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Perception of Social Costs of Digitalization: Profiling Top Managers, Middle Managers, and Front-line Employees

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Abstract: Although information technology has become advanced in profiling users, we often offer this knowledge to marketing and forget that profiling is needed for information technology implementation itself. If digitalization is introduced in a firm, it may encounter internal resistance. Top managers, middle managers, and front-line employees may have different expectations with regard to digitalization initiatives in their firms. Having different visions of what digitalization is about may result in conflicts with regard to digital solutions selection and implementation and, consequently, lead to digitalization failure. In this paper, we look at differences in digitalization cost perception using a Discrete Choice Experiment. Based on our findings, we propose to approach firms by profiling top managers, middle managers, and front-line employees.

Keywords: Digitalization, Profiling, Discrete Choice Experiment, Social Costs, Software Solutions Perception

1 Introduction

Although information technology has become advanced in profiling users [ENS19], we often offer this knowledge to marketing and forget that profiling is needed for information technology implementation itself. Digitalization as an "emergence of technological platforms of information and communications technology (ICT) is determining significant and unprecedented changes in many aspects of our social and economic life" [CO02]. These different aspects of social life could be addressed using profiling techniques.

Witschel and colleagues [WDK19] argue that "because of path dependencies, lack of sensitivity and experience, high uncertainty and a "knowledge-doing-gap" most companies struggle to respond to digital disruption." One should add another aspect to this list - the social costs of digitalization [BO19, BS10]. Digitalization impacts the whole firm, including top management, middle management, and front-line employees. Yet, if digitalization is being introduced in a firm, it may encounter internal resistance. Top managers and middle managers are different in their decision styles which might lead to

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different outcomes [Nu90]. This is especially important for the digitalization initiative: having different visions of what digitalization is about may result in conflicts with regard to digital solutions selection and implementation. This paper answers a research question "What is the value of different social costs accompanying digitalization for top managers, middle managers, and front-line employees?"

2 Theoretical background

Digitalization is a "process of transforming the structure, processes, people skills and culture of the entire organization so it can use digital technologies to create and offer products, services and experiences that customers, employees and partners find valuable" [SAK16]. Consequently, social costs that a firm encounters incorporate not only the firm's internal costs but also relational costs with the firm's partners. While many researchers focus on direct technology costs during the implementation phase [BL02, IEG97, IL00], it is the social issues that may lead to the failure of organizational transformation [BS10, IL00, ACF00]. In this short paper, we exploratively investigate the differences in perception of social costs of digitalization by the top and middle managers and front-line employees in order to explain reasons for internal struggles and failures of digitalization.

Social costs are costs of perception, i.e., they are by definition of a subjective nature. For instance, even though the price of a product is the same, the associated expected utility will differ for each individual [Mc74]. Moreover, individuals have their own demands, whereby different characteristics of the product may have a different fit [La91]. These different characteristics may impact the willingness to pay, i.e., to bear costs [MW14, MPM19]. Yet, the "payment" can be not only monetary but also a sacrifice of efficacy [HDD14] or efficiency [BO19]. In our study, we want to explore the question of the perception of social costs among managers and front-line employees of a firm. We are interested in the perceived differences between top managers, middle managers, and users without managerial experience. The goal of the study is to understand the differences in willingness to pay (or in our event, willingness to trade efficiency) for different social costs accompanying digitalization projects.

Based on research conducted by Bunduchi and Smart [BS10] and Bogodistov and Ostern [BO19], we decided to focus on the implementation phase of a digitalization project and the three types of its indirect costs: (1) organizational costs, i.e., costs related to necessary changes in corporate practices, structures, and work processes plus temporary declines in productivity; (2) human costs that are attributable to individuals and include training costs or additional time requirements; (3) relational costs, i.e., costs related to the lack of trust that arises from business partners within a supply network [BO19, BS10, ACF00]. Revealing the preferences of each of the investigated groups with regard to the social costs of digitalization can be used as the input for profiling digitalization users.

