 shared more views as they were stimulated by what they read. This would normally
12 result in a total of up to 100 different views being displayed.
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27

28 To more fully understand the relationships between the views, group discussion around
29 the clusters would ensue. To graphically represent a relationship on the map, a link
30 would be inserted between appropriate views in the form of an arrow, for example,
31 knowledge of “customer’s own experiences” provides “customer feedback” of “what
32 the customer wants” (in the top right of Figure 2). The participants, as a group, could
33 then amend or move the views and the clusters. As well as linking and clustering views,
34 everything else about the entire map could be amended until the participants were
35 agreed that it represented their position on the issues.
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54

55 The advantages of computer support in this context include speed, anonymity, creativity
56 and accuracy. They are discussed in detail in Shaw (2003).
57
58
59
60

5.1 A flexible agenda for the workshops

It is generally accepted that knowledge management must vary between organisations.
This implies that the participants must design their own agenda. However, as the

1
2
3
4 organisations were relatively new to knowledge management, a starting-point was
5
6 needed. We therefore initially suggested the following four sessions:
7
8

- 9 • Session 1: “What knowledge informs our business?”
- 10
- 11 • Session 2: “What knowledge management processes currently exist in our
12 organisation?”
- 13
- 14 • Session 3: “What knowledge management processes should exist in our
15 organisation?”
- 16
- 17 • Session 4: “How do we (or should we) evaluate how good these processes
18 actually are?”
- 19
- 20
- 21
- 22
- 23
- 24
- 25

26 In both workshops the groups partially followed this agenda (through Sessions 1 and 2),
27 and then decided to design their own sessions before returning to this agenda (as
28 discussed below). Each session produces at least one map, but to save space we have
29 included only one map from Session 1 of each workshop.
30
31
32
33
34

35 36 37 38 **6. The organisations and the findings**

39 40 **6.1 HighTechManuf**

41 HighTechManuf is a high technology manufacturing group, privately owned with
42 £100M turnover and 800 employees. It had recently been formed through a merger of
43 four constituent companies, two of which had been competitors. There had been little
44 pursuit of knowledge management previously, but this was now seen as important to
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
*“start acting like a large company as now we cannot act like a small informal
company”*. The client (who was tasked with improving the organisation’s processes)
saw that improving knowledge management practices was an important move – to get
knowledge flowing between the former constituent companies.

1
2
3
4
5
6
7 Most of the 7 workshop participants were engineers by background. The participants
8 thought that knowledge management was important to HighTechManuf, evident
9 through their agreement with the statement on their exit questionnaire that “I think that
10 knowledge management is an important issue in HighTechManuf” (average 1.57, where
11 1 = Strongly Agree and 5= Strongly Disagree).
12
13
14
15
16
17

18
19
20 The first session asked “What knowledge informs HighTechManuf?” and produced the
21 map shown in Figure 1. The participants identified 11 clusters, ranging from “R & D” to
22 “customer requirements”. Note that we have retained the exact terms used by the
23 participants, even when they include errors of spelling or grammar, as with the cluster
24 named “metallurgically capability”.
25
26
27
28
29
30
31
32
33
34

35 {Take in Figure 1: “A map from the HighTechManuf workshop”}
36
37
38
39

40 There was also discussion about the currency of knowledge, around the statement “*if it*
41 *is not owned and updated, is it of any value*”. It was agreed that ideally all knowledge
42 and information should be up-to-date, and that processes based on ownership should be
43 implemented to ensure this.
44
45
46
47
48
49
50

51 Reflecting on the range of knowledge contained in the group map, one participant
52 questioned: “*what knowledge are we not aware that are we missing? How do we find*
53 *out?*” This was an example of the general issue of being able to ‘know what you don’t
54 know’.
55
56
57
58
59
60

1
2
3
4
5
6
7 The second session asked “What processes are used to acquire, share, retain and utilize
8 knowledge?” Post-workshop, these processes were analysed on a 2x3 matrix to identify
9 which were formal or informal and which were oral or written or electronic. A
10 quantitative analysis is provided in Table 1. Nearly half of the existing processes within
11 HighTechManuf were formal, written processes (for example, standard operations
12 sheets, key performance indicators, reports and guidelines, quality records and
13 drawings). Moreover, the participants thought that improving these written, formal
14 processes was one of the best ways to improve their practice of knowledge management
15 (participants wanted to improve 33 of the 51 processes currently used). Formal, oral
16 processes were also felt to be a useful way of sharing knowledge, for example, weekly
17 communication meetings. However, there was a significant amount of frustration in the
18 participants about having too many meetings. This was seen as a barrier to knowledge
19 management (due to information overload). Electronic formal processes included shared
20 files on computer, databases and a single point of access to information.
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41

