
Organisational Routines and Interfirm Collaboration: Measurement Dilemmas and Recommendations for Further Research Steps¹

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Stańczyk-Hugiet E., Kozyra C., Piórkowska K., Stańczyk S.²

Abstract:

Purpose: The paper aims mainly to present the results and consequences of measurement inaccuracies and to make recommendations for further research.

Design/Methodology/Approach: We began our research by providing studies on the theoretical origins of constructs in survey questions. Specifically, we studied the theorems and related constructs. We then reviewed the measurement of the constructs, selecting reliable scales. We conducted an initial study on 101 firms in Poland randomly selected from the high-technology sector, specifically the IT sector. We selected an industry in which inter-firm relationships are common. They are distinguished by high innovation, short product and process life cycles and therefore require many relationships to meet customer expectations. The respondents were top managers. The inclusive criterion was their employment of at least five employees. Collected data were analysed with Statistica 13 software (TIBCO Software Inc. (2017)).

Findings: After solving measurement dilemmas we made methodological recommendations regarding population structure and scales revealing particular constructs.

Originality/Value: The implementation of the recommendations aforementioned would allow to formulate and verify hypotheses resulting from the propositions we have formulated while proposing our research framework. Additionally, we obtained a new Propensity to Collaborate scale as the questions referred to particular dimensions joined in quite different groups. Hence, one item has been deleted and the dimensions have been combined. We propose to check the new scale (without dimensions) in the future research.

Keywords: Organisational routines, interfirm collaboration, measurement scales.

JEL Codes: L1, L2.

Paper Type: Research Paper.

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²Wroclaw University of Economics and Business, ewa.stanczyk-hugiet@ue.wroc.pl; cyprian.kozyra@ue.wroc.pl; katarzyna.piorkowska@ue.wroc.pl; sylwia.stanczyk@ue.wroc.pl

1. Introduction

In the evolutionary logic, the routines are central units for the process of evolution (Nelson and Winter, 1982). Moreover, in organisation and management theory in general, the routine construct is very often the phenomenon under investigation. Organisational routines have been well studied in the past several decades, and numerous research approaches have been developed to study it (Becker, 2002; Loebel, 2012; Narduzzo, Rocco, and Warglien, 2000; Rerup and Feldman, 2011; Teece and Pisano, 1994).

However, there are still limited attempts to study routines in the inter-firm collaboration context (Agostini and Nosella, 2017; Cantwell, Dunning, and Lundan, 2010; Dyer and Hatch, 2006; Johansson and Kask, 2013; Salvato and Rerup, 2011). Our motivation is to introduce and expand an understanding of organisational routine in the inter-firm relationship. To do so, we have made an extensive literature review of routines and inter-firm relationships. The up-to-date literature, in general, emphasises the potential of the routine for change and flexibility (Aroles and McLean, 2016; Geiger and Schröder, 2014; Pentland, Feldman, Becker, and Liu, 2012; Stańczyk-Hugiet, Piórkowska, and Stańczyk, 2017; Yi, Knudsen, and Becker, 2016).

Hence, organisational routines, from the inter-firm relationships studies perspective, may have an impact on a firm's propensity to collaboration. As a result, we argue that organisational routines may play an essential role in forming inter-firm relationships.

We bring the literature of the inter-firm relationship into a discourse with organisational routines. Overall, some researchers assert that organisational routines and inter-firm relationships are interrelated and influence organisational performance (Cohen and Bacdayan, 1994; Cowan, Jonard, and Zimmermann, 2007; Nelson and Winter, 1982). Internal routines allow explaining and articulating the firm inclination to inter-firm relationships and the effectiveness of those relationships. Furthermore, inter-firm relationships encompass the exploitation of resources and capabilities and are faced with existing routines (Floyd and Lane, 2000).

In doing so, we use a survey as a method. When using surveys in management research reliability is most often presented with coefficient alpha as an indicator of internal consistency (Cronbach and Shavelson, 2004; Cronbach and Warrington, 1951). One reason for Alpha's popularity is the reliability estimation of a single measurement tool (Thompson, 2003). Given its omnipresence, the most highly cited methodological articles concern the use and interpretation of Alpha (Hogan, Benjamin, and Brezinski, 2000).

Following the argumentation, as mentioned earlier, it is not surprising that the researchers look for reliable scales to measure specific constructs because measurement clarity is critical for the success of future research. In our research, we did the same. Surprisingly, it turned out that these scales are not entirely reliable with the research carried out.

Hence, the paper aims mainly to present the results and consequences of measurement inaccuracies and to make recommendations for further research. A broader, methodological perspective is essential because methodological rigour is the fundamental value of recognising research results as scientific ones.

Along with this study, the contribution is two-fold. First, our paper contributes to the organisational routines research and to inter-firm research by proposing a formal model, which shows the relationship between routine concept and inter-firm dynamics determined by external and internal context. That relationship enables a firm to form collaborative relationships assuming the organisational routines imply a firm's propensity to enter collaborative relationships. Hence, we match a routine concept and inter-firm perspective to examine whether organisational routines may determine collaboration. Second, we contribute to the development of organisational routines stream from a methodological perspective. We discussed the measurement tools that we had implemented in our study. Namely, following statistical analysis results we presented methodological dilemmas and recommendations for the future research steps.

In the next sections, we present research design including the rationale for our research framework and propositions. We also discuss measurement challenges and formulate adequate recommendations. We conclude with methodological suggestions for further research.

2. Research Design

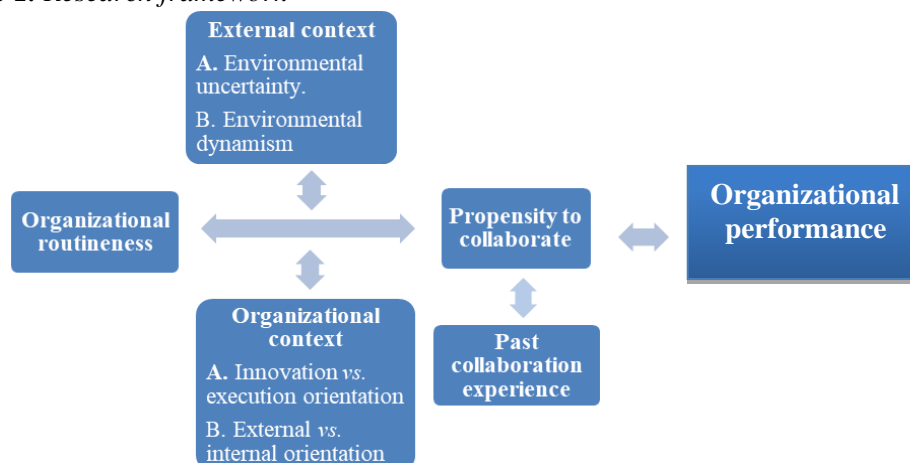
Because methodology and measurement originate from the conceptualisation of the constructs, we begin our research by providing studies on the theoretical origins of constructs in survey questions. Specifically, we study the theorems and related constructs. We then review the measurement of the constructs, selecting reliable scales that expose satisfactory Cronbach's Alpha.

