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**Organisational change, innovation and  
human resource Development  
as a response to increased competition**

by

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**Abstract**

This paper draws upon a questionnaire survey, conducted 1996 in 1900 Danish Firms, on technical and organisational change. The topics in the survey were among others if firms been through significant organizational change, how the firm had developed its human resources, and what were the motives for organizational change. Our analysis shows that more intense competition is a primary driving force behind organisational change and technical innovation. Firms are divided into three groups (the C-firms, the A-firms and the S-firms), according to how far the intensity of competition had changed in recent years. The propensity to change and adapt is much higher among the firms that have experienced the strongest rise in competition (the C-firms). Further we show that there is a very clear and consistent direction of change among the C-firms. The C-firms tend to change towards what in broad terms is called organisational and functional flexibility. The C-firms emphasise human resource development, apply modern management tools and introduce innovations related both to products and processes, to a much higher extent than the other firm types. But they are also more selective in their hiring of new labour. At the end some policy implications that relate to the marginalisation of the unskilled workers are sketched.

**Keywords**

Innovation, competition, human resources.

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## **Introduction**

A classical theme in industrial economics is the possible trade off between static efficiency and innovative capability. This discussion has its roots in Schumpeter's late contributions on big firms as being the most efficient in promoting science-based innovation (Schumpeter, 1939). The idea that a high degree of industrial concentration tends to promote innovation was stated most strongly by Galbraith (Galbraith, 1967). The debate was later followed up by a multitude of empirical tests of R&D-intensity in firms of different size. The main result of these studies was that R&D-intensity was growing with size until a threshold limit where the intensity started to fall again. Many of these studies addressed the issue of innovation and competition only indirectly since the connections between size and market concentration and between R&D-intensity and innovative output are at best indirect.

Recent contributions in this field can be grouped into two categories. On the one hand, Schumpeterian oriented economists (such as for instance Dosi, Nelson and Winter) have insisted on the fact that there is a two-way relationship between innovation and competition. They typically work with models where both innovative activities and industrial structures are treated as endogenous variables and as outcomes of evolutionary processes (Nelson & Winter, 1982, Dosi, 1984).

On the other hand, Geroski and other economists with neo-classical roots have tried to test directly if innovations are positively or negatively correlated with high degrees of market control. Geroski demonstrates that the intensity of competition on average has a positive impact on innovation but that technological opportunity is a more important factor than the competition regime. Actually, his analysis confirms that the relationships between innovation and competition go both ways (Geroski, 1996).

In what follows, we will tackle the issue of competition and innovation in a different way. First, the empirical analysis is based on survey data. Second, we focus on changes in the intensity of competition. Third, we relate these changes to organisational change as a way to obtain a higher degree of both flexibility and innovativeness. In what follows we will give some brief reflections on these peculiarities.

## **Competition, innovation and flexibility**

Innovation is not the only important aspect of dynamic economic performance. Among economists close to the realities of business it has been generally accepted that the last

decade has given a competitive advantage to firms with a high degree of *functional flexibility* enabling them to react and adapt promptly in an increasingly turbulent environment. In the present context, we are going to analyse how the change in the competitive pressure relates to changes in terms of both flexibility and innovativeness.

It is important to note that the emphasis is on change. Actually, it might be argued that an analysis which focuses on changes in the intensity of competition is more relevant for policy issues than an analysis comparing the intensity of competition across sectors (or their structural characteristics in terms of concentration ratios) at a given point in time. The fact that sectors characterised by intense competition perform well is no guarantee that an *increase* in the intensity of competition will lead to an *improvement* in performance in sectors which have been sheltered from competition<sup>1</sup>.

## **Caveats**

There are a number of caveats to be made in this context. The most important has to do with the direction of causality. Third factors such as for instance the richness of the pool of technological opportunities may be driving innovation as well as intensifying competition.