42 {Take in Table 1 “The types of knowledge to be managed”}
43
44
45
46

47 In contrast there was felt to be a lack of informal, oral processes, and there was much
48 debate about depending on “random bumpings” between people as a means of
49 knowledge management. Comments included:
50
51
52

53 *“They’re not working if they’re stood around the coffee machine”, a reply to*
54 *which was “we don’t even have a coffee machine”. However, one participant*
55 *commented “I think we should encourage it – in a formal meeting you do not*
56
57
58
59
60

1
2
3
4 *say what you might informally*” while another observed that *“It’s not a process*
5
6 *you can formalise”*
7
8

9 Electronic informal processes were largely about “random email” and bulletin boards.
10
11 Experiential processes included on the job training and apprenticeship. Other processes
12
13 included using industry experts and consultants, competitor analysis via tradeshows.
14
15

16
17
18 After a vote, participants decided to depart from the original agenda, and concentrate on
19
20 improving three specific aspects of knowledge management: the use of standard
21
22 operating sheets; social networks; meetings.
23
24
25

26
27
28 The third session therefore asked the question “How do you get the information into
29
30 standard operating sheets?” but the focus was wider, covering the motivation for sharing
31
32 information and the use of standard operating sheets (SOPs). The group focussed on
33
34 four issues. First “enablers” were identified, including: developing a common language
35
36 across the three units; creating a generic methodology for their development; identifying
37
38 skills which the company might be at risk of losing.
39
40
41

42
43
44 Second, methods for “capturing key information” were discussed, including:
45
46 confiscating personal black books which cannot be shared; breaking up the jobs into
47
48 small elements and agreeing and documenting in a consistent way the best (and worst)
49
50 ways of doing those; using visual representations (photos, drawings etc) or video in
51
52 addition to the written word. However, one participant said *“there are things we do not*
53
54 *have a best practice on {to put into a SOP}, because we do not know how to do them*
55
56 *yet.”*
57
58
59
60

1
2
3
4
5
6
7 Third, participants discussed how they would provide support and encourage workers to
8 put information into SOPs: asking “what’s in it for me?” Methods included: aligning
9 reward and recognition incentives to knowledge sharing; training; linking standardised
10 work to skills matrix and educating workers as to the benefits of standardised
11 procedures, including Team Leaders; appointing champions.
12
13
14
15
16
17
18
19
20

21 Fourth, evaluation of the SOPs was discussed. This included: monitoring rework/scrap
22 of re-engineered processes; audits, evaluate and modify operations and SOPs; address
23 recurring non-conformance; create a database of SOPs which is updated. Overall,
24 changing the design and use of SOPs was considered to require a change in process, as
25 well as (and probably more difficult) a change in the perspective of the workers in terms
26 of their attitude towards SOPs and how dedicated they were to successfully
27 implementing them.
28
29
30
31
32
33
34
35
36
37
38
39

40 The fourth session considered the importance of social and professional networks in the
41 knowledge management strategy of HighTechManuf. The discussion did not get much
42 beyond identifying the enablers, which included: gaining executive sponsorship;
43 providing a budget; rewarding the achievements of networks. Discussion also
44 considered the type of activities – brainstorming events, newsletters, special interest
45 groups, social events, guest speakers, team rivalry dimension, off-site events. One
46 participant noted that there might be *“more of a tangible benefit from an accountant
47 and a purchasing guy talking than two purchasing guys from different divisions.”*
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 In the fifth, and last, session participants discussed the when, and how, of meetings.
5
6 This arose out of a sense of desperation among the participants of being invited to too
7
8 many meetings, which were often unfocussed, too long, and attended by the wrong
9
10 people. It was decided that meetings should be called when: all the necessary
11
12 information is available; multi-disciplinary input or debate is required; it is imperative
13
14 to avoid misunderstanding and to ensure a consistent message is conveyed; more than
15
16 two people are involved. In terms of how meetings should be more effective the group
17
18 decided that meetings should be: planned, with an agenda circulated well in advance;
19
20 chaired effectively; short, sharp and task oriented (with a time limit); able to produce
21
22 minutes and a list of actions within 24 hours.
23
24
25
26
27
28
29