The purpose of the following sections is to describe the methodology used to answer two questions: (1) Are the adopted measurement tools relevant in the research context? and (2) Whether and how does the initial research model need corrections due to measurement inaccuracies? Measurement is a foundation for building organisational theory (Schmidt, 2010). Specifically, in a theory-testing context, if the measurement of the construct is insufficient, then the observed relationships provide marginal or even no meaningful information (Podsakoff, MacKenzie, and Podsakoff, 2016). That is why high-quality research requires adopting of validated

measures (DeVellis, 2016). As mentioned, scale development started with a literature review and extracting items for each of the constructs. The constructs are defined and followed by a request to indicate the extent to which items measure the critical construct.

We focus on whether and how organisational routines result in forming collaborative relationships. We theorise organisational routines imply a firm's propensity to enter collaborative relationships, which in turn is supposed to be related to past experience collaboration. Nevertheless, the process is also under the influence of contextual factors. Taking into account the perspective of collaboration, we consider both external and internal contexts. External context associates with environmental dynamism and uncertainty whether internal (organisational) one links to managerial innovation vs execution orientation and external vs internal orientation. An initial research framework has been presented in Figure 1.

Figure 1. Research framework



Source: Based on authors' own research.

Below, we present the rationale for developing the framework and adapting the scales for each construct. Organizational routines and specifically job routineness – the first key construct - is the important variable influencing organizational context in general (Aiken and Hage, 1966). We use operationalization of this construct taking arguments of Dewar, Wetten and Boje (1980) who have done analysis of scale of Aiken and Hage. The operationalization is the same, so no conceptualization is required here. The details we can find in the book by Hage (1980). Job routineness consists of two items: (1) 'nothing new, the same day in day out', and (2) 'the task is simple and no variety is involved'.

The next critical construct for our study is related to inter-firm stream of research. Inter-firm collaboration is a relevant topic today. After literature review we suppose that organisational routineness level is associated with organisational propensity to collaborate. We propose that the higher the level of routineness, the lower the propensity to collaborate (proposition 1). Henceforward identifying the constructs determining collaborative relationships seems to be reasonable for adequate constructs measurement and theory development subsequently. Previous research shows that historical relationships are the significant antecedent of forming new inter-firm relationships (Smith, Carroll, and Ashford, 1995; Tiessen and Linton, 2000).

In general, there is a lack of research on the role of specific experience in forming an inter-firm relationship and its consequences for organisational performance. We assume that propensity to collaborate influences the organisational performance. We would even assume that propensity to collaborate is positively related to organisational performance (proposition 2). However, there is little research addressing the issue of routine from the inter-firm perspective (Agostini and Nosella, 2017; Cantwell *et al.*, 2010; Johansson and Kask, 2013; Luoma, Laamanen, and Lamberg, 2020; Mathews, 2001). To reduce this limitation in organisational routines research as well as in inter-firm research, we propose the construct named propensity to collaborate to measure firm propensity to enter inter-firm relationships.

After careful literature studies, we adopt an inter-organisational trust scale developed by Seppänen (2008), to measure the propensity to collaborate. This measure consists of three dimensions: capability (the exemplary item: ‘The products/services of our partner company are of good quality’), goodwill (the exemplary item: ‘When making important decisions, the partner company also considers our welfare’), and self-reference (the exemplary item is: ‘The partner company is aware of its own capabilities’), and refers to a vital construct related to collaboration. Trust is an essential construct in studying inter-firm collaboration (Nielsen, 2004).

Most authors agree that there are two essential yet imperative factors that form a relationship – trust and commitment (Wang, 2012). However, trust impacts commitment (Kusari *et al.*, 2013), and it is an antecedents for commitment (Palmatier *et al.*, 2013). Thus, trust is the general relationship indicator (Meng, 2010), it is at the heart of a relationship (Kam and Lai, 2018). Trust is a relational feature important for collaboration (Hastings *et al.*, 2016). It contributes to the collaboration tendency to enter and follow inter-firm relationships (Madhok, 2006).

Besides, empirical studies have shown that trust influences the intent, reliability, and fairness of partner behaviour (Zaheer, McEvily, and Perrone, 1998), allows for constructive interpretation of partner motives (Uzzi, 1997), reduces the potential for conflict (Zaheer *et al.*, 1998), encourages information flow between partners (Sako, 1991; Zand, 1972), and mitigates uncertainty about partner behaviour (Krishnan, Martin, and Noorderhaven, 2006). Moreover, prior research fails to involve trust,

which leaves ample room for investigation into the decision to enter cooptation (Czernek and Czakon, 2016).

Additionally, a set of studies indicates considering collaboration characteristics as network-level antecedents. High intensity of collaboration influences building legitimacy and trust (Zahoor, Al-Tabbaa, Khan, and Wood, 2020). We found similar to the propensity to collaborate construct called collaboration management capability. The one to study the ability of a firm to maintain long-lasting relationships by using a set of routines, skills, or both is that developed by (Al-Tabbaa, Leach, and Khan, 2019). However, the propensity to collaborate in our study is to measure willingness rather than maintenance.

Academics have emphasised the relationship-specific experiences (Gnyawali and Park, 2011; Zaheer *et al.*, 1998) behind the development of inter-firm relations over time and emphasise the specific interaction among firms, which develop in the course of repeated collaboration (Reuer, Zollo, and Singh, 2002). For that reason, we use past collaboration experience as a construct corresponding with the notion that routines originate from previous routines (Felin and Foss, 2005; Nelson and Winter, 1982). Past relational experience may make firm to be able and wanting to form new collaborative relationships. What is more, it may influence the successful management of the relationship (Reuer *et al.*, 2002).

Hence, we propose that past relational experience is strongly related to propensity to collaborate (Proposition 3). To measure past collaboration experience as a control variable highlighting the firm-level experience in managing inter-firm relationships, we adapt the measure developed by (Zaheer *et al.*, 1998). This scale contains three dimensions including more specifically: relational reliability, predictability and competence of partners (the exemplary item: 'The partner has been frank in dealing with us'), goodwill, benevolence and honesty (the exemplary item: 'The partner may use opportunities that arise to profit at our expense'), and inter-firm-learning to examine the predictability, opportunistic intent, and fairness of the exchange partner (the exemplary item: 'We learned or acquired some new or important information from the partner').

The organisational context refers to a managerial and organisational orientation where the routines are embedded. A lot of studies have presented that routines are specific to the organisation in which they exist (Rerup and Feldman, 2011). The organisational context in our study includes innovation vs execution orientation as a managerial orientation modes and external vs internal market orientation describing organisational orientation modes.

Managers may try to influence the organisational context affected by routines to affect routines. Managerial preferences for being innovative versus being execution-oriented we argue as important factors describing organisational context. Managerial innovation-orientation, in contrary to execution-orientation, highlights the manager's

ability to create and apply novel ideas and initiatives within the firm (Norris and Ciesielska, 2019). The execution vs innovation orientation has significant effects on the propensity to collaborate and subsequently on corporate performance. We therefore assume that managerial execution-oriented performance moderates negatively the relationship between routineness and propensity to collaborate (proposition 4). Moreover, we also propose that managerial innovation-oriented performance moderates positively the relationship between routineness and propensity to collaborate (proposition 6).