A second point has to do with the kind of innovations captured by our questionnaire. Since the majority of all firms indicate that they introduce product innovations it is safe to say that the majority of these innovations are incremental, rather than radical, technological breakthroughs. This should be kept in mind when comparing the results with other studies where the focus is on more significant and science-based innovations. At the same time, it is important to note that for a small and open economy as the Danish, where most of the new technologies will be developed abroad and then adopted and adjusted to local needs, these incremental forms of change might be the most important for long-term competitiveness.

A third point to be made is that we can capture the changes provoked in the surviving firms but not to what degree the increasing pressure of competition has resulted in firms closing down. This is important because it must be taken into account before jumping to normative

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<sup>1</sup> This focus on change and industrial transformation has precedents among Nordic economists. The major Swedish Schumpeterian economist Erik Dahmén has developed an original and unique analytical model where he analyses how different 'blocks of development' react differently when confronted with a stronger pressure for change (Dahmén, 1988). His historical analysis shows, for instance, that one and the same development block may be characterised with a positive potential for transformation in one historical period and with a negative in another. The analysis pursued below may be regarded as a first step toward developing a Dahménian perspective on Danish industrial development in the 90's.

conclusions.

Fourthly, the term flexibility has become a buzzword with different meanings according to who uses the term, and in which context it is used. For instance flexibility in the Piore & Sabel sense (1984) is related to the firm's ability to adapt to change in the composition of demand. Firms may be functionally or numerically flexible. Numerical flexibility refers to hiring and firing in connection with changes in the scale of the activities. Functional flexibility refers to the ability to adapt to new needs by ensuring a work force which is well trained and able to perform different and new functions within the organisation. When we, in the following analyse use the term flexibility it is meant as functional flexibility, and referring to characteristics in the organizational set-up.

### **Most firms report increased competition pressure**

Of all firms (1869 firms), 40% report that the competition has been strongly increased in the last couple of years (these will be referred to as *C-firms*), 33% that it has increased somewhat (these will be referred to as *A-firms*) while only 24% report no change or a milder competition pressure (these we refer to as *S-firms*) and 3% report that they do not know. It could be argued that the high average positive response on this question should not be taken too seriously since firms might have a general tendency to report intensified competition (as farmers' tend to complain about the weather).

Still the response pattern can be used for analytical purposes to the degree that it reflects real differences between firms and across sectors (if farmers from regions where the weather is the worst complain the most). A break-down to the most disaggregated level (111 sectors) and an inspection of the data at this level shows that at least for the sectors where you have supplementary information the response pattern makes sense. The reported intensification of competition is lowest for firms belonging to the construction sectors which is compatible with the fact that these are sectors where the average rate of return has been continuously growing during the first half of the 1990s (Erhvervsredegørelsen, 1996, p. 399). Intensified competition is reported most frequently in the traditional, labour intensive and import-intensive manufacturing product areas such as clothing and textiles as well as in the production of telecommunication components. The first type of sectors is obviously sensitive to international competition and here the strengthening of the Danish currency may be one major factor behind the intensified competition. Telecommunication components is one of

the areas where a decisive effort has been made to deregulate the market in order to increase competition (Erhvervsredegørelsen, 1996, p. 300).

Intensified competition may reflect an acceleration of technical innovation and the fact that information and communication technologies makes the distance between continents much smaller. Among other explanations are certainly the international competition, including new entrants from the Far East. For Danish service sector firms the entrance of new major players in areas such as banking, insurance as well as privatisation of public sector activities and deregulation of private activities has changed identified the competition pressure. It is important to note that all of those mechanisms will be working also in the future especially in relation to the service sector.

### **Competition pressure and organisational change**

Firms experiencing a much stronger competition pressure (*C-firms*) introduce organisational change at a much higher rate than those which do not register any change, or respond that competition has been weakened through the last couple of years (*S-firms*). The firms which report some increase in the rate of competition (*A-firms*) position themselves in between the two groups.

*Table 1: Proportion of firms responding positively to the following question: 'Has the firm carried through important organisational changes during the period 1993-95?'*

N=1869	C-firms	A-firms	S-firms	All-firm
Yes	63.53%	54.26%	31.29%	52.27%
	122	104	60	100

Table 1 confirms that there is a strong positive relationship between intensified competition and the proneness to introduce organisational change. The proportion of firms introducing organisational change is double as high in the firms experiencing a strong intensification than in the S-firms which did not report any increase in the intensity of competition.