30 **6.2 *ManufIndProd***

31
32
33 ManufIndProd is a privately owned manufacturer of industrial products for engineering
34
35 and construction, formed through a recent management buy-out. There had been an
36
37 informal recognition of the importance of knowledge for years, but only recently had
38
39 the new senior management team begun to formalise the knowledge management
40
41 processes. They accepted a need for cultural change in the longstanding workforce. The
42
43 client (the Managing Director and co-owner of ManufIndProd) outlined the
44
45 organisation's problem as: *where is the knowledge? how can we utilise it? where do we*
46
47 *want to be? how do we get to where we want to be?*
48
49
50
51
52
53

54 The 10 participants represented the range of the hierarchy – from the top management
55
56 team right down to team leaders – however the majority were from the manufacturing
57
58 side of the organisation. The participants agreed that “I think that knowledge
59
60

1
2
3
4 management is an important issue in ManufIndProd” (average 1.70, where 1 = Strongly
5 Agree and 5= Strongly Disagree).
6
7
8
9

10
11 The first question was “What knowledge informs ManufIndProd?” Responses are
12 displayed in Figure 2. Seeing the finished map, one participant reflected “*that looks just*
13 *like the ISO9000 chart*”, quickly responded to by another participant, “*Yes, but it took*
14 *two hours, not 15 weeks*”.
15
16
17
18
19
20
21

22
23 {Take in Figure 2: “A map from the ManufIndProd workshop”}
24
25
26
27

28 The second question was “What processes are used to acquire, share, retain and utilize
29 knowledge?” Post-workshop analysis of the views was performed using the same
30 framework as for HighTechManuf (results in Table 1). In ManufIndProd well over half
31 of the processes were formal, written in nature. Many of these processes were
32 concentrating on manufacturing and technical knowledge, for example: process
33 specifications and sheets; technical reports; quality manual; and vendor rating. Within
34 ManufIndProd there was a strong commitment to using notice-boards for sharing
35 formal, written knowledge and monitoring progress. Also, there was a desire to monitor
36 process control more, again in a formal, written way. Additional examples are available
37 for each category of knowledge as for HighTechManuf, but will not be reproduced here,
38 except to observe that written informal processes included ‘post-it’ notes.
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53

54
55
56 There was some concern over the number of processes they wanted to improve: they
57 thought that 52 out of the 86 processes currently used could be improved. However,
58
59
60

1
2
3
4 they also realised that this desire to improve was a healthy reflection of the desire of the
5
6 organisation to improve its business.
7
8
9

10
11 As with HighTechManuf, participants decided to refocus Session 3 in the original
12 agenda to address “What processes should we be using to improve our process control?”
13
14 This was to lead to a final discussion, “What measures should be used to evaluate the
15
16 improvement in process control?”
17
18
19

20
21
22
23 The third session therefore focussed on improving process control. This improvement
24 was thought possible through improved: use of statistical process control, capability
25 studies and cause and effect diagram; process recording including plan-do-check-act,
26
27 improving the accurate capturing of relevant data; discipline through doing things
28 properly, such as, tooling, labelling, paperwork traceability, planning; training to ensure
29 it is adequate. Also recommendations for improvements covered: work instructions –
30 many of the views were similar to those for how HighTechManuf might improve SOPs;
31 ergonomics, lighting, space utilisation; quality assurance including shelf life control,
32 tighter sampling control, and control of incoming materials.
33
34
35
36
37
38
39
40
41
42
43
44
45
46

47 One participant noted that “*the men will fill in the work study sheet to fit the procedure,*
48 *but that won't be what they {actually} do*”, suggesting that capturing useful data through
49
50 this might be problematic.
51
52
53

54
55
56 The fourth, and final, session asked the question “What measures should be used to
57
58 evaluate the improvement in process control?” Measures included: output from the
59
60

1
2
3
4 statistical process control; improved stock management, including reduced WIP and
5
6 obsolete stock; machine down-time and retooling times increasing utilisation; improved
7
8 productivity, including energy consumption. Other measures pertained to: quality of the
9
10 customer service, service levels and satisfaction; quality of the product in terms of
11
12 number of returns and complaints; meeting due dates for delivery. There were also:
13
14 business benefits of profitability, increased orders and lower running costs; and
15
16 employee benefits of reduced absenteeism and 'smile charts'. In ManufIndProd most of
17
18 these measures were already being done to some degree, but the group felt that they
19
20 could do a lot more on many of them, and that this work could start immediately.
21
22
23
24
25
26
27

