

Empirical Determinants of Employee Resistance Against Innovations

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Abstract

Employee resistance against innovations is a virulent phenomenon and there is a broad theoretical literature on its determinants. The empirical evidence is scarce, however, and mainly provides descriptive evidence on the incidence of the phenomenon and concentrates on the effectiveness of change management as a measure against it. A second branch of the empirical literature investigates the impact of unions on adoption costs and the successful implementation of innovations. There is no representative evidence on the impact of the economic environment on employee opposition against the implementation of an innovation in the firm independent of managerial activities, however.

This paper uses a unique firm-level data set of a representative sample of German service firms which includes detailed information on the economic environment of the firm. It shows that employee opposition against innovations can be predicted by very basic information on the firm that is relevant for the economic situation of the employees. Employee opposition is smaller in firms whose generic business strategy is differentiation, while it is larger in firms aiming at gaining competitive advantage by low costs and prices. If the goals of the innovation is an increase in employee performance, the firm experiences higher resistance, while resistance is lower in firms aiming at increasing the product range by the innovation. Profit and turn over expectations of the firm and the outside option of the employees are negatively correlated with employee resistance. Finally, smaller firms and firms operating in the computer and software or the technical consulting sector experience lower employee resistance. Therefore, the focus on change management measures or union activities in order to predict employee resistance against innovations seems too narrow.

JEL-codes: J24, J53, M12, O32

Key Words: Innovation, Labour-Management Relations, Estimation

1 Introduction

Employee opposition against changes in the firm is a virulent phenomenon. It can retard and hinder the introduction of necessary innovations and thereby reduce the competitiveness and the long-run perspectives of the firms. In the innovation literature the crucial aspect of worker acceptance plays a minor role, however. Economists frequently just assume that innovation costs are mainly research and development costs or the costs to buy patents or the right to use new processes or ideas. The implementation of innovations in a firm after it is available for the management is frequently seen as cost-less (see for example Ulph, 1996, page 85). An exception is the influence activity literature that explicitly mentions resistance of the workers against central managerial decisions, compare for example Milgrom (1988), Milgrom and Roberts (1990), or Schaefer (1998). This literature is vague about the concrete situation of innovations, however. Another strand of the economic literature are studies about union attitudes towards innovations, see for example Daniel (1987), Hyman and Streeck (1988), Ulph and Ulph (1988), Machin and Wadhvani (1991), or Dowrick and Spencer (1994). This literature concentrates on differences between unionised and non-unionised establishments stressing that unions may appropriate a larger share of quasi-rents than individual workers or that unions may increase adjustment costs. The empirical impact of unions on worker resistance is not measured directly, however, but the estimations concentrate on the impact of unions on investment, see Machin and Wadhvani (1991). Daniel (1987) compares the level of resistance of union officers, manual workers and shop stewards perceived by managers.

The business literature mainly concentrates on the correlation between management activities (for example employee participation in the innovation process, information by the management or change agents) and the implementation success, see for example Witte (1973), Maydl (1987), Bitzer and Poppe (1993), Staehle (1994), Rosenstiel (1997), Mohr and Woehe (1998), or Hauschildt (1999). A further important branch of literature in this context deals with the psychological sources of opposition against changes, see for example Böhnisch (1979) or Watzka (1987).

The (scant) empirical literature on the resistance of employees against innovations frequently does not explain employee opposition against innovations by the economic motives of the employees. Instead, it concentrates on descriptive evidence—mostly based on case studies—about the relevance of employee resistance against innovations, associations employees have with certain types of innovations and the correlation of employee opposition with different organizational arrangements in the firm and management methods, see also the literature surveys in Bemmels and Reshef (1991), or Hauschildt (1999).

This paper is mainly motivated by the availability of representative and detailed data on worker resistance against innovations in addition to a broad variety of general economic information about German service firms. This unique data

set allows to test several hypotheses on the empirical determinants of employee resistance against innovations beyond management or union activities. The paper thereby shows that basic enterprise information like the business and innovation strategies, the prospects of the firm and the size and sector also partly explain employee resistance. The advantage of this approach is that it detects general patterns of worker resistance that are independent of organizational, managerial or personal peculiarities in a representative sample. In addition, the regression controls for relevant variables such as the sector, the location, and the firm size that might bias simple cross-tabulations.