### **The objective of introducing organisational change in the C-firms**

The fact that firms introduce organisational change more frequently when facing an

intensification of competition does not tell us in which direction they change the organisation. It might be a defensive change cutting down employment and focusing on production efficiency or a change towards a more flexible and innovative organisation. Here we shall analyse if there are any differences in these respects between the three categories of firms. In table 2 we have constructed a simple index showing how the response 'to a high degree' deviates from the average of the whole population of firms which have introduced organisational change (977 firms).

*Table 2: Proportion of firms responding high extent to the following question: 'Have the organisational changes primarily had as their objective to strengthen:'*

N=977	C-firms	A-firms	S-firms	All-firm
The effectiveness of daily work	69.07% 109	59.21% 93	56.52% 89	63.36% 100
The ability to adapt to more turbulent surroundings	59.96% 122	42.30% 86	31.16% 63	49.33% 100
The ability continuously to develop new products and services	34.75% 120	26.89% 93	14.49% 50	28.86% 100
	N=472	N=331	N=138	

Table 2 shows that a large proportion of all firms (63%) give high priority to obtaining efficiency in daily operations as their motive for organisational change. This does not single out the C-firms as strongly from the rest, however, as do the objectives of adaptability and innovativeness. It is interesting to note that the group of firms meeting stronger competition tends to focus both on flexibility and innovativeness. Some firms in this group will try to obtain both at the same time while others might put the major emphasis on one of the two objectives.

### **In what direction do the C-firms change their organisation?**

From table 1 and 2 it is obvious that the C-firms engage in processes of change to a higher



extent. Further we see that especially the adaptability to turbulent surroundings and the ability to continuously develop products are very outspoken needs in the C-firms in relation to the A- and especially the S-firms. In the following we will analyse how for these differences are reflected in the organizational characteristics of the three categories of firms.

*Table 3 Proportion of firms responding 'yes' to the following question: 'Has the firm extended its use of the following organisational traits during the period 1993-95?'*

	C-firms	A-firms	S-firms	All-firm
Delegation of responsibility	63.25% 111	58.36% 102	46.48% 81	57.23% (N=1653)
Cross occupational working groups	55.38% 106	55.75% 107	43.39% 83	52.19% (N=1029)
Quality circles/groups	51.78% 108	48.56% 101	42.51% 89	47.93% (N=845)
Integration of functions (e.g. sales production/service, finance)	51.98% 113	48.40% 105	31.97% 70	45.91% (N=1222)
Wages based upon quality and results (not piece time wage)	43.62% 102	45.99% 108	36.88% 86	42.69% (N=855)
Job rotation	46.84% 112	45.14% 107	27.40% 65	42.00% (N=781)
Systems for the collection of proposals from employees	48.38% 118	36.89% 90	34.07% 83	41.10% (N=978)

Table 3 shows that in general the C-firms are more prone to introduce all the different new forms of organisational techniques than the S firms. The difference is especially marked when it comes to the use of job rotation and the integration of functions. These are some of the core characteristics of the flexible and innovative organisation. The analysis reinforces the hypothesis that increased competition drives firms toward more flexible forms of organisation. (The fact that wage systems based on quality does not follow the usual pattern in its ordering between the C- and the A-firms is, in a sense, comforting because it shows that there is no automaticity in the results.)

## Competition and innovation

How about the impact on innovation? In the questionnaire, firms were asked if they had introduced new products or services in the period 1993-95 disregarding minor improvements of existing products. More than half of the firms signalled that they had introduced new products and given the character of the whole population, as already mentioned, this indicates that many of the innovations referred to are minor and incremental rather than major and radical.

In tabel 4 we can see how the C-firms behave with respect to product innovation as compared to the other two categories.