28 **7. Discussion**

29 *7.1 The structure of the knowledge maps*

30
31
32
33
34 Figures 1 and 2 represent the knowledge that participants from the two organisations
35
36 thought important. Although their detailed content seems very different, the two maps
37
38 are remarkably similar in structure. HighTechManuf (Figure 1) has a cluster of
39
40 operational knowledge (labelled "manufacturing") on the lower left-hand side. The
41
42 remainder of the left-hand side consists of knowledge related to the structure part of
43
44 manufacturing strategy, with a central cluster ("learning and sharing") of knowledge
45
46 relating to the infrastructure part of manufacturing strategy. The right-hand side of the
47
48 map comprises knowledge relating to corporate strategy. For ManufIndProd (Figure 2)
49
50 the operations knowledge is in a different place (centre right, labelled "manufacturing
51
52 product"). However, it is again surrounded by the knowledge related to the structure
53
54 part of manufacturing strategy, with the infrastructure knowledge at the top on the left
55
56 hand side, and the corporate strategy knowledge along the bottom.
57
58
59
60

1
2
3
4
5
6
7 These stand in sharp contrast to Figure 3, which shows the corresponding map for a
8 non-manufacturing organisation that was involved in the provision of social housing. In
9 this map it is almost impossible to distinguish operational knowledge from strategic
10 knowledge, and this is typical of these maps for non-manufacturing organisations.
11
12
13
14
15
16
17

18 {Take in Figure 3: “A map from the Housing workshop”}
19
20
21
22

23 It should be noted in this discussion that these maps, capturing as they do the opinions
24 expressed during a particular session, are not perfect. The two activities at the top left in
25 Figure 2, “credit rating information” and “customer prospects” are not joined to the rest
26 of the map and clearly misplaced. The same is true of “IT support knowledge” (bottom
27 left). (A principle of the Journey Making approach is that the maps are not normally
28 amended after the workshop.) Nevertheless, the overall similarity between Figures 1
29 and 2 is striking, especially when set against the difference between these and the maps
30 from Session 1 for non-manufacturing organisations.
31
32
33
34
35
36
37
38
39
40
41
42

43 *7.2 The importance of core processes*

44 Looking in slightly more detail, the importance of core processes is apparent. In Figure
45 1 (HighTechManuf), eight of the eleven clusters related entirely to knowledge about
46 core processes and their management, including the whole of the left hand side of the
47 map (manufacturing operations and strategy). The “market knowledge” cluster was also
48 mainly core, with one or two elements of support processes, while the “general
49 management of the business” cluster was mainly about support processes and their
50 management.
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7 ManufIndProd (Figure 2) started with a strong focus on the customer and their
8 requirements. Around 16 clusters were identified, although some of these were just one
9 item, and as already mentioned “customer prospects” and “IT support knowledge”
10 seems to have been ‘orphaned’. Seven of the clusters were entirely knowledge about
11 core processes and their management, covering almost half the map, from the right-hand
12 side. “External sources of technical knowledge” and “internal sources of knowledge”
13 were also mainly about the management of core processes, while “external general
14 knowledge” was mainly management of support processes. The three small clusters
15 (168, 169 and 133) were management of support processes. The remaining three,
16 “business direction”, “people” and “competitor activity” were mainly knowledge about
17 management of support processes, although some of the “People” cluster seemed to
18 relate more specifically to knowledge about the support processes themselves.
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

As Figures 1 and 2 demonstrate, much of the knowledge mentioned by participants was
knowledge about core processes and their management. This was also seen as being the
most important, as the topics discussed in most detail in later sessions showed.
HighTechManuf’s main emphasis was manufacturing operations – on standard
operating sheets (SOPs) for knowledge sharing. ManufIndProd’s was on process control
– a strategic infrastructure aspect with the discussion having strong links to operations
and structure aspects such as product characteristics and design. Management of these
core processes was also discussed at some length in the workshops, including strategies
for encouraging employee ownership of processes. By contrast, support processes
received relatively little attention, except for that of retention of skills. The formal oral