To evaluate those relationships, we use the dimension called behavioural innovativeness as a construct describing innovation-oriented performance. We use innovation orientation measure (Wang and Ahmed, 2007) revealing Alpha of Components on an acceptable level in previous research. This is a 4-items scale. The exemplary item is 'We encourage people to think and behave in original and novel ways'. To measure execution-oriented behaviour, we use counterproductive work behaviour scale (Ho, 2012) as a construct describing the task-focused items with satisfactory reliabilities. As a result, the execution-oriented behaviour are measured using 9-items scale. The exemplary item is 'Failed to warn someone of upcoming work problems or issues'.

External vs internal market orientation has dominated the research and practise of marketing strategy (Rodrigues and Pinho, 2012) arguing that market orientation is the implementation of the marketing concept (Jaworski and Kohli, 1993; Slater and Narver, 1994). Previous theoretical and empirical research has supported a positive relationship between market orientation and organisational performance, specifically market orientation influence on financial and non-financial indicators of performance. As we assumed that organisational performance may be influenced by propensity to collaborate, which in turn might be related to routineness, we propose that external orientation positively moderates the relationship between routineness and propensity to collaborate (proposition 7).

In a similar vein, we propose that internal orientation negatively moderates the relationship between routineness and propensity to collaborate (proposition 8). The empirical studies question the most popular in marketing research the market orientation dimensions recommended by Slater and Narver (1994) by providing different results about their contributions to the construct (Zhou, Brown, and Dev, 2009). Against this conditions, we take different items of the market orientation construct proposed by de Waal (2013). This measurement scale consists of seven items. The exemplary item is 'Continuously strive to enhance customer value creation'.

Organisational routines and propensity to collaborate are not only under the influence of internal conditions, but they are also externally stimulated and consequently all routine activities evolve (Zollo and Winter, 2002). It has been also evidenced that external sources are responsible for actors' composition and inter-

organisational collaboration dynamics (Majchrzak, Jarvenpaa, and Bagherzadeh, 2015). Hence, we propose that environmental dynamics and environmental uncertainty moderate positively the relationship between routineness and propensity to collaborate. The external context we measure using existing scales for environmental uncertainty adopted from John and Weitz (1988) (5-item scale, the exemplary one: 'Stable market shares Volatile market shares' and environmental dynamism (5-item scale, the exemplary one: 'The environmental demands on us are constantly changing') developed by Schilke (2014).

To sum up, the survey consisted of fifty four items, eleven propensity to collaborate items, two job routineness items, four innovation orientation items (called behavioural innovativeness), nine execution/task-focused behaviour items, seven external orientation items, three past collaboration experience dimensions consisting of 9 items, two organisational performance items, five environmental uncertainty items, and five environmental dynamism items. The survey instrument that was designed to capture views on the validity and appropriateness of items brings quantitative feedback.

3. Measurement: Challenges and Recommendations

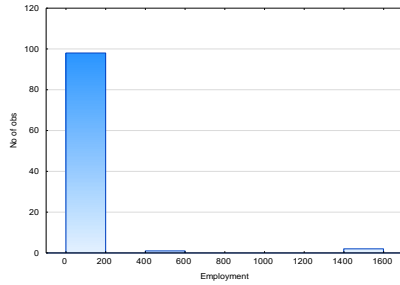
We conducted an initial study on 101 firms in Poland randomly selected from the high-technology sector, specifically the IT sector. We selected an industry in which inter-firm relationships are common. They are distinguished by high innovation, short product and process life cycles and therefore require many relationships to meet customer expectations. The high-technology sector meets this criterion. Inter-firm relationships are widespread in the high-technology sector (Almeida, Phene, and Grant, 2003). It is almost imperative for high-tech firms to form inter-firm relationships because a large part of innovative activity in high-tech industries occurs through relationships (Hagedoorn, 1993; Rothaermel and Deeds, 2004). The respondents were top managers. The inclusive criterion was their employment of at least five employees. Collected data were analysed with Statistica 13 software (TIBCO Software Inc. (2017). Statistica (data analysis software system), version 13. <http://statistica.io>).

3.1 Demographic Variables Analysis

However, as it has occurred, the sample is not homogenous concerning the employment structure. Figure 1 presents extreme companies; namely, two of them count 1500 employees, two several hundred ones. The others are micro- and small enterprises.

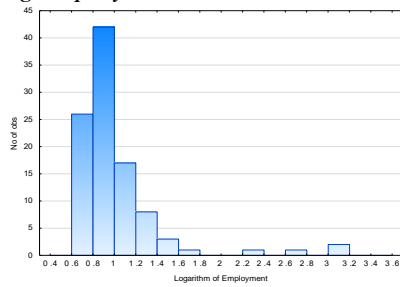
Even if we use the logarithm for the right-skewed distribution, the situation will not change (i.e. log above three concerns the companies employing more than 1000 employees and a dominant is slightly less than 1). Furthermore, we cannot obtain a more normal distribution (Figures 2, 3 and 4).

Figure 1. Histogram of employment



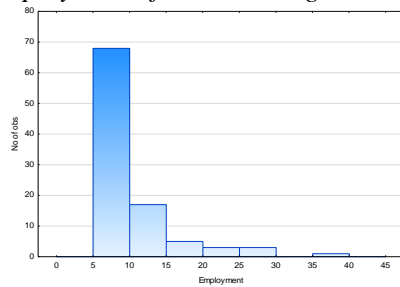
Source: Own study.

Figure 2. Histogram of log employment



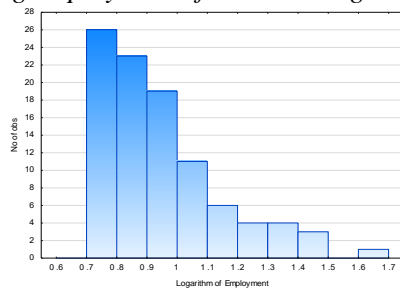
Source: Own study.

Figure 3. Histogram of employment after extracting extreme companies



Source: Own study.

Figure 4. Histogram of log employment after extracting extreme companies



Source: Own study.

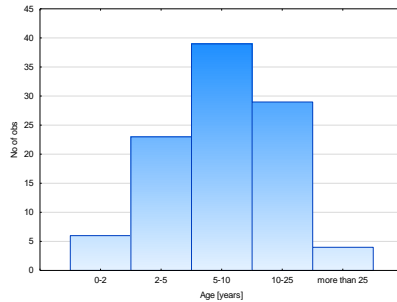
Consequently, we have formulated the following recommendation:

Recommendation 1: In future research, it would be better to focus on micro- and small enterprises in the IT sector. In the current research, we propose not to extract our extreme companies since such a small number of those enterprises should not disturb the correlation results.

When it comes to the analysis of the age distribution, we conclude that it is entirely appropriate (Figure 5). We just recommend as follows:

Recommendation 2: Taking into account a small number of extreme companies (below two years and above 25 years), we propose to combine them with adjacent categories. Then, we would have three main categories with a similar numerical amount.