*Table 4: Proportion of firms responding 'yes' to the following question: 'Has the firm introduced new products/services during the period 1993-95 when excepting minor improvements of existing products?'*

N=1869	C-firm	A-firms	S-firms	All firms
New. prod	63.66% 123	55.74% 108	30.39% 59	51.69% 100

Table 4 demonstrates that the firms experiencing an intensified competition are much more prone to develop new products. As indicated in the introduction this might reflect that rich technological opportunities have a positive effect on both the intensity of competition and the rate of innovation. Even so, it is difficult to avoid the conclusion that there is a positive causal relationship going from changes in the intensity of competition to the innovativeness of firms. To innovate is one major way of reducing the pressure on profits emanating from increased competition.

## The change in the content of work

In table 3 and 4 we saw that C-firms have extended their use of managerial routines such as work teams, integration of functions, jobrotation, and systems to collect employee proposals. In the literature on new organizational forms all these routines or practices are seen as important means to increase adaptability. Further, we saw that the C-firms are much more

innovative than the A- and S-firms. Next we will see how far these new managerial traits and the increased innovativeness are linked to changes the skill requirements of the work force? In what follows we will compare the C-firms with the other firms in this respect. The basic assumption is that the observed shift in demand in the direction of more skilled personnel reflects an acceleration in the rate of change and a sharpening of competition (OECD, 1996).

Table 5 shows an interesting pattern regarding the change in the content of work. First, in general there is an increase in work tasks which are demanding in terms of work related qualifications.

*Table 5: Proportion of firms responding 'more' and 'less' to the following question: 'Has the content of work changed for the employees during the period 1993-95 regarding:'*

Work cont.		C-firms	A-firms	S-firms	All firms
1. Work autonomy	more	63.93	57.70	41.40	55.38
	less	3.10	4.10	3.40	3.48
2. Co-operation with management	more	56.93	49.02	31.97	47.30
	less	5.38	5.08	4.54	5.19
3. Occupational qualifications	more	52.76	49.51	34.92	46.71
	less	6.73	6.72	5.22	6.42
4. Co-operation with colleagues	more	53.03	46.23	27.89	43.71
	less	4.98	6.07	3.63	5.24
5. Contact to customers	more	49.39	41.97	29.02	40.98
	less	4.31	5.08	2.49	4.17
6. Specialisation	more	32.71	29.84	27.89	30.18
	less	19.11	14.75	7.71	14.61
7. Contact to sub-contractors	more	34.72	26.23	17.46	27.02
	less	5.52	6.39	5.22	5.72
8. Contact to other firms	more	24.09	19.02	13.15	19.37
	less	5.52	4.59	4.31	4.92
9. Routine content of work	more	6.33	6.07	9.30	6.85
	less	34.72	32.79	16.55	29.87

But even more important for the whole population is the increased demand for general qualifications such as autonomy and co-operation with management. None of these are the factors which distinguish the C-firms from the rest most clearly, however. C-firms are especially characterised by a stronger reduction in the demand for routine work and a

stronger increase in tasks related to communication inside and outside the firm. Also, in many C-firms the need for specialisation is reduced. Together this gives a picture of changes in the work process where a more dynamic environment puts a premium on the capability to learn to absorb change and to interact and communicate. In this context, individual experts not able to adapt to new conditions and to communicate with peers with different kinds of expertise will not be very useful. The focus is on learning as well as on knowledge-intensity in specific fields.

### **The change in the demand for skills in the C-firms**

Firms were also explicitly asked about changes in the demand for skills during the period 1993-95 in four dimensions: Vocational qualifications, ability to co-operate and communicate, ability to readjust to change and, finally, responsibility and quality consciousness.

*Table 6: Proportion of firms responding 'larger' to the following question: 'Has the firm changed the demands when recruiting employees during the period 1993-95 Regarding:'*

N=1869	C-firms	A-firms	S-firms	All firms
Responsibility and quality consciousness	72.14 117	65.57 106	42.40 69	61.80 100
Ability to adjust	63.66 122	54.59 105	32.43 62	52.06 100
Ability to co-operate and communicate	62.05 121	54.43 106	31.75 62	51.15 100
Vocational qualifications	56.39 123	45.74 99	31.07 68	46.01 100