1
2
3
4 processes discussed in HighTechManuf also tended to be support processes. Sales is
5
6 also a support process, although whether ManufIndProd really used the term “sales” to
7
8 mean marketing (which would be core) is not certain.
9
10

11 12 **7.3 Process and culture (perspective) change** 13 14

15 While it may be obvious that the implementation of a knowledge management initiative
16
17 will involve process change in the organisation, it will also require some culture, or
18
19 perspective, change throughout the organisation: the top-down initiative needs to be
20
21 matched with bottom-up commitment and enthusiasm (Edwards and Kidd 2003b). What
22
23 was evident in both cases was the need for a cultural change in the perspective of the
24
25 entire organisation towards knowledge management.
26
27
28
29
30

31
32 The appointment of a knowledge champion (which both had done: in ManufIndProd it
33
34 was the Managing Director) is an acknowledgement of the importance of knowledge
35
36 management from the top of the hierarchy. One of the corresponding
37
38 acknowledgements needed from lower in the hierarchy is the diligent recording of
39
40 process information and knowledge. Both workshops raised concerns that changing the
41
42 way in which paperwork is requested is more than just a change in process; it perhaps
43
44 requires a change in the perspective of the worker about the importance of the process.
45
46 The manufacturing infrastructure needs to support the structure in a very deep sense. A
47
48 significant incident occurred during a break between sessions in the ManufIndProd
49
50 workshop. One of the shop floor workers (a team leader) asked to speak to the
51
52 facilitator. He was not sure about raising some rather controversial issues relating to the
53
54 workforce taking management initiatives seriously. Previously, when the company had
55
56 been part of a much larger organisation run from a ‘remote’ head office, the workers’
57
58
59
60

1
2
3
4 reaction to any new initiative was to carry on regardless, but adapt the paperwork to
5
6 look as if the new system was being operated, as mentioned above. Now, with the new
7
8 management buy-out, at one level the workforce realised that the management
9
10 genuinely wanted change, and genuinely valued the workers' inputs as to what that
11
12 change should be. However, at another level there was still the deep-seated feeling that
13
14 it was all another fad and if they ignored it, it would go away. The team leader found it
15
16 very hard to make this point to the Directors who were present, but was encouraged to
17
18 do so, and this led to valuable progress.
19
20
21
22
23
24

25
26 The following sub-sections pursue other aspects of "top down" and "bottom up"
27
28 commitment.
29
30

31 ***7.4 Management for informal and formal knowledge***

32
33 Results of the type of knowledge to be shared (see Table 1) were consistent for both
34
35 organisations. Comparing these to other, non-manufacturing organisations from the
36
37 original study (which represented a breadth of UK organisations, public and private), we
38
39 found that the manufacturing organisations had a similar balance on the management of
40
41 formal and informal knowledge. This suggests that the task facing manufacturing
42
43 organisations is not dissimilar to that for organisations in other sectors. Also, as for the
44
45 other organisations, the participants' desire to improve the majority of these processes
46
47 suggests a widespread desire for better knowledge management.
48
49
50
51
52

53 ***7.5 Informal oral processes***

54
55 While informal (in particular, oral) knowledge sharing will always happen in
56
57 organisations there was some disagreement in HighTechManuf and ManufIndProd over
58
59
60

1
2
3
4 whether it should be encouraged. Briefly, the opposition to informal knowledge
5 management processes felt that what might be shared is gossip, personal views or
6 rumour which will be mistaken for fact, and that it cannot easily and consistently be
7 shared around the wider organisation if it is not formal. The support for informal
8 knowledge management processes felt that: enhanced personal relationships will make
9 for more effective working; you will share some things in a more relaxed setting that
10 you would not readily share in a meeting; sometimes you can have spontaneously
11 innovative thoughts in a corridor conversation.
12
13
14
15
16
17
18
19
20
21
22
23
24
25

26 Davenport and Prusak (1998) promote the merits of informal knowledge management -
27 they note the importance of the water-cooler as a focus for congregating. However, in
28 Hill's (1987) terms, these difficulties are apparent, because of the confusion of
29 structural and infrastructural aspects that may result.
30
31
32
33
34
35