At the same time, we understand that in order to address the issue systemically and to offer a solution for software developers one needs to introduce structure and, if possible, a categorization of different digitalization users. To do so, one needs to reveal the preferences with regard to each aspect of the social costs of digitalization. In order to achieve this result, we conducted a discrete choice experiment. This method allows us to understand differences in perception of different aspects of digitalization as well as estimate willingness to pay for these aspects. As it would be biasing to ask about the value of different digitalization-related costs in EUR – for small firms 1,000 EUR would be a big sum while for large corporations even 100,000 might be a relatively small number – we used *efficiency growth* as an equivalent of money. Consequently, we were able to calculate willingness to "trade" different social costs of digitalization for efficiency [HDD14]. As each firm has its own value reflected in efficiency, this is a good equivalent for the willingness to pay [BO19].

3 Methodology

3.1 Experimental design

In order to address our research question, we applied a discrete choice experiment. A DCE contains two main types of variables: attributes and levels – the independent variables, and the variable capturing a decision, i.e., the dependent variable. An attribute stands for the name of the category of product-related aspects, e.g., "organizational costs of digitalization" or "relational costs of digitalization". Each attribute can have several levels of a categorical (e.g., "additional learning costs"/ "salary adjustments") or can be of a scalable nature (e.g. "10%, 11%, 12%, 13%"). The decision variable is dichotomous" (project rejected or accepted). We used Qualtrics© in combination with the Conjoint Survey Design Tool by Hainemueller and colleagues [HHY14].

In our DCE, we asked each participant to choose between two digitalization solutions. Each solution had a short description of the associated social costs. Each project referred to four attributes related to organizational, human, and relational costs as well as expected efficiency gains brought through these solutions. Tab. 1 shows the different levels for each attribute of the proposed digitalization solutions.

In order to avoid a possible ordering bias, we randomized the appearance of the attributes and levels. All attribute positions, as well as levels, were randomized (Fig. 1). We adopted the initial attributes and their respective levels from previous research [4, 5].

The willingness to trade efficiency is calculated by the formula [BO19, HDD14]:

$$Willingness\ to\ trade\ efficiency = \frac{B\ of\ focal\ indirect\ cost}{B\ of\ efficiency\ gain * (-1)} \qquad \text{(Equation 1)}$$

Put differently, willingness to trade indicates how much of the level of the attribute "Efficiency gain" the participant would be willing to give up (or receive) in order to start preferring the focal attribute.

Level Attribute	**0**	**1**	**2**	**3**
Organizational Costs	Temporal deceleration of business processes[1]	Excessive usage of company resources	Additional costs for adjustments of business processes	Additional costs for adjustments of the company structure
HR-related Costs	Increased expenditure of employees' time	Additional learning costs of employees	Salary adjustment[2]	Additional HR costs
Relational costs	Emerging 'ill feelings' by business partners	Tensions by business partners due to incompatibilities	Triggering internal discussions by business partners	-
Efficiency gain	10%	11%	12%	13%

Tab. 1: Attributes and levels of a digitalization project, translated from German

3.2 Data Collection and Sample

The population consists of persons who are associated with the implementation of digitalization projects. In particular, the study addressed individuals using digital solutions. We shared the link to the online experiment in groups for digitalization on social networking platforms such as LinkedIn. Further, we distributed the link via email to personal and professional contacts. The study was conducted in German and English language, involving professionals from European countries.

In our analyses, we controlled for the role and position within the company, age, work experience, and country of origin. Overall, we managed to collect 156 answers, whereby 78 participants were female and 78 were male. The average age of participants was 36.76 years (SD = 8.81). We had an interesting representation of functions: 36 participants were managers, followed by 40 participants active in finance/controlling, 18 in Back-Office,

[1] In contrast to the study by Bogodistov and Ostern [4] we stressed the *temporal* nature of business process deceleration.