Table 6 shows that for the population as a whole there is a strong increase in the demand especially for general competences in terms of responsibility, flexibility and capability to communicate. It also shows that the more strongly firms have experienced increased competition the more prone are they to point the need for more qualifications in all these respects. The C-firms differ from the S-firms especially in their demand for more flexibility and communicative abilities. This pattern of response gives strong support to the hypothesis

that intensified competition is a major force behind a shift of demand for labour toward more skilled workers and especially toward a workforce which can adapt to a rapidly changing environment by being responsible, able to communicate and co-operate.<sup>2</sup>

### **Driving forces behind the change in the content of work**

Table 7 is an attempt to determine which forces drive the change in the content of work, and if the driving forces are different for the C-firms than for the average firm?

*Table 7: Proportion of firms responding 'high extent' to the following question: 'To which degree have the following conditions contributed to changes in the work content of employees during the period 1993-95?'*

N=1869	C-firms	A-firms	S-firms	All firms
1. Sharper Competition	54.24 180	18.52 61	9.30 31	30.2 100
2. Introduction of new technology	37.55 134	26.39 94	17.91 64	28.1 100
3. Need for better contacts with customers.	35.13 149	18.52 78	12.70 54	23.6 100
4. Better possibilities for development of new products or services	18.98 146	9.67 74	7.94 61	13.0 100
5. Need for better contacts with sub-contractors	16.15 166	7.05 73	4.08 42	9.7 100
6. Demands and wishes from the Employees	13.19 136	7.54 78	6.58 68	9.7 100

Table 7 shows that for the whole population of firms intensified competition is the single most important factor affecting the content of work. This supports strongly our analytical perspective. New technological opportunities both in terms of process technology and in

<sup>2</sup> The fact that the shift in the demand for labour is not mainly for more skilled people but rather for workers with a high learning capability is emphasised in the recent OECD analysis of Technology, productivity and job creation, where it is stated that: '... technical change is less biased against certain types of skills than against the inability to learn'. (OECD, 1996, p. 9).

terms of a greater potential for new products are also important factors in affecting the content of work and so is the need for a closer interaction with customers.

That the C-firms stand out in their emphasis on intensified competition should mainly be taken as a confirmation of a high degree of consistency in the response patterns of the interviewed persons. But also when it comes to all the other factors the C-firms are much more prone to

point them out as being of major importance. The over all picture is one where new technology and more turbulent markets go hand in hand and reinforce the dominant factor, intensified competition in reshaping the content of work.

There is a stronger emphasis on increased possibilities to develop new products in the C-firms and this gives some support to the proposition that increased technological opportunities promote competition. But, still, only 19% of the C-firms point to this as a major factor. More important for the C-firms is new process technology which is referred to by almost 40%. These data do not support an interpretation where the intensification of competition is regarded as caused mainly by increased technological opportunities. Especially in a small open economy it is reasonable to assume that the intensity of competition tends to be exogenously rather than endogenously determined.

### **Do C-firms give high priority to investments in human resources?**

Given the emphasis on changes in the content of work and in the demand for skills in the C-firms it is interesting to analyse how and to what extent C-firms engage in human resource development. Table 8 presents the proportion of firms which say that skill development is of decisive importance. It shows a marked difference between the C-firms and the rest.

There is a very strong connection between the need felt for continuous training and intensified competition. This result is compatible with the hypothesis of the learning economy (Lundvall and Johnson, 1994) where it is assumed that an acceleration in the rate of change intensifies competition and makes the capability to learn at the level of the firm and the individual the key factor in determining competitiveness.

*Table 8: Proportion of firms responding 'Decisive' to the following question: 'How important is it for the firm's competitiveness that the employees continuously develop their skills?'*

n=1869	C-firms	A-firms	S-firms	All firms
Decisive	38.49	25.25	17.46	28.30
	136	89	62	100

We can also analyse how C-firms prioritise different ways of increasing the skills of the employees. In Table 9 the alternative modes have been ordered after the priority given to them by the whole population of firms.