In the second section, a brief survey of the empirical literature on personnel resistance against innovations is given. The third section provides an informal review of alternative reasons for employee resistance against innovations. The hypotheses derived hereby are then empirically tested with estimations based on the firm-level data of the Mannheim Innovation Panel. This is a large, representative, and topical data set from the German service sector. The last section concludes.

2 Empirical evidence in the Literature

There are only a few empirical studies in the business literature on the incidence and causes of workforce resistance against innovations (see also Hauschildt, 1999). Those studies can be divided into two main approaches: case studies and industry studies.¹

Bitzer and Poppe (1993) questioned about 200 employees in two middle sized enterprises in order to find phase specific roles of promoters of innovations in firms. They report that personnel was the main obstacle to innovation (in contrast to organizational, financial or technical obstacles) while the critical phase in the innovation process was that of accepting new ideas (in contrast to these phases: finding ideas, realization of ideas or implementing ideas). Gierschner (1991) interviewed 142 employees in 14 German enterprises on communication and information during the innovation process and on the role of innovation promoters. He finds that information plays a crucial role for the success of innovations while the impact of promoters is not significant.

On the industry level, there are also only a few studies to mention. Daniel (1987) and Daniel and Hogarth (1990) analyse the impact of technical change on workplace relations on the basis of an extensive survey held on the establishment level. 2019 establishments participated in the interviews from all areas of the British economy. The authors find that worker support for changes in the firm strongly depends on the characteristics of the change. While changes in work practices introduced independently of new machines provoked strong

¹The following short survey only covers the recent empirical business and economics literature on worker opposition against innovations.

resistance, the introduction of new plants, machinery, or equipment found the support of employees. These findings were robust even in firms where technological change caused reductions in the work force while organizational change did not (see Daniel, 1987, p. 70). The explanation by Daniel and Hogarth (1990) for this surprising result is that technological change is emotionally associated with progress and success, while organizational change is associated with a reaction on management failures.

Another study was performed by Bemmels and Reshef (1991). They present answers of 206 Canadian enterprises that implemented innovations between 1980 and 1988. While on average the workers were in favour of changes, the presence of a union and a technology clause in the labour contract increased resistance. Changes that increased employees' skill requirements reduced resistance. Problematic is the (uncommented) result that innovations that lead to reductions in the labour force induced less resistance than changes that increased the labour force.² Hauschildt (1999) presents the results of a survey with 151 German firms that had successfully introduced an innovation. The survey concentrates on the characteristics of opposition, especially, if constructive and destructive opposition have different sources and lead to different outcomes with respect to the innovation success.

3 Theoretical Determinants of Employee Resistance Against Innovations

The survey on the empirical literature about worker resistance against innovations reveals that previous studies mainly concentrate on the impact of technological changes on management–worker relations or the correlation between organizational arrangements and the success of the implementation of innovations. In addition, these studies frequently confine themselves to reporting one–to–one cross–tabulations. This means that they probably are prone to omitted variable bias and spurious correlations, in other words the significant correlations could vanish when proper additional controls would be included.

The theoretical literature mentions a couple of relevant mechanisms that influence the strength of employee opposition against changes. Frequently, the effects do not point in the same direction, however. In this section, the main determinants identified in the literature are reviewed and hypotheses derived that serve as a basis for the empirical validation in the next sections.

When there is opposition to innovations, it reveals conflicts of motives and is associated with conflicts of distribution (see Hauschildt, 1999). A main determinant mentioned in the theoretical literature is therefore the compensation

²Bemmels and Reshef (1991) use ordinary least squares which may lead to biased results because the dependent variable is measured on an 11–point intensity scale.

offered by the firm for the adoption costs imposed on the workers, see for example Milgrom (1988). The smaller the compensation offered by the firm the stronger employee resistance against innovations should be.

There are two main negative economic impacts of innovations.³

First, innovations always require training efforts and adoption costs from the employees. These investments have three specific characteristics that induce employees to be reluctant to make them.