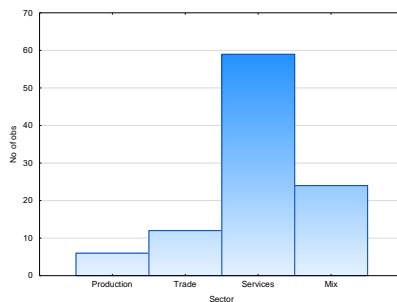
Figure 5. Histogram of age



Source: Own study.

As for sectors, which examined companies operate, services and mixed operations are dominant (Figure 6).

Figure 6. Histogram of sectors



Source: Own study.

We also investigated the relationships between the employment size and sectors, and we noticed that there were no strong relations (Table 1).

Table 1. A two-way contingency table including sectors and employment size

Contingency table Table:M3(4) x Employment category (3)				
M3	Employment 5-9 employees	Employment 10-49 employees	Employment 50 and more employees	Total
Production	4	2	0	6
Trade	8	4	0	12
Services	38	18	3	59
Mix	13	10	1	24
Total	63	34	4	101

Source: Own study.

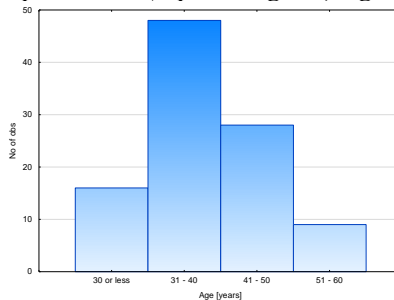
Hence, we propose the following solution:

Recommendation 3: We recommend to distinguish two main categories, namely non-trade services, and the others.

Concerning the last demographics variable, we remark it is quite suitable (Figure 7). However, we notice that the number of managers aged 51-60 years is relatively small. Hence, we have formulated the following recommendation:

Recommendation 4: We recommend to combine the category of managers aged 51-60 years with the category of managers aged 41-50 years.

Figure 7. Histogram of respondents' (top managers') age.

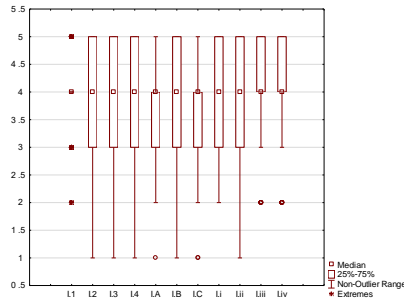


Source: Own study.

3.2 Descriptive Statistics Analysis

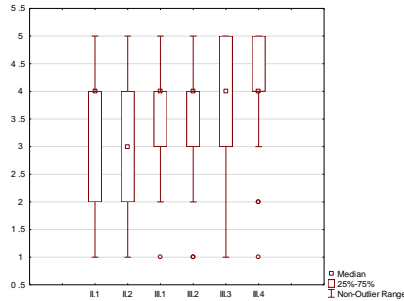
Due to the descriptive statistics of survey answers, we present box plots for many variables (Figure 8 – Figure 14). The box plots enable not only to analyse median and quartiles but also to find such questions in the questionnaire for which most of the respondents selected one category.

Figure 8. The box plots for the questions from the group I (propensity to collaborate items).



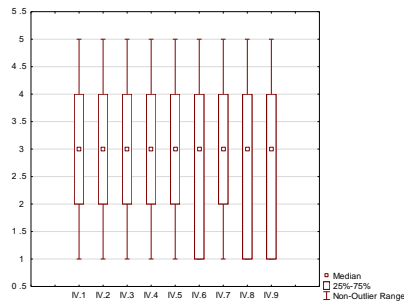
Source: Own study.

Figure 9. The box plots for the questions from the groups II and III (job routinness and managerial innovation orientation items).



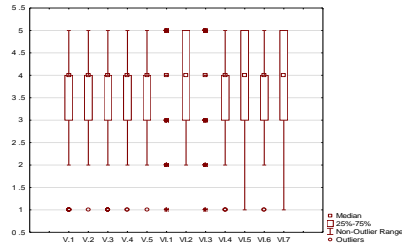
Source: Own study.

Figure 10. The box plots for the questions from the group IV (managerial execution orientation items).



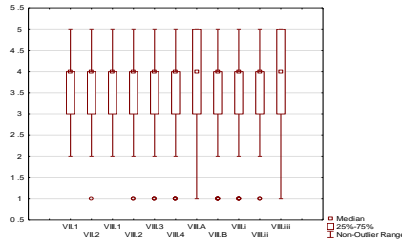
Source: Own study.

Figure 11. The box plots for the questions from the groups V and VI (environmental dynamism and external orientation items).



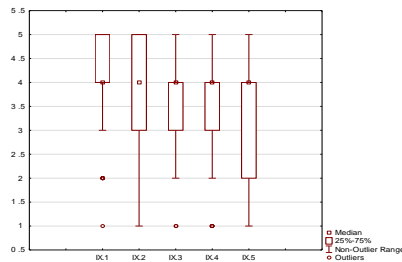
Source: Own study.

Figure 12. The box plots for the questions from the groups VII and VIII (organisational performance and past collaboration experience items).



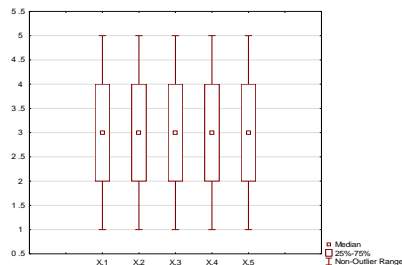
Source: Own study.

Figure 13. The box plots for the questions from the group IX (technological turbulence)



Source: Own study.

Figure 14. The box plots for the questions from the group X (environmental uncertainty items).



Source: Own study.

Thus, we have formulated the following recommendation:

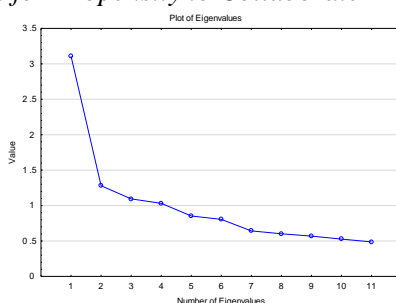
Recommendation 5: To ensure more study clarity, we recommend to extract from the questionnaire the following questions: I.1 (The products/services of our partner company are of good quality), VI.1 (Continuously strive to enhance customer value creation) and VI.3 (Monitor the environment consequently and respond adequately).

4. Reliability and Variability Analysis

We decided to check the survey credibility employing reliability, variability, and survey questions content analysis. We tested the reliability using the Cronbach alpha coefficient. When it comes to the variability, we used the exploratory factor analysis and supportively surveyed questions content analysis. As we have presented in the previous section, we selected measurement scales with right level reliability. Nonetheless, in our study, 6 of all the scales did not reach Cronbach Alpha 0,7 what we presented below. We implemented the following ways of tackling reliability problems: combining scales measuring similar issues, not including items decreasing the reliability as well as the measurement using one the most important question from the given scale.

An original scale - Inter-organisational trust – propensity to collaborate includes eleven items divided into three dimensions (capability, goodwill, self-reference). In our study, the factor loads after varimax rotation show that items have grouped in a different way than theoretical factors (Figure 15, Table 2).