36 ***7.6 Taking ownership of information processes***

37
38 In both workshops, participants were keen to ensure that information and knowledge
39 stay current through constant up-dating. HighTechManuf thought that this might be
40 encouraged through individuals taking the ownership of processes which produce the
41 information and knowledge. Both the knowledge management and business process
42 literatures would support this. However, Collinson (1999) found approaches for similar
43 types of empowerment to be "difficult, and change will take longer than anticipated"
44 page 355. Again, this is a longer-term, infrastructural measure, when results may be
45 needed in the shorter term.
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 A key element in such a change would be a role for a senior and respected manager as
5
6 champion of knowledge management, actively promoting a collectivistic culture and
7
8 encouraging the free sharing of knowledge and information. Glazer (1998) identifies
9
10 some of the many benefits this can deliver.
11
12

13 14 15 *7.7 Communicating knowledge*

16
17 Participants in both organisations were frustrated with the lack of effective
18
19 communication of knowledge. Complaints included: meetings were unfocussed and too
20
21 long with the wrong people being present; email was abused by people sending
22
23 indiscriminately; briefings were not of the right information. In most cases the solutions
24
25 to these problems were straightforward, yet it was only through confronting the issue in
26
27 a group that commitment to action began to be built. However, as few of these
28
29 mechanisms involved core knowledge, it is possible that participants were
30
31 subconsciously giving these matters a lower priority on their action list.
32
33
34
35
36

37 38 *7.8 Action plans to improve knowledge management*

39
40 Despite the enthusiasm of the participants to make progress in knowledge management
41
42 strategy, there was often an element of frustration and despair at the enormity of the
43
44 task. To focus and co-ordinate the efforts of the organisation we encouraged each to
45
46 develop action plans, including both quick-wins and longer-term actions (Shaw and
47
48 Edwards 2005 (to appear)). Quick-wins were designed to build momentum from
49
50 realising the benefits from knowledge management, and to help build enthusiasm in rest
51
52 of the organisation. Some of these quick-wins included: updating SOPs through tying a
53
54 laminated SOP sheet and a marker pen to each machine so that the operator can update
55
56
57
58
59
60

1
2
3
4 the SOP in line with current operations; issuing a protocol for deciding when a meeting
5 should be called and who should be invited; improving team briefings.
6
7
8
9

10
11 Longer-term actions were those which would need significant resources to realise.
12 These included: the design of training programmes to share process knowledge among
13 the workforce; harnessing the full benefits from statistical process control; synthesising
14 the use of integrated databases to break the “islands of databases” as in
15 HighTechManuf.
16
17
18
19
20
21
22
23

24 ***7.9 Using workshops for manufacturing knowledge management***

25
26
27 Questionnaire responses provide strong support from participants that the workshops
28 were beneficial for their development of knowledge management strategy. Participants
29 agreed: “I enjoyed the workshop” (average 1.65, where 1 = Strongly Agree and 5=
30 Strongly Disagree), “the process was useful in helping us to explore knowledge
31 management” (average 1.88) and agreed that they “had ability to share ideas with group
32 members” (average 1.88). In terms of the action plans which were generated,
33 participants agreed that: “I think that the outcome of the workshop was the right list of
34 things that we need to do” (average 2.31); “I hope that these outcomes will influence
35 what our organisation does on knowledge management.” (average 1.88); “I think that
36 the outcome was generated in an appropriate way” (average 1.88); and “I feel that I
37 have had an impact on the outcome” (average 2.13). All these are factors that are crucial
38 for the participants’ continued support of these actions through to their implementation
39 (Eden and Ackermann 1998).
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4 Group workshops also have the benefit that misunderstandings can be identified and
5
6 queried – for example, the term “rates per hour” was assumed by operational staff to be
7
8 output, yet a member of support staff interpreted it to be pay rate.
9
10

11 12 13 14 15 **7.10 Limitations**

16
17 The most obvious limitations of this study are that it is based on only two organisations,
18
19 and a limited number of participants from each. Concerns were expressed in the
20
21 workshop about biased representation in the group. One ManufIndProd participant
22
23 commented “a broader cross-section of staff may have produced a different set of
24
25 priorities” as no-one from sales was present. In HighTechManuf the group focused on
26
27 the issues which participants felt they could most usefully handle – there was a lack of
28
29 people with responsibility for quality systems in the group, but the group only realised
30
31 this as quality began to be discussed.
32
33
34
35
36
37
38

39 This underlines the importance of the selection of participants, but also that knowledge
40
41 management permeates all functions of the organisation. Any implementable knowledge
42
43 management strategy needs, at minimum, to include a wide range of functions and, we
44
45 believe, to synthesise and be respectful to the competing priorities of these different
46
47 functions.
48
49
50
51
52