[2] In Austria and Germany salary adjustment means salary increase since a decrease is legally prohibited.

and 16 from administration or IT. Front-office was represented by 8 participants, 4 were from supply chain management, 2 were from product development, and 32 indicated "other". With regard to the position in their firm and managerial responsibilities, 74 participants indicated "Employee without managerial responsibilities", followed by 36 "Head of Department", and 32 "Middle Management". A number of 12 participants were C-level managers, while 2 participants indicated "Private Entrepreneur" and "Management Support" (German "Stabsstelle"). With regard to their experience, most participants (78) had 6 to 15 years of experience, 42 participants had 1-5 years of experience, 32 participants had more than 15 years of work experience, and 2 participants had worked for less than one year.

As each participant was asked to make ten decisions during the experiment and as each decision contained implicitly two decisions (for one option and against the other option, Fig. 1), we came up with 1,618 cases to analyze (due to a few missing observations).

	Project 1	**Project 2**
Human Costs (in relation to the digitization project)	Additional learning costs of employees (e.g., resource expenditure for training courses)	Changes in salary structure (e.g., due to increased qualification and capabilities of employees)
Organizational Costs (organizing the project implementation)	Excessive usage of company resources (e.g., IT-resources because of newly emerging processes)	Excessive usage of company resources (e.g., IT-resources because of newly emerging processes)
Efficiency Gain (process optimization)	10%	13%
Relational Costs (business partners' costs due to digitization)	Tensions by business partners due to incompatibilities (e.g., the new IT system produces data in a new format)	Triggering internal discussions by business partners (e.g., controversial discourse about similar projects)
Which of the digitalization projects do you prefer?	○	○

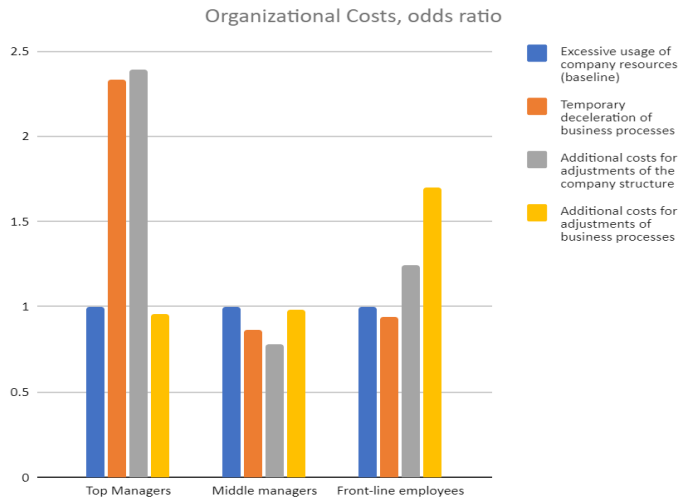
Fig. 1. Example of a Selection Decision, translated from German

4 Results

4.1. Calculation of the perception of the social costs

We analyzed our data using logistic regression as our dependent variable was coded as 0 (project rejected) or 1 (project accepted). We split the file based on the variable "managerial experience". We coded this variable as "top managers" for C-level managers, "middle management" for middle managers and department chiefs, and "no managerial functions" for the rest of the participants. Management support was coded as "middle management", while the private entrepreneur became a "top manager" as being responsible for strategic decision-making in his/her firm. Afterwards, we ran a *t*-test to indicate group moderation effects. We found that there are significant effects within groups and that in some perceptions of costs, results show statistically significant differences between the groups (see Tab. 2, Tab. 3, Tab. 4 in Appendix).

Based on the data, we can depict the profiles of an average top manager, a middle manager, and a front-line employee. As we can see, with regard to organizational and HR-related costs, the perceived value of social costs related to digitalization allows us to create profiles for each target group. For instance, instead of excessive usage of the company's resources top managers would two times more likely prefer temporal deceleration of business processes or would be willing to adjust the company's structure. Front-line employees are also not willing to have excessive usage of resources if compared to adjustments of business processes and their firm's structure. Instead, they would strongly prefer the adjustment of business processes (about 1.7 times more likely option). Middle managers would not trade the excessive usage of resources against adjustment of business processes. Yet, in contrast to top managers and front-line employees, they would rather prefer to excessively use the company's resources than adjust the company's structure (Fig. 2). Knowing the preferences might help, first, frame the digitalization project in an acceptable for the target group way and, second, help software producers address the preferences in the long-term perspective when developing new solutions.