- First, the pay-off of the investment is risky. It is unclear, how long the labour relation will last and therefore how long the pay-off period will be. Employees who lose their jobs in connection with the restructuring after the implementation of the innovation, because their skills are not needed any longer or the work force is reduced, do not get a pay-off for their adoption effort if they can not use the newly acquired knowledge elsewhere. In addition, the productivity advantage after the training is not certain.
- Frequently the knowledge required by innovation is firm-specific and therefore useless outside the firm. According to human capital theory, the costs for these parts should be borne by the employee. Employees frequently are risk averse and especially young employees and employees with low qualifications are constrained in their liquidity, however. These factors have the consequence that the firms have to pay for these training costs, too. Their incentive to do so is limited, however, because they fear that the employees could leave for a better paying rival afterwards.
- It is unclear how long the acquired knowledge is topical in the firm and when technological progress leads to obsolescence.

Employee opposition should therefore be larger if the required new skills are very specific, costly or topical for a short period.

The second stimulus for employee resistance is that innovations frequently increase the pressure on employee performance and supervision possibilities. In addition, the innovation may be labour-saving and therefore endanger employment. Employment is also at risk, if the firm substitutes some employees with obsolete skills by better suited employees. Strong opposition against innovations is therefore more likely, if the innovation is aiming at rationalization or the substitution of labour by capital. The same is true if the innovation tends to increase the labour burden or demands major adoption costs from the employees.

A further element determining employee resistance is market power. The rent from the successful implementation of the innovation has to be divided between employer and employee. If the employer is in a strong negotiation position, the

³In addition to “psychic” costs like uncertainty, loss of control etc. discussed in the socio-psychological literature, see for example Böhnisch (1979))

part of the rent attributed to the employee and therefore the incentive to invest may be small. Unions may increase the share the employees skim from the rents induced by the innovation and therefore decrease employee resistance, but also the incentives of firms to innovate, see Machin and Wadhvani (1991). Therefore, the relative bargaining power of employers and employees is important for the strength of employee opposition.

Meyer, Milgrom and Roberts (1992) show in a theoretical model that the prospects of layoffs increase the incentive of employees to exert influence activities. This is especially observed when employees at the endangered units may hope to divert resources from better-off departments and thereby can avoid job losses. Therefore opposition against changes in the entire firm should increase when the employment prospects of the firm or firm units are bleak. Schaefer (1998) assumes that the value of employees' job-related quasi rents is increasing in influence activity and increasing in firm's prospects. Therefore a worsening of the firm's prospects reduces the available job-related quasi rents and thus reduces incentives for influence activity. In this model, the employees can not influence the decision whether a change is introduced or not, but only the form of change. Therefore, it seems an empirical question if stronger opposition against changes is experienced in firms with bleak employment expectations or firms with positive profit expectations.

Also theoretically unclear is the impact of the outside option of the employees on employee resistance. On the one hand a low outside option could have a disciplining effect on the employees who reduce their resistance in order to secure the competitiveness of the firm or reduce their personal unemployment risk. On the other hand, a low outside option may increase resistance, because employees fear imminent labour reductions associated with innovations.

The larger the firm the more indirect are the communication channels and garbling of information may occur. Therefore we might assume that formal resistance against innovations may increase with the size of the firm, see for example Meyer, Milgrom and Roberts (1992).

The empirical evidence in this paper is based on data that do not cover all the aspects mentioned in the theoretical literature. There is no information on management and union activities, the impact of innovations on quasi-rents and their distribution, compensation, or the adoption or training costs in the data. Nevertheless, there are data on the business strategy, the innovation strategy, the outside option of the employees and the prospects of the firm that allow the empirical test of the following hypothesis:

1. Firms pursuing a rationalization and cost cutting strategy encounter high employee opposition against innovations.
2. Firms pursuing an expansion of business strategy encounter low employee opposition against innovations.

3. Innovations that aim at increasing the performance of the employees or may increase the unemployment hazard of the employees should encounter high employee resistance.
4. Innovations that increase employment certainty should encounter low employee resistance.
5. Larger firms encounter higher employee resistance.

4 The Data

The estimation is based on the “Mannheim Innovation Panel in the Services Sector” (MIP-S), a representative questionnaire filled out per wave by about 2500 (personnel) managers in German service firms with more than five employees. A detailed description of the data is provided in Ebling et al. (1999). There are 3 waves available now from 1995, 1997 and 1998. Unfortunately, only the 1995 wave of the MIP-S contains a question about worker resistance as a source of innovation barriers. Therefore, a panel estimation taking account of fixed and random effects is not possible at that moment.

Innovation barriers are measured on an intensity scale from 1 (= not important) to 5 (= very important) and several explanatory variables are also measured by intensity or a dummy variable. Therefore in the cross section regression a multinomial ordered probit model seems to be adequate.