Figure 15. The scree plot for Propensity to Collaborate



Source: Own study.

Table 2. The factor matrix for Propensity to Collaborate

Variable	Factor loadings.(Varimax normalised) Principal components (Marked factors >.500000)			
	Factor 1	Factor 2	Factor 3	Factor 4
I.1	-0.153433	0.742981	0.118187	0.242169

Variable	Factor loadings.(Varimax normalised) Principal components (Marked factors >.500000)			
	Factor 1	Factor 2	Factor 3	Factor 4
I.2	0.220656	-0.110469	-0.035322	0.711900
I.3	0.011191	0.233421	0.168660	0.681168
I.4	0.212637	0.291466	0.758523	-0.113322
I.A	0.200789	0.776692	0.073990	-0.058568
I.B	-0.051834	-0.076788	0.757123	0.305404
I.C	0.487409	0.400679	0.214146	0.292273
I.i	0.828163	0.025609	0.168430	0.056710
I.ii	0.216020	0.453942	-0.130671	0.500664
I.iii	0.674540	0.033927	-0.089728	0.269848
I.iv	0.231538	0.140437	0.254436	0.511101
Initial	1.639273	1.700946	1.361819	1.812328
Share	0.149025	0.154631	0.123802	0.164757

Source: Own study.

The factor analysis shows that there is no reliable scale in particular dimensions. Hence, we decided to check the reliability for the whole scale (without extracting dimensions) (Table 3).

Table 3. *The reliability analysis for the whole scale Propensity to Collaborate*

Variable	Aver.=42.6337 St.dev.=5.30231 N:101 Cronbach's alpha: .737486 Stand. alpha:.739351 Aver. correl: .206786				
	Aver, if extr.	Var., if extr.	St. dev. if extr.	Tot. correl.	Alpha, if extr.
I.1	38.64357	24.80365	4.980326	0.357139	0.722783
I.2	38.73267	24.19586	4.918929	0.328454	0.725768
I.3	38.78218	22.92285	4.787781	0.442234	0.710013
I.4	38.78218	23.63573	4.861659	0.335129	0.725834
I.A	38.84158	24.11352	4.910552	0.346452	0.723368
I.B	38.89109	23.78022	4.876496	0.275374	0.736750
I.C	38.98020	21.60357	4.647964	0.548350	0.692699
I.i	38.71287	23.98687	4.897639	0.389575	0.717988
I.ii	38.66337	22.95598	4.791240	0.437782	0.710659
I.iii	38.64357	24.40761	4.940405	0.343631	0.723694
I.iv	38.66337	23.29262	4.826242	0.433177	0.711723

Source: Own study.

The results show that resigning from particular dimensions of the scale allows receiving the reliability higher than 0,7. Moreover, extracting the question I.B. that is at the least level correlated with the other questions did not change the reliability

level. Averaging for measuring only one factor might be justified with a very high decrease of the first value in the scree plot. Hence, we recommend the solution as follows:

Recommendation 6: We recommend to resign from analysing particular dimensions of the Propensity to Collaborate scale as well as to extract the question I.B.

The second scale – Job Routineness – is reliable in our study at a very similar level to the original scale (Table 4). Thus, we do not suggest any changes in the further steps of our analysis.

Table 4. The reliability analysis for the scale Job Routineness

Variable	Summary for scale: Mean=6.49505 Std.Dv.=2.23438 Valid N:101 Cronbach alpha: .732984 Standardized alpha: .738604 Average inter-item corr.: .585545				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
II.1	3 .118812	1 .807666	1 .344495	0 .585545	
II.2	3 .376238	1 .323792	1 .150561	0 .585545	

Source: Own study.

The next measurement scale – Innovation oriented behaviour – has occurred to be unreliable in our study (Table 5) due to general cut-off standards. What we can argue with our result is that .586 is close to .600 and even if this is not good could be acceptable score and we can accept this limitation in further analysis. So, in the literature we can find reference for .600 and claim that our reliability is close to this threshold. The cut-off points between .5 - .7 is appropriate for moderate reliability (Brownlow, Hinton, & McMurray, 2014). In addition, an expert's positive opinion back up our action.

Table 5. The reliability analysis for the scale Innovation orientation

Variable	Summary for scale: Mean=15.4257 Std.Dv.=2.38473 Valid N:101 Cronbach alpha: .397600 Standardized alpha: .386593 Average inter-item corr.: .137797				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
III.1	11 .69	3 .975	1 .994	0 .162	0 .389
III.2	11 .72	3 .507	1 .873	0 .291	0 .247
III.3	11 .58	3 .253	1 .804	0 .297	0 .232
III.4	11 .28	4 .478	2 .116	0 .120	0 .418

Source: Own study.

We decided to check the correlation between Innovation orientation and Execution orientation. In contrary to the Innovation orientation scale, we found that the Execution orientation one is very reliable in our study (Table 6).

Table 6. *The reliability analysis for the scale Execution orientation*

Variable	Summary for scale: Mean=25.5644 Std.Dv.=9.09991 Valid N:101 Cronbach alpha: .907606 Standardized alpha: .906840 Average inter-item corr.: .525123				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
IV.1	22 .60	63 .19	7 .949	0 .748	0 .892
IV.2	22 .60	68 .16	8 .256	0 .629	0 .901
IV.3	22 .65	65 .81	8 .112	0 .693	0 .897
IV.4	22 .80	67 .86	8 .238	0 .577	0 .905
IV.5	22 .73	69 .09	8 .312	0 .578	0 .904
IV.6	22 .89	63 .56	7 .973	0 .756	0 .892
IV.7	22 .67	63 .53	7 .970	0 .744	0 .893
IV.8	22 .78	64 .33	8 .021	0 .733	0 .894
IV.9	22 .77	64 .24	8 .015	0 .698	0 .896

Source: Own study.

Table 7. *The factor analysis for the scales Innovation orientation and Execution orientation*

Variable	Factor Loadings (Varimax normalized) Extraction: Principal components (Marked loadings are >.500000)	
	Factor 1	Factor 2
III.1	-0 .108	0 .802
III.2	-0 .362	0 .533
III.3	-0 .487	0 .101
III.4	-0 .340	-0 .342
IV.1	0 .815	0 .036
IV.2	0 .707	0 .080
IV.3	0 .755	-0 .183
IV.4	0 .684	0 .418
IV.5	0 .639	-0 .105
IV.6	0 .812	-0 .009
IV.7	0 .800	-0 .187
IV.8	0 .780	-0 .065
IV.9	0 .766	-0 .131
Expl.Var	5 .599	1 .338
Prp.Totl	0 .431	0 .103

Source: Own study.

We just propose, in this case as follows:

Recommendation 7: We recommend to extract the least correlated question IV.4.

Then, we conducted the factor analysis for the Innovation orientation and Execution orientation altogether (Table 7).

The factor analysis convinced us that innovation orientation and execution one are independent each other, and it would be better not to join them. Consequently, we formulated the following recommendation:

Recommendation 8: We recommend to implement another scale representing managerial innovation orientation (e.g. Narver et al. (2004) innovation orientation scale).