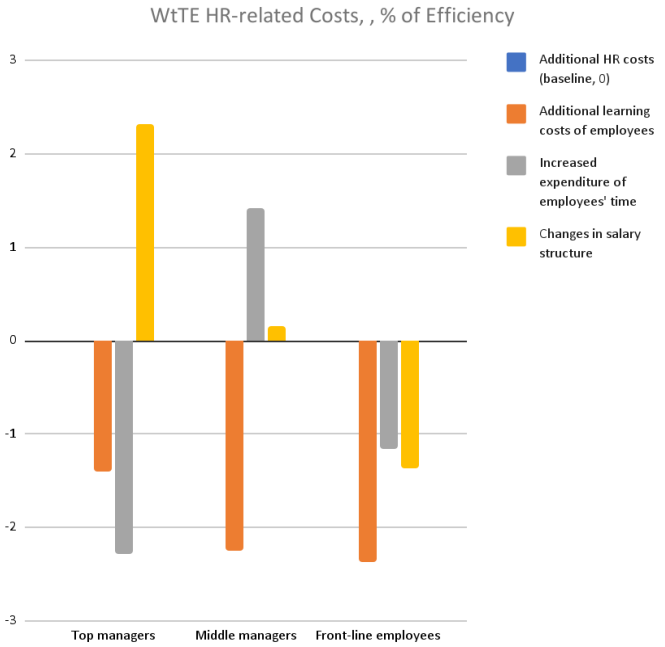
Note: The baseline *Exp(B)*is equal to 1, i.e. the participant is set to be indifferent. The other values are either higher than 1, i.e. the participant prefers the focal attribute over the baseline, or lower than 1, i.e. the participant prefers the baseline over the focal attribute.

Fig. 2. Preferences with regard to organizational costs.

4.2. Profiling based on the willingness to trade social costs against efficiency gains.

After discovering the preferences of different groups of participants with regard to different aspects of social costs of digitalization, we calculated the willingness to trade each of the levels against efficiency gain, i.e. our equivalent of "money". The results are shown in Tab. 5

The perception of efficiency gains allows us to develop the following profiles of managers of different levels as well as of front-line employees with regard to the costs of digitalization costs perception (Equation 1, Fig. 3). Negative values in other attributes indicate that a person needs to be offered a higher efficiency gain in order to accept the social cost. A positive value means that the person is even willing to sacrifice efficiency in order to receive this social cost. All values are comparative, e.g., if a top manager sees that digitalization is accompanied by additional HR costs (baseline) and changes in salary structure, she would accept the latter until efficiency gain does not exceed 3%.



Note: As a baseline value, additional HR costs are set to 0.

Fig. 3. Profiling based on the perceived value of HR-related costs.

5 Discussion

Our analysis made it possible to, first, understand that there are differences in the perception of organizational costs related to digitalization. Our findings elucidate that digitalization plays a different role at different levels of a firm. For instance, we observe that top managers are ready to (temporarily) accept a slow-down of their business processes and their firm's restructuring, but tend to avoid process restructuring and excessive usage of their firm's resources. Yet, the opposite is the case for middle managers. As top managers have to deal with a more abstract level of analysis (e.g. long-term planning), have a better overview of the industry, and possess more information about the internal situation across different divisions and departments of their firm, they may perceive the digitalization as an investment in their capability accepting changes in the hierarchy over changes in business processes [GJ15].