In 1995, 2553 managers filled in the questionnaire. Amongst them 2301 (1493 from West-Germany and 808 from East-Germany) answered on the following question: “Please judge the importance of employee resistance against innovations on a scale from 1 (no importance) to 5 (very high importance) with respect to the extent of the innovation activities of your enterprise in the years 1993 to 1995.” Successful innovators as well as non-innovators expressed the intensity of barriers against innovations in their firms, while managers in those firms that did not even consider to innovate did not comment on this question. Opposition against innovation is therefore measured in firms only that intended to introduce an innovation or introduced an innovation. Finally, unobserved heterogeneity between managers like risk aversion, ability to receive support for a long-run investment project, indebtedness of the firm which might influence manager perception can not be controlled for.

Together with employee opposition, a list of other potential innovation barriers was asked about. In contrast to studies for example by Bitzer and Poppe (1993), Kirsch, Esser, and Gabele (1979) and Fröhlich and Krieger (1990), but in accordance for example with Hauschildt (1999), descriptive statistics reveal that worker resistance is a barrier factor with relatively small importance in comparison to for example innovation costs or financing constraints. Almost half of the

firms indicate that this barrier is not important and innovations are not accompanied by employee opposition. The small importance of employee resistance as a barrier to innovation may result from the time period, the questionnaire was filled out. Between 1993 and 1995, employment shrank and unemployment increased in Germany.⁴ The employment outlook was also bleak in 1995. In addition, labour relations in the service sector were relaxed in the period between 1993 and 1995. The only major strike was in the retail trade sector leading to a single extra premium on wages.

Nevertheless, employee resistance against innovations has enough variation in the data to allow it to be explained by factors mentioned below. Table 1 shows the shares of answers between 1 and 5 indicating the distribution of the relative importance of barriers to innovations.

Table 1: Relative Importance of Barriers to Innovations (Shares and Mean)

Barriers to Innovation	<i>N</i>	1	2	3	4	5	Mean
1: Feasibility is Risky	2308	0.268	0.239	0.276	0.140	0.077	2.521
2: Market Chances are Risky	2300	0.250	0.229	0.253	0.184	0.084	2.626
3: Costs are Risky	2310	0.212	0.229	0.266	0.214	0.079	2.720
4: Costs too High	2299	0.152	0.141	0.231	0.305	0.171	3.203
5: Amortization too Low	2303	0.177	0.171	0.264	0.251	0.137	3.002
6: Innovation Easy to Copy	2310	0.303	0.176	0.182	0.187	0.152	2.714
7: Lack of Capital	2321	0.318	0.173	0.168	0.140	0.201	3.735
8: Lack of Credit	2301	0.439	0.180	0.154	0.097	0.130	2.303
9: Lack of Specialists	2320	0.248	0.207	0.264	0.200	0.081	2.662
10: Lack of Technology	2302	0.353	0.273	0.231	0.110	0.033	2.200
11: Technology is Obsolete	2294	0.342	0.215	0.275	0.129	0.039	2.308
12: Personnel Resistance	2301	0.456	0.229	0.187	0.095	0.033	2.020
13: Red Tape	2301	0.484	0.170	0.131	0.097	0.118	2.199
14: Laws	2288	0.421	0.163	0.168	0.114	0.134	2.375

Remark: *N* is the number of questionnaires with valid answers on the item. The relative importance of barriers is measured on an ordinal scale between 1 (no importance) and 5 (very high importance).

Source: Mannheim Innovation Panel for the Service Sector (MIP-S), wave 1995

Opposition to innovations may be harmful, useful or insignificant for the implementation of innovations (see also the discussion in Hauschildt, 1999). Here, only the harmful aspect of opposition is recorded by classifying employee opposition as a barrier to innovation. Useful opposition that empirically matters, because it reveals the weaknesses in the innovation project or involves practitioners who have an information advantage with respect to the staff in the research and development department is not taken into account here.