*Table 9: Proportion of firms responding 'Great' to the following question: 'How great importance do the following conditions have for the management's efforts to secure that the employees continuously develop their skills?'*

n=1729	C-firms	A-firms	S-firms	All firms
By solving working tasks	55.21	46.10	42.33	48.64
	114	95	87	
By giving time for sparring with management/other employees	32.95	22.88	22.22	26.60
	124	86	84	
By prompting co-operation and network across divisions and groups	31.95	24.75	20.11	26.14
	122	95	77	
By organising the work in teams	29.67	22.54	21.59	24.81
	120	91	87	
By educational activities tailored to the firm's needs	27.10	24.41	22.49	24.75
	109	99	91	
By long-term educational planning	22.54	17.46	12.17	18.22
	124	96	67	
By standard courses	13.27	11.86	7.94	11.68
	114	102	68	
By planned job rotation	9.27	5.59	5.82	7.11
	130	79	82	



Table 9 shows that informal forms of competence building (learning-by-doing, team-working, sparring with management etc.) are more frequently emphasised by all firms than specific courses (tailor made courses or standard courses). It is interesting to note that the C-firms emphasise all forms of training more strongly than the rest but that the difference is the least when it comes to the more formalised forms of training. This indicates the importance of building a 'learning organisation' when confronted with intensified competition<sup>3</sup>. Some of the more demanding measures such as planned job rotation and long term educational planning which are only mentioned by a small minority of all firms are quoted much more frequently by the C-firms.

### **How much do C-firms actually invest in education and training?**

An interesting question is if the strong emphasis on continuous knowledge creation among the C-firms is reflected in actual efforts made by these firms to invest in human resources. The fact that they experience a more intensified competition may by itself put strict limits on the budgets which can be allocated to education and training even if the need to do so were fully accepted by management.

In tabel 10 we have presented results for those firms which introduced organisational change in the period 1993-95 regarding if they did combine organisational change with specific efforts to train and educate employees. Are firms driven by intensified competition more or less prone to invest in training as compared to firms introducing organisational change for other reasons?

*Table 10: Proportion of firms responding 'yes' to the following question: 'Have any of the employees got education/continuous education as a consequence of organisational change?'*

n=977	C-firms	A-firms	S-firms	All firms
Yes	63.77 108	58.31 98	51.45 87	59.26 100

There is some tendency that firms that introduce organisational change under the pressure of

<sup>3</sup> The notion The Learning Organisation was put forward by Senge P. in 1990.

intensified competition are more prone to combine organisational change with education and training than the rest. But the tendency is not as strong as the indicated change in demand for skills among the C-firms. As mentioned above the fact that C-firms are coming under intensified competition and therefore confronted by more narrow budget restraints might be a factor which restricts their capability to invest in human resources as compared to the needs they experience. But it might also be a reflection of the fact that C-firms have been more successful in establishing 'learning organisations'.

Table 11 shows the proportion of all firms - not only those which have introduced organisational change - in the different groups which have had more than half of their total workforce in some kind of formal training for the years 1995-96.

*Table 11: Proportion of firms responding 'More than half' to the following question: 'How large part of the firm's employees has taken part in internal or external course or educational schemes in 1995 or 1996?'*

n=1869	C-firms	A-firms	S-firms	All firms
More than half	42.40	44.75	29.02	39.49
	107	113	73	100

Table 11 shows that firms experiencing more intense competition are more prone to give access to education and training but the differences are less systematic and clear than those registered in for instance table 8 above where firms were asked to indicate the priority they give to continuous development of skills.

*Table 12: Proportion of firms responding 'More than 5 days' to the following question: 'On average how many work days per year do various employee groups use for education?'*

n=1609	C-firms	A-firms	S-firms	All firms
Top management	37.57 112	34.85 104	25.44 76	33.56 100
Middle management	39.31 106	39.93 108	29.53 80	37.02 100
Workers	27.50 108	26.32 103	20.47 80	25.47 100

Table 12 shows the same pattern as table 11. For all categories of the personnel the C-firms tend to allocate more time to education and training than the average firm but the differences to the A-firms are small. The difference is most clear for training of management but even here differences are not dramatic.