53 **8. Conclusions**

54
55 Two manufacturing organisations concentrated on identifying and designing a strategy
56
57 for better knowledge management. Both organisations, although relatively new to
58
59 knowledge management as an explicit activity, found it easy and natural to concentrate
60

1
2
3
4 on their core knowledge, much of it concerning the manufacturing process. These are
5
6 areas where the link to bottom-line results is the clearest. Nevertheless, the knowledge
7
8 maps show that knowledge management strategy cuts across operations, manufacturing
9
10 strategy and corporate strategy. It should not be seen as a subset of either of the latter
11
12 two.
13
14

15
16
17
18 In terms of implementing the knowledge management strategy, both top down and
19
20 bottom up actions were needed. From the top, successful implementation might be
21
22 supported through a knowledge champion promoting a collectivistic culture,
23
24 implementing reward structures appropriate to such a culture, and the influence of line
25
26 management in reinforcing this. The latter applies especially to informal methods of
27
28 sharing knowledge. These may be effective, but some managers find it hard to allow
29
30 them to take place. From the bottom up, the workforce needs to take ownership of
31
32 processes, and to make sure that descriptions of the process remain in step with what
33
34 actually happens. Training was viewed as an important means of sharing and retaining
35
36 knowledge, but can only work if what is recorded matches what is done.
37
38
39
40
41
42

43
44 To be a knowledge-led company it seems crucial that all categories of knowledge are
45
46 managed: within, across and between functions. Manufacturing organisations may have
47
48 an advantage here in that it may be easier for them to distinguish between operational
49
50 and strategic knowledge than it is for non-manufacturing organisations.
51
52
53

54
55
56 A fruitful area for future work could be to explore the consistency of knowledge
57
58 management strategy with the organisation's manufacturing and corporate strategies.
59
60

1
2
3
4
5
6
7 As for the workshops, they seemed appropriate for enabling people from different
8
9 manufacturing functions in the same organisation to share their knowledge about how to
10
11 improve knowledge management processes. The workshops enabled the participants'
12
13 negotiation on different action plans in pursuit of a strategy which was appropriate for
14
15 implementation.
16
17
18
19
20

21 **Acknowledgement**

22
23 This research was funded by CIMA, the Chartered Institute of Management
24
25 Accountants in the UK.
26
27
28
29

30 **References**

- 31
32
33 Beckett, A. J., Wainwright, C. E. R. and Bance, D., Implementing an industrial
34
35 continuous improvement system: A knowledge management case study,
36
37 *Industrial Management and Data Systems*, 2000, **100**, 330-338.
38
39
40 Bhatt, G. D., Organizing knowledge in the knowledge development cycle, *Journal of*
41
42 *Knowledge Management*, 2000, **4**, 15-26.
43
44
45 Chaston, I., Badger, B., Mangles, T. and Sadler-Smith, E., Organisational learning style,
46
47 competencies and learning systems in small, UK manufacturing firms,
48
49 *International Journal of Operations & Production Management*, 2001, **21**,
50
51 1417-1432.
52
53
54 Chaston, I. and Mangles, T., Business networks: assisting knowledge management and
55
56 competence acquisition within UK manufacturing firms, *Journal of Small*
57
58 *Business and Enterprise Development*, 2000, **7**, 160-170.
59
60

- 1
2
3
4 Collinson, S., Knowledge management capabilities for steel makers: A British-Japanese
5
6 corporate alliance for organizational learning, *Technology Analysis and*
7
8 *Strategic Management*, 1999, **11**, 337-358.
- 9
10
11 Davenport, T. H. and Prusak, L., *Working Knowledge: How Organizations Manage*
12
13 *What They Know*, 1998 (Harvard Business School Press: Boston, Mass).
- 14
15
16 Earl, M. J., The new and the old of business process redesign, *The Journal of Strategic*
17
18 *Information Systems*, 1994, **3**, 5-22.
- 19
20
21 Eden, C. and Ackermann, F., *Making Strategy: The Journey of Strategic Management*,
22
23 1998 (Sage: London).
- 24
25
26 Edwards, J. S. and Kidd, J. B., Bridging the gap from the general to the specific by
27
28 linking knowledge management to business processes. In *Knowledge and*
29
30 *Business Process Management*, edited by V. Hlupic, pp.118-136, 2003a (Idea
31
32 Group: Hershey PA).
- 33
34
35 Edwards, J. S. and Kidd, J. B., Knowledge Management sans frontières, *Journal of the*
36
37 *Operational Research Society*, 2003b, **54**, 130-139.
- 38
39
40 Germain, R., Droge, C. and Christensen, W., The mediating role of operations
41
42 knowledge in the relationship of context with performance, *Journal of*
43
44 *Operations Management*, 2001, **19**, 453-469.
- 45
46
47 Glazer, R., Measuring the knower: Towards a theory of knowledge equity, *California*
48
49 *Management Review*, 1998, **40**,175-194.
- 50
51
52 Hayes, R. H. and Wheelwright, S. C., *Restoring Our Competitive Edge*, 1984 (Collier
53
54 Macmillan: New York, NY).
- 55
56
57 Hill, T. J., Teaching manufacturing strategy, *International Journal of Operations &*
58
59 *Production Management*, 1987, **6**, 10-20.
60