Another data restriction is the aggregation level. There is only one set of answers per firm and we therefore cannot analyse the behaviour of individual

⁴Employment decreased by 1.8% in 1993, 0,7% in 1994, and 0,3% in 1995 while unemployment increased from 8,9% in 1993 to 9,4% in 1995, see for example IAB (1996).

workers, teams or different departments in the firm. In addition, we have to rely on the worker resistance level the manager who is filling out the form is experiencing. This perception may vary over the firm's hierarchy (with higher levels perceiving less worker resistance)⁵ and from innovation to innovation. On the other hand, studying managers' perception of worker resistance is important, because it is them who decide whether or not to introduce the innovation, see Bemmels and Reshef (1991).

5 The Evidence

The factors that explain employee opposition in the data set can be divided into four categories. The first category is the business strategy of the firm. The business strategy is covered in the survey by a 16 item list. Several of the answers on the list are highly correlated and therefore the proper approach to include business strategies is by a factor or principal components analysis. The purpose of a factor analysis is to identify a limited range of underlying unobserved components which capture a large proportion of the many observed variables. Here, the choice of factors has to be guided both by the data and by theoretical sense, that is, the interpretability of the factor. The factor analysis reduces the list of 16 items to 7 principal factors with loadings above zero (which is the threshold usually applied for factors). These factors can be interpreted by the items with the highest loadings, compare also the pattern list in Table 4 in the appendix. We find the following generic business strategies:

- Novelty of product, production and organization,
- Cost reduction by outsourcing,
- Low prices and input costs,
- Efficiency in using infrastructure and services,
- Broad variety of products and services,
- Flexibility in client service,
- High reputation and product quality.

The business strategies mentioned in the questionnaire are broadly in accordance with the generic competitive strategies, Porter (1985) defines as suitable for establishing a profitable and sustainable position against competitors. Porter (1985) mentions two basic types of competitive advantage: low cost or differentiation.

⁵A dummy on the position and function of the person who answered the questionnaire proved to be insignificant, however.

Cost Leadership can be achieved by cost reduction, by flexibility and innovation, outsourcing or efficiency in using infrastructure and services. The cost leadership may induce low prices. Differentiation on the other hand may take the form of flexibility in the client service, a broad variety of products and services and a high reputation in product quality. The only strategy that does not fit into both categories is the first one where the firm seeks competitiveness by being at the leading edge in innovations. This strategy consists of the four factors “Novelty of products and services, improvement in client advice and service, cost optimizing by implementing new technologies, and costs optimizing by re-organization”. The last three factors should increase employee resistance because they may lead to rationalization and a higher employee performance demand while the last factor could increase sales and thereby employment security of the employees. The sign of the factor therefore depends on the weights of the individual elements.

If the employees behave according to the hypotheses formulated above, the firm should experience higher worker resistance if the business strategy of the firm implies higher job loss hazards for the employees, higher training costs or demands on employee performance. This is especially the case if the competitive strategy of the firm is cost leadership (Cost reduction by outsourcing, low prices and input costs, and efficiency in using infrastructure and services), because this strategy implies rationalization, intense supervision of labour and tight cost control, see for example Porter (1980).

If the competitive strategy of the firm is to be unique in its industry along some dimensions that are widely valued by buyers, jobs should not be endangered by innovations, the firm offers amenities to attract highly skilled labour and has a creative flair, see Porter (1980). Therefore employee resistance should be negatively correlated with these business strategies (Broad variety of products and services, flexibility in client service, and high reputation and product quality).

The second set of explanatory variables concerns the goals of innovations. Again, this was asked on a 16 item list. The factor analysis produces 6 principal factors with loadings above zero. The factors with the highest loadings lead to the following interpretation of the principal goals of innovations (see Table 5):

- Improve service availability,
- Higher productivity,
- Better employee performance,
- Better product performance during usage,
- Replacement of traditional services,
- Better client friendliness, flexibility and satisfaction.

The first innovation goals aim at increasing the efficiency in production and therefore put pressure on employee performance. Replacement of traditional services demands adoption efforts while it does not increase employment certainty of the employees in the short run. These goals associated with the innovations should therefore increase employee resistance. It is interesting to note that the goal to “increase the motivation of the employees” is highly correlated with the factor “increase in the performance of the employees” and therefore forms one component. The sign of this component therefore depends on the pervasiveness of the two factors.

Better client friendliness, flexibility and satisfaction promises higher employment security when indeed market shares can be secured or increased by this innovation. Nevertheless also demands on employee performance for example in the service sections could increase. Therefore the net effect is unclear in this case.

The third set of economic variables concerns the future prospects of the firm and the outside option of the employees.