The next scale – Environmental dynamism – revealed the reliability of nearly 0,6 (Table 8). Interestingly, some researchers accept such a level of reliability in social and behavioural science, so it might be considered to be used. Alpha value less than 0.7 is also acceptable (Hair, Black, Babin, Anderson, and Tatham, 2006) when we measure variable with for instance, three items and if variables are correlated. Nunnally (1978) recommends a minimum level of .7. Cronbach alpha values are dependent on the number of items in the scale. When there are a small number of items in the scale (fewer than 10), Cronbach alpha values can be quite small. In this situation, it may be better to calculate and report the mean inter-item correlation for the items (Starkweather, 2012). Optimal mean inter-item correlation values range from .2 to .4 (as recommended by Briggs and Cheek (1986)).

Table 8. *The reliability analysis for the scale Environmental dynamism*

Variable	Summary for scale: Mean=17.6436 Std.Dv.=3.19870 Valid N:101 Cronbach alpha: .591301 Standardized alpha: .595032 Average inter-item corr.: .228003				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
V.1	14 .33	6 .893	2 .625	0 .334	0 .546
V.2	14 .03	7 .494	2 .738	0 .379	0 .524
V.3	14 .27	6 .632	2 .575	0 .406	0 .502
V.4	14 .05	7 .493	2 .737	0 .270	0 .578
V.5	13 .90	7 .218	2 .687	0 .362	0 .529

Source: Own study.

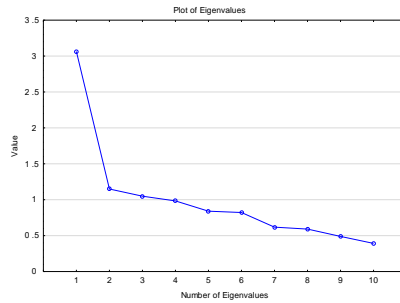
Table 9. *The reliability r analysis for the scale Environmental uncertainty*

Variable	Summary for scale: Mean=15.7030 Std.Dv.=3.88984 Valid N:101 Cronbach alpha: .684751 Standardized alpha: .685444 Average inter-item corr.: .306108				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
X.1	12 .70	9 .89	3 .145	0 .476	0 .618
X.2	12 .53	10 .31	3 .211	0 .423	0 .642
X.3	12 .50	10 .11	3 .180	0 .508	0 .605
X.4	12 .68	10 .51	3 .242	0 .393	0 .655
X.5	12 .40	10 .89	3 .300	0 .399	0 .651

Source: Own study.

Simultaneously, we considered replacing the Environmental dynamism scale with the Environmental uncertainty one. The reliability of this scale is 0,68 (Table 9). On the other hand, we thought about combining those two scales (Figure 16, Table 10, Table 11).

Figure 16. *The scree plot for Environmental dynamism and Environmental uncertainty*



Source: Own study.

Table 10. *The factor analysis for Environmental dynamism and Environmental uncertainty*

Variable	Factor Loadings Extraction: Principal components (Marked loadings are >.500000)
	Factor 1
V.1	-0 .556
V.2	-0 .483
V.3	-0 .538
V.4	-0 .421
V.5	-0 .537
X.1	-0 .596
X.2	-0 .598
X.3	-0 .675
X.4	-0 .580
X.5	-0 .512
Expl.Var	3 .063
Prp.Totl	0 .306

Source: Own study.

Table 11. *The reliability analysis for Environmental dynamism and Environmental uncertainty*

Variable	Summary for scale: Mean=33.3465 Std.Dv.=6.09989 Valid N:101 Cronbach alpha: .745789 Standardized alpha: .744783 Average inter-item corr.: .227811				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted

V.1	30 .03	30 .54	5 .527	0 .405	0 .725
V.2	29 .73	32 .45	5 .697	0 .355	0 .733
V.3	29 .97	30 .88	5 .557	0 .390	0 .728
V.4	29 .75	32 .21	5 .675	0 .299	0 .740
V.5	29 .60	31 .47	5 .610	0 .395	0 .727
X.1	30 .35	29 .59	5 .440	0 .439	0 .720
X.2	30 .18	29 .61	5 .442	0 .446	0 .719
X.3	30 .14	29 .23	5 .406	0 .525	0 .707
X.4	30 .33	29 .71	5 .450	0 .439	0 .720
X.5	30 .04	31 .15	5 .581	0 .367	0 .731

Source: Own study.

The factor and reliability analysis for the environmental dynamism scale and the Environmental uncertainty one shows that the combined scale is reliable at the .75 level. Additionally, potentially shortening the scale does not lead to the reliability lower than .7. Hence, we propose as follows:

Recommendation 9: We recommend to combine the Environmental dynamism scale and the Environmental uncertainty one and just to call it Environmental unpredictability.

The next scale – External orientation – showed the reliability at the 0,61 level (Table 12).

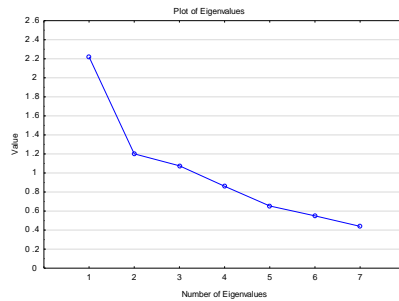
Table 12. The reliability analysis for External orientation

Variable	Summary for scale: Mean=26.7525 Std.Dv.=3.75874 Valid N:101 Cronbach alpha: .612677 Standardized alpha: .615376 Average inter-item corr.: .190381				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VI.1	22 .88	10 .05	3 .169	0 .522	0 .510
VI.2	22 .87	10 .13	3 .183	0 .474	0 .524
VI.3	22 .84	12 .01	3 .466	0 .191	0 .616
VI.4	23 .12	10 .92	3 .304	0 .284	0 .591
VI.5	22 .81	11 .16	3 .341	0 .308	0 .581
VI.6	23 .08	11 .42	3 .379	0 .214	0 .615
VI.7	22 .91	10 .89	3 .300	0 .322	0 .577

Source: Own study.

On the one hand, we might not make any changes in this scale. On the other hand, the factor analysis shows that eliminating some questions, especially to reliable ones, increases the reliability level of the scale (Figure 17, Table 13, Table 14).

Figure 17. The scree plot for External orientation



Source: Own study.

Table 13. The factor analysis for Environmental dynamism

Variable	Factor Loadings (Varimax normalized) Extraction: Principal components (Marked loadings are >.500000)		
	Factor 1	Factor 2	Factor 3
VI.1	0 .681	0 .431	0 .060
VI.2	0 .804	0 .094	0 .189
VI.3	0 .141	-0 .107	0 .803
VI.4	0 .147	0 .808	-0 .126
VI.5	0 .002	0 .764	0 .248
VI.6	0 .037	0 .190	0 .675
VI.7	0 .801	-0 .074	0 .006
Expl.Var	1 .795	1 .485	1 .218
Prp.Totl	0 .256	0 .212	0 .174

Source: Own study.