There are two possible interpretations compatible with the patterns observed in the last sections of this chapter. One is that there might be some underinvestment in education and training especially in the C-firms. An alternative interpretation is that C-firms on average have been successful in their efforts to build 'learning organisations' where new competences and qualifications are built through the everyday activities making the need for formal training less strong. Probably, the truth is a combination of these two interpretations.

### **Cooperation and competition**

Intensified competition implies an environment which is changing rapidly and markets which are demanding both in terms of rapid response and in terms of new products. In such a context there might be a strong pressure to develop network relationships with customers, subcontractors and other organisations. In table 13 and 14 we have showed how the C-firms change their relationships to different actors. In table 13 firms responding 'high extent' when it comes to establish closer co-operation has been sorted out and here the focus is on the two partners most often referred to by the firms: Customers and subcontractors.

*Table 13 Proportion of firms responding 'high extent' to the question 'To which extent has the firm developed a closer co-operation with the following actors during the period 1993-95?'*

n=1869	C-firms	A-firms	S-firms	All firms
Customers	54.10 147	29.51 80	20.41 56	36.70 100
Sub-contractors	29.61 145	15.57 76	12.47 61	20.39 100

Table 13 indicates a very strong relationship between the intensity of competition and the intensity of co-operation between firms. Increased competition goes hand in hand with an increase in the intensity of cooperation especially with customers and sub-contractors. This is not trivial and it raises important analytical and policy issues. How can firms which increasingly base their competitiveness on competence and skills protect their knowledge-base while entering into close network relationships?

Table 14: Proportion of firms responding either 'High extent' or 'Some extent' to the question: 'To which extent has the firm developed a closer co-operation with the following actors during the period 1993-95?'

n=1869	C-firms	A-firms	S-firms	All firms
Customers	90.57 112	85.25 105	63.04 78	81.11 100
Sub-contractors	70.39 114	63.11 102	34.8 56	61.64 100
Educational institutions	30.69 118	28.20 108	15.87 61	26.06 100
Consultants	23.83 107	25.91 116	15.64 70	22.31 100
Public Authorities	22.07 114	19.34 100	15.19 79	19.31 100
Knowledge centres such as universities and technological institutes	18.30 115	17.2 108	10.65 67	15.95 100

Table 14 extends the analysis to other actors less frequently referred to and includes responses saying 'some extent' to the question about increased co-operation. In all categories, the C-firms are more prone to establish closer co-operation than the average firm. It is interesting to note that the differences are greatest for 'Educational institutions' and for 'Knowledge centres such as universities and technological institutes'. This indicates that in a long term dynamic perspective the role of these organisations might be more important than what is indicated by *average* data for the whole population.

These data and the observations made earlier indicate that the intensification of competition triggers simultaneously a wave of organisational change within the firm, product innovations and stronger linkages and more communication especially with users and subcontractors. In earlier work we have pointed to the close connection between user-producer interaction and product innovation (Lundvall, 1988 and Lundvall (ed.), 1992) and argued that these micro relationships are among the most critical in constituting separate national systems of innovation.

## Conclusions

We have already referred to a number of important implications of the results reported in this chapter. Here we shall focus on the interpretation of organisational change as a process and a policy issue.

The analysis shows that in this specific case organisational change is promoted by an intensification of competition and that the resulting move is one towards a learning organisation where there is less room for routine work and rigid interdivisional splits. One outcome is a stronger demand for skilled labour and for continuous upgrading of human resources.

The triggering role of competition has several interesting implications:

- for firms that remain sheltered from competition it is not self-evident that a move toward a flexible and innovative form of organisation is attractive or necessary.
- there is no reason why firms which have adopted a flexible and innovative organisation should be more successful in terms of their private rate of return since firms following more traditional organisational trajectories on average are those least exposed to competition<sup>4</sup>
- there might be an under-investment in human resource development especially in firms experiencing most strongly on intensification of competition.
- intensification of competition in product markets reinforces the polarisation of the labour market affecting the relative position of less skilled employees negatively.
- to strengthen the capability to learn of all parts of the work force and especially of the least skilled becomes of critical importance to avoid a polarisation in the labour market.
- to design incentives which make it attractive to firms, and especially for C-firms, to engage in upgrading the skills of the least skilled parts of the workforce is of key importance.
- there is no reason to believe that globalization and the intensification of the competition