- Unemployment rate in the German state (“Land”) the firm is located in,
- Revenues are expected to increase,
- Turn over is expected to increase.

The outside option of the employees is instrumented by the unemployment rate in the region of the firm. It is costly to move from one state to another in order to find a new job (especially in Germany with its low labour mobility). Therefore, the local unemployment rate gives a good indication of the specific average unemployment hazard of the employees. The unemployment rate in the German states in 1995 has been merged from the official unemployment statistics. The sign of these impacts can not be predicted by the theory.

It can be assumed that employee resistance is more likely in larger firms, because supervision seems more difficult and the contact and information between managers and workers is more indirect. Hauschildt (1999) interprets firm size as a proxy for the system complexity and finds a positive correlation between the size of the organization and constructive opposition. The set of control variables are the sector and the location of the firm in East- or West-Germany and the size of the firm. These are the usual control variables, because employee resistance can be expected to differ in these categories. A detailed list of the explanatory variables is provided in Table 3.

The evidence is collected in Table 2. The low costs business strategy has the expected positive sign, while the differentiation strategy leads to lower employee opposition. A pure innovation strategy leads to higher employee resistance against innovations. Therefore the increase in employment performance demand and rationalization outweigh the increase in employment security in firms pursuing this business strategy.

Table 2: Results of Ordered Probit Estimation Explaining Personnel Resistance Against Innovations

Independent variables	coefficients	—z—
Business strategies		
Novelty of product, production and organization	.085 *	1.901
Cost reduction by outsourcing	.238 ***	5.745
Low prices and input costs	.064	.943
Efficiency in using infrastructure and services	.218 **	2.135
Flexibility in client service	-.090 *	-1.665
Broad variety of products and services	-.103 *	-1.852
High reputation and product quality	-.338 **	-2.263
Innovation goals		
Improve service availability	.018	0.466
Higher productivity	.047	1.135
Better employee performance	.102 **	2.328
Better product performance during usage	.065	1.290
Better client friendliness, flexibility and satisfaction	-.095	-1.509
Replacement of traditional services	.181 **	2.239
Turn over is expected to rise	-.061	-.944
Revenues are expected to rise	-.021	-.313
Unemployment rate in state where firm is located	-.007	-.470
Large firm	.288 ***	4.440
Firm located in East-Germany	-.412 ***	-3.723
Wholesale trade	-.071	-.721
Retail trade	-.082	-.730
Transport and telecommunications	-.134	-1.267
Banking and insurance	.042	.447
Computer and software	-.314 **	-2.405
Technical Consulting	-.261 **	-2.148
Number of observations	1405	
Log likelihood	-1820	

Remark: The significance levels are marked by stars:*** means significance lower than one percent, ** lower than five percent and * lower than ten percent.

Source: Mannheim Innovation Panel for the Service Sector (MIP-S), wave 1995.

The innovation goals “better employee performance” and “replacement of traditional services” induce higher employee resistance as expected from the hypothesis.

The sign of the prospects of turn over and profits as well as the outside option was theoretically unclear and the estimation indicates a negative, but insignificant impact.

We observe significantly lower employee resistance in Eastern Germany. Lower worker resistance may be a consequence of a better workforce–management relation in the mainly newly founded and small firms in the East or a stronger consciousness about the necessity of change in order to stay or become competitive. As we also control for regional unemployment rates in the regression, the difference in the outside option in both parts of the country can not be the explaining factor here.

We also allow for sectoral effects by including seven sector dummies for different service branches. Electronic data processing firms encounter significantly less worker resistance than other firms. This may be a consequence of the fact that the electronic data processing branch is notorious for its innovation dynamics. Therefore employees should only choose an employer in electronic data processing when they do not consider permanent adoption costs, changes, and the risk to lose the job as a major problem. Larger firms experience more resistance against changes in our data set. This is in line with other empirical investigations, see for example Daniel (1987). Therefore, the more formal communication channels in larger firms induce higher resistance.

In a further illustrative regression (not reported here) it is shown that the parameters have the same sign and about the same significance level, if the sample is restricted to firms having introduced a process innovation or to firms having introduced a product innovation. The same applies to the parameter indicating the share of innovation expenditures on total revenues and the share of innovation expenditures on investments. These insignificant variables are excluded from the reported regression accordingly, because about 600 firms did not answer at least one of the questions and therefore the number of observations would be reduced significantly.