Knowing the existing preferences can help firms explain conflicts that appear within a firm if it starts a digitalization initiative. Moreover, it is not clear, why top managers perceive HR-related costs as less preferable than salary adjustment. Interestingly, the average efficiency gain top managers would be willing to give up for salary adjustments is about 3 per cent. We may assume that they "convert" efficiency gain into money and calculate an adjusted salaries equivalent. A further investigation with the attribute "Price in EUR" in a combination with information about the salaries in a firm could shed light on the reason for the observed result.

Second, if consultants and external software providers offer a digitalization solution, they have to bear in mind that they need to use a different "language" in their communication at different organizational levels [Mo14]. For instance, efficiency gain as a contribution of digitalization is a good argument for front-line employees, but not as good for top managers. Our research might help external providers of software solutions for digitalization to establish better communication and avoid possible conflicts.

Third, any firm should profit from digitalization - a way to re-organize a firm's roles, social life, and business processes [RP20]. Even though the benefits might be clear for top management, they have to communicate them correctly to a firm's middle management and its front-line employees. As our research shows that they have a different understanding of social costs, they need to "frame" digitalization accordingly. Focusing on efficiency gains for front-line employees and the value of employees' work time for middle managers might help them foster the implementation of digital technologies in their firms.

Of course, this research makes only a first step in the direction of profiling different levels within a firm, future steps are needed. For instance, researchers might be interested in investigating profiles of different departments or even the firms' profiles. We can imagine that service-oriented firms might have a different vision of the social costs of digitalization as compared to manufacturing firms and that IT departments (i.e., developers of digitalization solutions) may think differently than sales departments (i.e., users of digitalization solutions). We see great potential in research in this field and stress the necessity of such research. Indeed, the new digital economy requires compromises. Yet, many of these compromises are a matter of perception. If we ignore their perceptive nature, we may end up in a set of conflicts that hinder digitalization and diminish the role of digital technology in firms all over the world.

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Appendix

DV: Decision	Top managers				Middle managers				Difference	
	B	*S.E.*	*p*	*Exp (B)*	*B*	*S.E.*	*p*	*Exp (B)*	*t*	*p*
Organizational costs										
Baseline: "Excessive usage of company resources"										
Temporary deceleration of business processes	.847	.637	.183	2.334	-.147	.241	.541	.863	1.512	.131
Costs for adjustments of the company structure	.871	.667	.191	2.390	-.251	.243	.302	.770	1.679	.094
Costs for adjustments of business processes	-.040	.629	.949	.961	-.018	.234	.939	.982	.035	.972
Human costs										
Baseline: "Additional HR costs"										
Additional learning costs of employees	.264	.599	.659	1.302	.801	.236	.001	2.229	.830	.402
Increased expenditure of employees' time	.429	.657	.515	1.534	-.507	.233	.030	.602	1.452	.147
Salary adjustments	-.436	.607	.472	.646	-.055	.229	.810	.946	.609	.543
Relational costs										
Baseline: "Triggering internal discussions by business partners"										
Tensions by business partners due to incompatibilities	-.332	.540	.539	.717	-.021	.201	.919	.980	.566	.572

Emerging 'ill feelings' by business partners	-1.328	.563	.018	.265	-.244	.207	.237	.783	1.910	.057
Efficiency	.188	.195	.336	1.207	.356	.076	<.001	1.428	.812	.417
Constant	-3.163	4.294	.461	.042	-4.622	1.141	.001	.010	.370	.712

Tab. 2: Top managers' vs middle managers' costs perception

DV: Decision	Top managers				Front-line employees				Difference	
	B	*S.E.*	*p*	*Exp (B)*	*B*	*S.E.*	*p*	*Exp (B)*	*t*	*p*
Organizational costs Baseline: "Excessive usage of company resources"										
Temporary deceleration of business processes	.847	.637	.183	2.334	-.063	.237	.789	.939	1.359	.174
Costs for adjustments of the company structure	.871	.667	.191	2.390	.220	.221	.319	1.246	1.025	.306
Costs for adjustments of business processes	-.040	.629	.949	.961	.530	.232	.022	1.699	.868	.386
Human costs Baseline: "Additional HR costs"										
Additional learning costs of employees	.264	.599	.659	1.302	1.060	.229	.001	2.888	1.233	.218
Increased expenditure of employees' time	.429	.657	.515	1.534	.517	.231	.025	1.677	.135	.892
Salary adjustments	-.436	.607	.472	.646	.612	.229	.007	1.844	1.621	.105