- 1
2
3
4 Leseure, M. and Brookes, N., Micro knowledge management: A job design framework.
5
6 In *Industrial knowledge management: A micro-level approach*, edited by R.
7
8 Roy, pp.163-178, 2001 (Springer-Verlag: xx).
9
10
11 Minor, E. D., Hensley, R. L. and Wood, D. R., A review of empirical manufacturing
12
13 strategy studies, *International Journal of Operations & Production*
14
15 *Management*, 1994, **14**, 5-25.
16
17
18 Misterek, S. D. A., Schroeder, R. G. and Bates, K. A., The nature of the link between
19
20 manufacturing strategy and organizational culture. In *Manufacturing Strategy:*
21
22 *Process and Content*, edited by C.A. Voss, pp.331-352, 1992, (Chapman &
23
24 Hall: London).
25
26
27
28 Mohanty, R. P. and Deshmukh, S. G., Evaluating manufacturing strategy for a learning
29
30 organization: A case, *International Journal of Operations and Production*
31
32 *Management*, 1999, **19**, 308-327.
33
34
35 Ordonez de Pablos, P., Knowledge management and organizational learning:
36
37 Typologies of knowledge sharing in the Spanish manufacturing industry from
38
39 1995 to 1999, *Journal of Knowledge Management*, 2002, **6**, 52-62.
40
41
42 Paiva, E. L., Roth, A. V. and Fensterseifer, J. E., Focusing information in
43
44 manufacturing: A knowledge management perspective, *Industrial Management*
45
46 *and Data Systems*, 2002, **102**, 381-389.
47
48
49 Platts, K. W. and Gregory, M. J., A manufacturing audit approach to strategy
50
51 formulation. In *Manufacturing Strategy: Process and Content*, edited by C.A.
52
53 Voss, pp.29-55, 1992 (Chapman & Hall: London),.
54
55
56 Prasad, B., Converting computer-integrated manufacturing into an intelligent
57
58 information system by combining CIM with concurrent engineering and
59
60

1
2
3
4 knowledge management, *Industrial Management and Data Systems*, 2000, **100**,
5
6 301-316.
7

8
9 Robertson, M., Swan, J. and Newell, S., The role of networks in the diffusion of
10
11 technological innovation, *Journal of Management Studies*, 1996, **33**, 333-359.
12

13
14 Robinson, S., Edwards, J. S. and Yongfa, W., Linking the Witness simulation software
15
16 to an expert system to represent a decision-making process, *Journal of*
17
18 *Computing and Information Technology*, 2003, **11**, 123-133.
19

20
21 Shaw, D. and Edwards, J. S. (2005 (to appear)), Building user commitment to
22
23 implementing a knowledge management strategy, *Information & Management*.
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60

TABLES

Table 1: The types of knowledge to be managed

For Peer Review Only

	HighTechManuf		ManufIndProd		Housing		Average for other organisations	
	Formal	Informal	Formal	Informal	Formal	Informal	Formal	Informal
Oral	17%	10%	9%	1%	25%	6%	18%	10%
Written	46%	0%	62%	1%	49%	2%	49%	1%
Electronic	8%	6%	4%	1%	4%	6%	10%	3%
Experiential	6%		7%		8%		3%	
Other	6%		13%		0%		6%	

Table 1: The types of knowledge to be managed

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47

FIGURES

Figure 1: A map from the HighTechManuf workshop

Figure 2: A map from ManufIndProd workshop

Figure 3: A map from Housing workshop