Resistance of employees against innovations is not the only barrier to innovations asked for in the questionnaire, but there is a list of fourteen items (compare table 4). Therefore it is possible that the managers who answered the questionnaire marked the intensity scale in a similar fashion, in other words there may be multicollinearity between the barrier factors. If this would be the case, the answers to employee resistance would represent a mixture of all barriers to entry and give the general impression of how difficult it is to implement an innovation in the particular firm and not in particular how intense is employee resistance against innovations. A principal components analysis shows that the item “personnel resistance” has the highest uniqueness in the list after the factor “innovation is easy to copy” (6). The factor loadings indicate that accordingly “personnel re-

sistance” and “innovation is easy to copy” are each a factor of their own. Other items on the list may be combined to one factor instead. The factor loadings are displayed in Table 6. These are the factors identified: Risks and costs of the innovation (1-5), personnel resistance (12), bureaucratic barriers (13, 14), lack of capital and technology (7-10), riskiness of the innovation (1,2), and innovation is easy to copy (6). We can therefore conclude that employee resistance is unique enough and sufficiently different from other barriers against innovations that the measurement of it does not pick up other factors.

This conclusion is also confirmed in an additional estimation that includes the intensity answers to the other six independent barriers to entry. The endogeneous variable employee resistance is “corrected” by the difference to the mean of the intensities of all innovation barrier variables. The new endogeneous variable therefore is high if employee resistance is high *in comparison* to all other barrier factors. Performing this transformation, a large number of intensity indicators between 0.2 and 5 are obtained. In order to estimate the impact of the exogeneous factors on the transformed indicator of personnel resistance by ordered probit again, the intensities are grouped to five⁶ again with roughly the same share of firms in each group. The estimation results are reported in table 7 in the appendix. Table 7 reveals that all significant explanatory variables keep their signs while some variables increase their significance levels and some decrease it, see Table 2. The business strategies “low prices” and the innovation goals “improve product by better labour organization and higher productivity” turn signs and are negative now. Finally, the insignificant correlations with the turn over and revenue expectations, and the outside option of the employees reverse signs while they are still insignificant.

6 Conclusions

This paper shows that basic information on the business environment of the firm partly explains personnel resistance against innovations. In a micro-econometric analysis, representative evidence is given that employees do not oppose innovations per se, but they try to prevent the implementation of innovations that endanger their jobs, increase their labour burden and cause large adoption costs. Opposition against innovations depends on the business strategy, the innovation goals, the outside option of the employees, and the prospects of the firm. Worker resistance is higher in firms pursuing cost leadership or innovativeness as their competitive strategy, while it is lower in firms concentrating on differentiation. Firms implementing innovations in order to increase employee performance or substitute traditional products encounter higher opposition than firms who want to increase client satisfaction by the innovation. When the firm expects a positive development of revenues and turn over and therefore the pay-off of adoption

⁶The number of groups does not have an impact on the results.

costs is more likely, employee resistance is lower. A lower outside option of the firm has a disciplinary impact on worker opposition. Findings in the literature that larger firms encounter higher employee resistance are confirmed. Finally, this study shows that firms in the computer and software business experience significantly lower resistance than service firms in other sectors.

We can therefore conclude that the focus in the innovation literature on management strategies, union activities, and institutional factors is too narrow. Also the business strategy of the firm, the innovation goals, the size and the sector of the firm have explanatory value for the prediction if innovations can be implemented successfully.

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7 Appendix

The endogenous variable is personnel resistance. The means and the number of answers (N) of the exogeneous variables included in the ordered probit regressions are given in table 3 below.

Table 3: Data description of exogeneous variables

Definition of dummy-variable	Mean	N
Large firm (more than 100 employees)	.329	2552
Turn over is expected to increase	.553	2507
Location of the firm in East-Germany	.362	2552
Revenues are expecting to increase	.577	2468
Unemployment rate in state (no dummy)	11.79	2543
Wholesale trade	.151	2552
Retail trade	.121	2552
Transport and telecommunications	.144	2552
Banking and insurance	.152	2552
Computer and software	.058	2552
Technical Consulting	.083	2552
Other community services (reference sector)	.291	2552
Number of questionnaires including all variables (net sample)		1405

Source: Mannheim Innovation Panel for the Service Sector (MIP-S), wave 1995.