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<sup>4</sup> This is probably part of the explanation of why the analysis made by the Danish Technological Institute shows a good performance (measured as an increase in profits) for the least dynamic firms (Erhvervsfremme Styrelsen, 1996, pp 33 et passim). It would be interesting to introduce variables reflecting the regime of competition and changes in the intensity of competition in the analysis to see if this changes the picture.

will not continue in the future. This will reinforce the policy implications pointed out here. Further, the need to increase the emphasis on training and innovativeness in Danish firms will become even more dramatic in the future especially in the sectors not yet affected, since these are becoming more and more exposed to deregulation and globalization.

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# **D**anish **R**esearch **U**nit for **I**ndustrial **D**ynamics

## *The Research Programme*

The DRUID-research programme is organised in 3 different research themes:

- *The firm as a learning organisation*
- *Competence building and inter-firm dynamics*
- *The learning economy and the competitiveness of systems of innovation*

In each of the three areas there is one strategic theoretical and one central empirical and policy oriented orientation.

### **Theme A: The firm as a learning organisation**

The theoretical perspective confronts and combines the resource-based view (Penrose, 1959) with recent approaches where the focus is on learning and the dynamic capabilities of the firm (Dosi, Teece and Winter, 1992). The aim of this theoretical work is to develop an analytical understanding of the firm as a learning organisation.

The empirical and policy issues relate to the nexus technology, productivity, organisational change and human resources. More insight in the dynamic interplay between these factors at the level of the firm is crucial to understand international differences in performance at the macro level in terms of economic growth and employment.

### **Theme B: Competence building and inter-firm dynamics**

The theoretical perspective relates to the dynamics of the inter-firm division of labour and the formation of network relationships between firms. An attempt will be made to develop evolutionary models with Schumpeterian innovations as the motor driving a Marshallian evolution of the division of labour.

The empirical and policy issues relate the formation of knowledge-intensive regional and sectoral networks of firms to competitiveness and structural change. Data on the structure of production will be combined with indicators of knowledge and learning. IO-matrixes which include flows of knowledge and new technologies will be developed and supplemented by data from case-studies and questionnaires.

### ***Theme C: The learning economy and the competitiveness of systems of innovation.***

The third theme aims at a stronger conceptual and theoretical base for new concepts such as 'systems of innovation' and 'the learning economy' and to link these concepts to the ecological dimension. The focus is on the interaction between institutional and technical change in a specified geographical space. An attempt will be made to synthesise theories of economic development emphasising the role of science based-sectors with those emphasising learning-by-producing and the growing knowledge-intensity of all economic activities.

The main empirical and policy issues are related to changes in the local dimensions of innovation and learning. What remains of the relative autonomy of national systems of innovation? Is there a tendency towards convergence or divergence in the specialisation in trade, production, innovation and in the knowledge base itself when we compare regions and nations?

#### **The Ph.D.-programme**

There are at present more than 10 Ph.D.-students working in close connection to the DRUID research programme. DRUID organises regularly specific Ph.D-activities such as workshops, seminars and courses, often in a co-operation with other Danish or international institutes. Also important is the role of DRUID as an environment which stimulates the Ph.D.-students to become creative and effective. This involves several elements:

- access to the international network in the form of visiting fellows and visits at the sister institutions
- participation in research projects
- access to supervision of theses
- access to databases

Each year DRUID welcomes a limited number of foreign Ph.D.-students who wants to work on subjects and project close to the core of the DRUID-research programme.

#### **External projects**

DRUID-members are involved in projects with external support. One major project which covers several of the elements of the research programme is DISKO; a comparative analysis of the Danish Innovation System; and there are several projects involving international co-operation within EU's 4th Framework Programme. DRUID is open to host other projects as far as they fall within its research profile. Special attention is given to the communication of research results from such projects to a wide set of social actors and policy makers.

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