Relational costs Baseline: "Triggering internal discussions by business partners"										
Tensions by business partners due to incompatibilities	-.332	.540	.539	.717	-0,425	0,197	.031	.653	.167	.868
Emerging 'ill feelings' by business partners	-1.328	.563	.018	.265	-0,803	0,200	.001	.448	.922	.357
Efficiency	.188	.195	.336	1.207	0,448	0,074	.001	1.565	1.243	.214
Constant	-3.163	4.294	.461	.042	-4.622	1.141	.001	.004	.660	.510

Tab. 3: Top managers' vs front-line employees' costs perception

DV: Decision	Middle managers				Front-line employees				Difference	
	B	*S.E.*	*p*	*Exp (B)*	*B*	*S.E.*	*p*	*Exp (B)*	*t*	*p*
Organizational costs Baseline: "Excessive usage of company resources"										
Temporary deceleration of business processes	-.147	.241	.541	.863	-.063	.237	.789	.939	.248	.805
Costs for adjustments of the company structure	-.251	.243	.302	.770	.220	.221	.319	1.246	1.439	.150
Costs for adjustments of business processes	-.018	.234	.939	.982	.530	.232	.022	1.699	1.664	.096
Human costs Baseline: "Additional HR costs"										

Additional learning costs of employees	.801	.236	.001	2.229	1.060	.229	.001	2.888	.788	.431
Increased expenditure of employees' time	-.507	.233	.030	.602	.517	.231	.025	1.677	3.119	.002
Salary adjustments	-.055	.229	.810	.946	.612	.229	.007	1.844	2.058	.040
Relational costs Baseline: "Triggering internal discussions by business partners"										
Tensions by business partners due to incompatibilities	-.021	.201	.919	.980	-.425	.197	.031	.653	1.437	.151
Emerging 'ill feelings' by business partners	-.244	.207	.237	.783	-.803	.200	.001	.448	1.945	.052
Efficiency	.356	.076	<.001	1.428	.448	.074	.001	1.565	.863	.388
Constant	-4.622	1.141	.001	.010	-4.622	1.141	.001	.004	.510	.610

Tab. 4: Top managers' vs middle managers' costs perception

DV: Decision	Willingness to trade social costs against efficiency, %		
	Top managers†	Middle managers	Front-line employees
Organizational costs			
Baseline: "Temporary deceleration of business processes"‡			
Excessive usage of company resources	-4.509	.412	.141
Costs for adjustments of business processes	-4.635	.706	-.491
Costs for adjustments of the company structure	.212	.050	-1.184
Human costs			
Baseline: "Additional HR costs"‡			
Additional learning costs of employees	-1.406	-2.249	-2.367
Increased expenditure of employees' time	-2.276	1.423	-1.154
Salary adjustments	2.321	.154	-1.367
Relational costs			
Baseline: "Triggering internal discussions by business partners"‡			
Emerging 'ill feelings' by business partners	1.768	.058	.950
Tensions by business partners due to incompatibilities	7.063	.686	1.793

Note: † – a negative value indicates that one has to pay the participant to make him prefer the indicated option; a positive value indicates that the participant would be willing to pay to have the preferred option. Put differently, even if we say that the accompanied efficiency gain is ≤ to the indicated value, she will prefer the indicated option.

‡ - the baseline (i.e., comparative value). Put differently, if a number is positive, the participant is ready to give up efficiency in order to have the focal cost instead of the baseline cost. A negative value indicates that one has to offer the indicated efficiency gain in order to make the participant prefer this option.

Tab. 5: Willingness to trade different social costs accompanying digitalization against efficiency gain.