Table 14. The reliability analysis for the simplified External orientation scale

Variable	Summary for scale: Mean=11.5941 Std.Dv.=2.27674 Valid N:101 Cronbach alpha: .685793 Standardized alpha: .686821 Average inter-item corr.: .425084				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VI.1	7 .723	2 .735	1 .654	0 .498	0 .595
VI.2	7 .713	2 .462	1 .569	0 .571	0 .498
VI.7	7 .752	2 .721	1 .650	0 .436	0 .676

Source: Own study.

Hence, we propose as follows:

Recommendation 10. We recommend limiting the scale External orientation to three items (VI.1, VI.2, and VI.6) since they fully reflect the essence of the External orientation and definitely provide better scale reliability.

The scale called Organisational performance is very reliable, as the original one occurred to be unreliable in our study (Table 15). Since Cronbach is based on the number of items, and we cannot add more statements/items that constitute to our construct, then there is no option of 'Scale if item removed'.

Table 15. *The reliability analysis for Organisational performance*

Variable	Summary for scale: Mean=7.55446 Std.Dv.=1.16168 Valid N:101 Cronbach alpha: .326339 Standardized alpha: .330565 Average inter-item corr.: .198010				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VII.1	3 .762	0 .656	0 .810	0 .198	
VII.2	3 .792	0 .462	0 .679	0 .198	

Source: Own study.

Thus, we noticed two options to be considered, namely:

Recommendation 11: As we do not have the possibility to retake the survey within the same sample, we recommend to select only one item VII.2 for further analysis.

We also used a control variable – Past collaboration experience – divided initially into three dimensions (1. reliability, predictability and competence; 2. goodwill, benevolence and honesty, 3. inter-firm learning). However, in our study, all of those dimensions scales occurred to be unreliable with no possibilities to improve (Table 16, Table 17, Table 18).

Table 16. *The reliability analysis for reliability, predictability and competence*

Variable	Summary for scale: Mean=7.06931 Std.Dv.=1.68082 Valid N:101 Cronbach alpha: .201304 Standardized alpha: .202718 Average inter-item corr.: .112791				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VIII.A	3 .505	1 .101	1 .050	0 .113	
VIII.B	3 .564	1 .414	1 .189	0 .113	

Source: Own study.

Table 17. *The reliability analysis for goodwill, benevolence and honesty*

Variable	Summary for scale: Mean=14.8812 Std.Dv.=2.38028 Valid N:101 Cronbach alpha: .464793 Standardized alpha: .463650 Average inter-item corr.: .178265				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VIII.1	11 .16	4 .074	2 .018	0 .206	0 .447
VIII.2	11 .20	3 .644	1 .909	0 .282	0 .378
VIII.3	11 .12	3 .610	1 .900	0 .308	0 .353

VIII.4	11 .17	3 .546	1 .883	0 .268	0 .393
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Source: Own study.

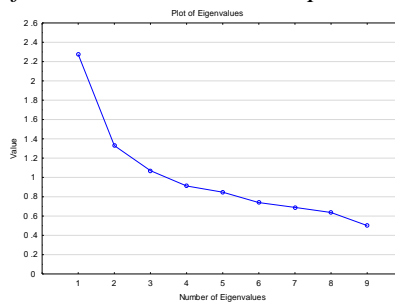
Table 18. *The reliability analysis for Inter-firm learning*

Variable	Summary for scale: Mean=10.9802 Std.Dv.=1.98988 Valid N:101 Cronbach alpha: .282131 Standardized alpha: .278911 Average inter-item corr.: .115479				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VIII.i	7 .366	1 .975	1 .405	0 .274	0 .000
VIII.ii	7 .327	2 .537	1 .593	0 .128	0 .262
VIII.iii	7 .267	2 .592	1 .610	0 .076	0 .374

Source: Own study.

The factor analysis and reliability one suggest combining the dimensions and creating one scale. It would allow increasing the reliability level up to 0,59 (Figure 18, Table 19, Table 20).

Figure 18. *The scree plot for Past collaboration experience (dimensions merged)*



Source: Own study.

Table 19. *The factor analysis for Past collaboration experience (dimensions merged)*

Variable	Factor Loadings (Varimax normalized) Extraction: Principal components (Marked loadings are >.500000)		
	Factor 1	Factor 2	Factor 3
VIII.1	0 .558	0 .066	-0 .019
VIII.2	0 .458	-0 .004	0 .368
VIII.3	0 .253	0 .318	0 .610
VIII.4	0 .700	-0 .087	0 .056
VIII-A	-0 .196	0 .745	0 .094
VIII-B	-0 .054	0 .183	0 .732
VIII.i	0 .721	0 .073	0 .189
VIII.ii	0 .329	0 .739	0 .044
VIII.iii	0 .156	-0 .346	0 .663

Variable	Factor Loadings (Varimax normalized) Extraction: Principal components (Marked loadings are >.500000)		
	Factor 1	Factor 2	Factor 3
Expl.Var	1 .768	1 .373	1 .533
Prp.Totl	0 .196	0 .153	0 .170

Source: Own study.

Table 20. The reliability analysis for Past collaboration experience (dimensions merged)

Variable	Summary for scale: Mean=30.7921 Std.Dv.=4.45941 Valid N:101 Cronbach alpha: .590607 Standardized alpha: .601073 Average inter-item corr.: .145014				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VIII.1	27 .07	17 .17	4 .144	0 .233	0 .573
VIII.2	27 .11	16 .26	4 .032	0 .322	0 .551
VIII.3	27 .03	15 .49	3 .936	0 .443	0 .519
VIII.4	27 .08	16 .33	4 .041	0 .282	0 .561
VIII-A	28 .36	17 .64	4 .199	0 .064	0 .628
VIII-B	28 .30	16 .19	4 .024	0 .284	0 .560
VIII.i	27 .18	15 .16	3 .893	0 .412	0 .523
VIII.ii	27 .14	16 .24	4 .030	0 .310	0 .553
VIII.iii	27 .08	16 .71	4 .087	0 .225	0 .577

Source: Own study.

Additionally we noticed that eliminating one item (VIII.A) would enable to increase the reliability level up to 0,63 (Table 21). Hence, eventually, we decided as follows:

Recommendation 12: We recommend to combine the dimensions of the Past collaboration experience scale and extract one item. We are conscious that the reliability at the level 0,63 is not entirely satisfactory; however, according to some scholars experience, it is enough in social sciences research.

Table 21. The reliability analysis for Past collaboration experience (dimensions merged with one item extracted)

Variable	Summary for scale: Mean=28.3564 Std.Dv.=4.22039 Valid N:101 Cronbach alpha: .628394 Standardized alpha: .628302 Average inter-item corr.: .175756				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itm-Totl Correl.	Alpha if deleted
VIII.1	24 .63	15 .12	3 .889	0 .248	0 .616
VIII.2	24 .67	14 .16	3 .763	0 .351	0 .589
VIII.3	24 .59	13 .69	3 .700	0 .437	0 .566
VIII.4	24 .64	14 .11	3 .756	0 .325	0 .596

Variable	Summary for scale: Mean=28.3564 Std.Dv.=4.22039 Valid N:101 Cronbach alpha: .628394 Standardized alpha: .628302 Average inter-item corr.: .175756				
	Mean if deleted	Var. if deleted	StDv. if deleted	Itrm-Totl Correl.	Alpha if deleted
VIII-B	25 .86	14 .42	3 .797	0 .266	0 .613
VIII.i	24 .74	12 .98	3 .603	0 .460	0 .555
VIII.ii	24 .70	14 .78	3 .845	0 .246	0 .617
VIII.iii	24 .64	14 .49	3 .806	0 .262	0 .614

Source: Own study.