The following tables 4 to 6 show the factor loadings for the item lists of business strategies, innovation goals, and barriers to innovations.

Table 7 presents the result for the ordered probit estimation of personnel resistance when the intensity of personnel resistance is divided by the average intensity of all barriers to entry.

Table 4: Pattern matrix of factor analysis: Business strategies

Success Factors	Novelty of product, production and organization	Cost reduction by outsourcing	Flexibility in client service	Broad variety of products and services	Low prices and input costs	Efficiency in using infrastructure and services	High reputation and product quality
Low prices					0.25		
High quality							0.06
Flexibility in the reaction to client demands			0.25				
Delivery on time			0.27				
Improvement in client advice and service	0.55						
Marketing and reputation							0.12
Broad product range				0.23			
Various distribution channels				0.29			
Novelty of products and services	0.60						
Cost optimizing by: outsourcing		0.47					
... outsourcing to foreign sites		0.46					
... outsourcing to new sites		0.41					
... implementing new technologies	0.56						
... re-organization	0.57						
... efficient use of infrastructure						0.14	
... reducing energy and material costs					0.32		

Table 5: Pattern matrix of factor analysis: Innovation goals

Innovation expenditures are targeted on:	Improve service availability	Higher productivity	Better employee performance	Better product performance during usage	Better client friendliness, flexibility and satisfaction	Replacement of traditional services
Increase in: client flexibility					0.19	
... client friendliness					0.25	
... reliability	0.62					
... temporal availability of services	0.58					
... spatial availability of services	0.55					
... speed of production/delivery	0.53					
... safety standards				0.31		
... ecological, medical and ergonomic standards				0.33		
... client performance and competitiveness	0.54	0.39				
... client satisfaction					0.11	
... productivity		0.39				
Improvement in maintenance longevity, and recycling of product				0.13		
Increase in motivation of employees			0.39			
Increase in productivity of employees			0.38			
Replacement of traditional services						0.19
Expansion of business areas					0.13	

Table 6: Pattern matrix of factor analysis: Barriers against innovations

Barriers	Risks and costs of innovation	Personnel resistance	Bureaucratic barriers	Lack of capital and technology	Riskiness of innovation	Innovation is easy to copy
Feasibility is risky					0.25	
Market chances are risky					0.28	
Costs are risky	0.70					
Costs too high	0.73					
Amortization too low	0.69					
Innovation easy to copy						0.22
Lack of capital				0.28		
Lack of credit				0.31		
Lack of specialists				0.28		
Lack of Technology				0.37		
Technology is Obsolete						
Personnel Resistance		0.38				
Red Tape			0.55			
Laws			0.54			

Table 7: Results of Ordered Probit Regression Explaining Personnel Resistance Against Innovations, Modified Endogeneous Variable

Independent variables	coefficients	—z—
Business strategies		
Novelty of product, production and organization	0.004	.100
Cost reduction by outsourcing	0.081 **	2.017
Low prices and input costs	-0.115 *	-1.759
Efficiency in using infrastructure and services	0.247 **	2.475
Flexibility in client service	-0.096 *	-1.807
Broad variety of products and services	-0.080	-1.483
High reputation and product quality	-0.295 **	-2.035
Innovation goals		
Improve service availability	-0.127 ***	-3.378
Higher productivity	-0.038	-.954
Better employee performance	0.035	0.816
Better product performance during usage	0.035	0.816
Better client friendliness, flexibility, and satisfaction	-0.086	-1.407
Replacement of traditional services	0.101	1.288
Turn over is expected to rise	0.096	1.513
Revenues are expected to rise	0.000	0.010
Unemployment rate in state where firm is located	0.009	0.602
Large firm	0.386 ***	5.951
Firm located in East-Germany	-0.427 ***	-3.945
Wholesale trade	-0.029	-0.296
Retail trade	-0.004	0.033
Transport and telecommunications	-0.116	-1.123
Banking and insurance	0.131	1.418
Computer and software	-0.507 ***	-4.02
Technical Consulting	-0.420 ***	-3.658
Number of observations	1355	
Log likelihood	-2052	

Remark: The significance levels are marked by stars:*** means significance lower than one percent, ** lower than five percent and * lower than ten percent.

Source: Mannheim Innovation Panel for the Service Sector (MIP-S), wave 1995.