Additionally, we used one more control variable – Technological turbulence. However, in our study it resulted to be unreliable without any improvement while deleting particular items (Table 22).

Table 22. *The reliability analysis for Technological Turbulence*

Variable	Summary for scale: Mean=18.3267 St.Dev. 2.91242 Vslid N:101 Cronbach alpha: .350677 Standardized alpha:.405104 Average inter-item corr.: .121984				
	Śred.gdy usunięte	War. gdy usunięte	OdSt.gdy usunięte	Poz-Cał. Korel.	Alfa gdy usunięte
IX.1	14.33663	6.243114	2.498622	0.310681	0.209947
IX.2	14.46535	6.902265	2.627216	0.101412	0.353700
IX.3	14.73267	5.621606	2.370993	0.346881	0.154710
IX.4	14.65347	6.305656	2.511106	0.185401	0.290654
IX.5	15.11881	6.164102	2.482761	0.017879	0.481764

Source: Own study.

Hence:

Recommendation 13: We recommend not to consider the control variable – Technological turbulence – in the next research steps.

5. Discussion, limitations and Final Remarks

Our research makes several contributions. First, our paper contributes to the organisational routines research and to inter-firm research by proposing a formal model, which shows the relationship between routine concept and inter-firm dynamics determined by external and internal context.

Second, the implementation of the recommendations aforementioned would allow to formulate and verify hypotheses resulting from the propositions we have formulated while proposing our research framework. We intend to verify the hypotheses resulting from the proposition no. 1 and no. 2 via employing the regression coefficient in cause and result models. The other hypotheses would be tested by verifying both interaction coefficients and the direct impact relation.

Third, we use alpha as the best choice to estimate reliability. We selected the measurement scales ambitiously as all fulfilled the rigorous methodological level. Unfortunately, only three of all met those challenge in our study. Two more achieved the level .61 and .68. The ways we implemented to face our reliability concerns included joining the items / scales, extracting items decreasing the reliability and even leaving one the strongest item from unreliable scale. Alpha has very strict assumptions: unidimensionality, uncorrelated errors, and essential tau-equivalence of all items. Essential tau-equivalence means, that all covariance between the items should be identical.

These assumptions should be checked, and in most cases, the assumptions are violated. Then, alpha over- or underestimates the true reliability. This is why we cannot trust alpha at all when the assumptions are not met. Alpha if item deleted does not help us in that cases. We used existing scales in our research, and the reliability is not typically better. It is enquiring why the original reliable scales occurred not to be reliable in our study. Have for example cultural differences resulted in misunderstanding some items by the respondents? It is therefore disputable whether we really should seek the scales with high Alpha and the question if the moderate reliability .5 - .7 is maybe enough arises. As it is known that Cronbach's Alpha is the usual test statistic, and .7 the usual cut-off.

Nevertheless, Alpha is affected by the number of items in the scale, and scales with only a few items are likely to have an alpha < .7, but it is still acceptable. Many social and behavioural researchers accept an alpha value of .7 to .9. However, the value of Alpha varies depending on the length of scale. Short scales tend to yield smaller Alpha and could be acceptable for analysis (Edlund and Nichols, 2019).

Third, we obtained a new Propensity to Collaborate scale as the questions referred to particular dimensions joined in quite different groups. Hence, one item has been deleted and the dimensions have been combined. We propose to check the new scale (without dimensions) in the future research.

There are several research limitations, mainly methodological ones, that have been experienced during the study. First, the study was based on a single informant (Strese *et al.*, 2016). It has been evidenced that key informants as the only source of information constitute a research limitation. The future research might also seek out a second source, either internally or externally (Bouncken *et al.*, 2018) to improve data quality (Strese *et al.*, 2016).

Second, due to the selected quantitative research method, an emphasis was put on short, yet very precise questions adhering to the main study topic. However, for some questions such restrictions imposed were sort of a limitation as more detailed information could lead to better understanding and potentially more accurate responses from contributors.

Third, another reason might be quite a different perception of Polish managers in comparison with Anglo-Saxon ones. More specifically scales have been translated and used in a country that is culturally dissimilar to where the scale was developed. As a result, it might have a lower reliability (Spector, Liu, and Sanchez, 2015). It is worth mentioning here, that if items are written in opposite directions, this could result in reduced alpha because item correlations are affected, especially if translated to another language or used in a culturally dissimilar setting (Spector, Van Katwyk, Brannick, and Chen, 1997).

Moreover, as we revealed our investigation is limited to one country and one industry. We do agree with Akrouf (2014) that a number of various sectors reveal the nature of relationship, but that was not our goal. However, considering that the specific characteristics of the ICT industry have determined the appearance of advanced strategic practices, we can presume that similar strategic changes took place in other high-tech sectors. Moreover, taking into account that the specificity of the ICT industry entails a number of relationships between companies, their experience in this area is more mature. In turn, the cultural context could have been of great importance in our research. Cultural context is seen as essential in inter-firm relationships research (Abosag and Lee, 2013) and inter-firm relationships are culturally dependent (Panda and Dash, 2016). As we have noted before, cultural issues may also play a role in the development of research tools. Nonetheless, we did not focus on the nature of the relationships or their dynamics, but more on methodological issues.

The next limitation might be a number of responses. However, response rates have rather little to do with reliability, although they may have substantial effects on validity if only a specific subset of the available population answers the survey. If we cannot add an item or remove an item that causes trouble, but we still have another way out. We can check for 'Variance' among the items. We can do that by creating a new variable by going to transform, using Variance under the option 'Statistical' and choosing variance. We can then check in the data view and remove those responses with a high value of variances. Then, we can remove them and our Cronbach Alpha will rise up.

However, our study suggests a number of stimulating opportunities for the future research. Our approach to the study of propensity to collaborate may be generalized beyond inter-firm relationships. It would be interesting to explore to what extent the effects of propensity to collaborate can also be found in the intra-organizational context.

6. Conclusion

Our research provides significant insights into the advantages and limitations of routineness for inter-firm relationships. Specifically, the study highlights the need to move beyond a focus on the direct link between routineness and organizational

performance in seeking to understand the conditions under which propensity to collaborate promotes or inhibits organizational performance.

Researchers (and managers) ought to take into account the external context and organizational context facing collaboration partners—that is, whether the source is internal or external to their relationship. In our study, the routines contribute to propensity to collaborate controlled by past collaboration experience. The relationship between propensity to collaborate and organizational performance matters in such a way that the propensity to collaborate-organizational performance relationship strengthened under managers innovation-oriented behaviour and weakened under environmental conditions. We hope that our study triggers future studies that will look in more detail at the complex and contingent role of routines in inter- and intra - firm relationships.

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