The impact of digital transformation

A survey based research to explore the effects of digital transformation on organizations

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Abstract
Many organizations nowadays feel pressured to change in order to meet customer demands and competitive pressure due to emerging digital technologies. When a combination of digital technologies is used a common heard buzzword is digital transformation. To date there only little academic research with regards to digital transformation and they often provide holistic non-deterministic definitions. In addition literature that dives deeper into the underlying technologies and effects only address specific elements or industries. This gap is address through a literature research and a business model based questionnaire held amongst IT consultants to determine both the concept and expected effects of digital transformation. We speak of digital transformation if a technology induced change by social, mobile, analytics or cloud technologies significantly impacts a minimal of three out of seven dimension on an individual, firm or social level. The research findings show that digital transformation is expected to change organizations across many different fronts as almost all business model constructs have at least one element that is expected to change moderately or even stronger. The greatest impact will be to organizations' their value proposition, the customer segments they can identify and serve, the way organizations reach their customers, and the resources they use.

Keywords
Digital Transformation, Digital Technologies, Social, Mobile, Analytics, Cloud, Organizational Effects, Business Models, Business Model Canvas, Data-analysis, Survey

1. Introduction

Information, communication and connectivity technologies have improved greatly during the last decade creating new functionalities (Bharadwaj, Sawy, Pavlou, & Venkatraman, 2013). These new digital technologies further enable the production, storage and handling of information, and facilitate communication between human beings and electronic systems (Ibem & Laryea, 2014).

Companies such as Google, Netflix, Amazon and Apple have successfully adapted these new digital technologies and have risen to great heights while others who did not adapt have not and became obsolete. Many organizations nowadays feel pressured to change in order to meet customer demands and competitive pressure through digital technologies (Westerman, Calmejane, & Bonnet, 2011).

A buzzword that surrounds these changes is often called digital transformation. While there are several consultancy-related studies such as Fitzgerald et al. (2013) and Westerman et al. (2011) that state the importance and potential upside of digital transformation there is very few truly academic literature available on the concept of digital transformation.

Some state that the underlying fundamental technologies are social, mobile, analytics and cloud (Bharadwaj et al., 2013) but most provide holistic non-deterministic definitions.

Although there are studies that describe the organizational effects of the social, mobile, analytics and cloud technologies in isolation, there are few studies that describe the effects from a digital transformation perspective i.e. a combination of those technologies.

Studies that do so (Kauffman, Li, & Heck, 2010; Piccinini, Gregory, & Kolbe, 2015; Westerman et al., 2011) mainly focus on customer insight, costumer relations and customer-organizations interactions which leaves the effects on organizational elements such as products and service offerings, internal processes and the usage of resources and accompanied costs relatively unknown. Additionally the described effects are mostly qualitative and it's uncertain if these are applicable outside their research scope or industry.

To address this gap the following research question was answered.

"What are the impacts of digital transformation on organizations' their business model?

In section two of this article the methodology followed during the research is described. Section three describes the concept of digital transformation and the expected effects based on previous studies. Section four describes the survey measurements and the hypothesis for each measure. Section five presents the results of the survey while section six discusses the main findings, contributions and practical implications. Section seven proposes recommendations for future search and section eight states the limitations of the research.

2. Methodology

In order to answer the research question, and determine the impact of digital transformation on organizations' their business model several steps had to be taken.

First the concept of digital transformation had to be described to define the concept and formulate the hypothesized effects. This was done through a literature study based on relevant academic literature as this would provide a comprehensive overview of the current body of knowledge. To do so MISQ and ISR articles from 2010 were scanned on relevance to digital transformation. The MISQ and ISR articles were chosen as they are highly ranked in the field of information systems. The year 2010 was chosen as cut-off point because little research regarding digital transformation was done prior to 2010.

Furthermore relevant articles were found in literature search engines such as google scholar and Scopus using the following search words; digital transformation, digital technologies, digitalization, digital business, digital enterprise, social, mobile, analytics, and cloud. Lastly the "snowball" method was used to identify appropriate academic sources by exploring the references of other relevant research.

The second step was to develop a business model measurement framework to needed to determine the actual effects of digital transformation. Four business model frameworks (VISOR, C-SOFT, the business model canvas and the entrepreneur's model) were evaluated of which the business model canvas of Osterwalder & Pigneur (2010) was chosen for further operationalization as it's industry agnostic and has clearer more distinct building blocks. The building blocks were further operationalized into measures based upon business model literature from several relevant meta-studies (Burkhart, Krumeich, Werth, & Loos, 2011; Dmitriev, Simmons, & Truong, 2014; Osterwalder, Pigneur, & Tucci, 2005; Shafer, Smith, & Linder, 2005) and the process classification framework (APQC, 2015).

The third part of this research was to determine the hypotheses that would be tested later on. Based on the relevant digital transformation literature found in the first part of the research and the operationalized business model canvas hypotheses could be formulated for the majority of the identified measures.

The last part of the research consisted of empirical data gathering through a survey to test the hypotheses and quantify the effects of digital transformation on organizations' their business model. A survey was chosen as method because it's the most efficient method to collect a large sample of quantitative information on the effects of digital transformation on organizations. The survey was held amongst IT consultants as they are arguably the most knowledgeable group when it comes to bringing digital transformation into practice, and thus determining the effects of digital transformation on organizations.

3. The concept of Digital Transformation

Patel and McCarthy (2000) were one of the first to mention the concept of digital transformation but did not go as far to conceptualize the term. Till date only few studies provide a definition of the concept.

The Capgemini research of Westerman et al. (2011, p. 5) specifies digital transformation as: *"the use of technology to radically improve performance or reach of enterprises"*. Similarly Stolterman and Croon Forst (2006, p. 689) define digital transformation as follows: *"Digital transformation can be understood as the changes that digital technology causes or influences in all aspects of human life".* From another perspective Lankshear and Knobel (2008) describe digital transformation as the final level of digital literacy. At this level digital technologies enable innovation and creativity, and stimulate significant changes in professional and knowledge domains.

These definition are holistic by nature and do not break down digital transformation in specific technologies and specific changes. One aspect that becomes apparent is that digital transformation does not entail gradual incremental changes, but fundamental "radical" changes due to digital technologies

Table 1: Seven dimension and impact criteria, adopted from Lucas et al. (2013).

Dimension	Threshold
Processes	More than half of the steps in an individual's or firm's process are changed
The creation of new organizations	Worth more than $100 million or change two hours of individual behavior a day.
Changes in relationships between organizations and costumers	More than half of the contact or double the contacts of individuals and/or firms or change two hours of individual behavior a day.
Changes in the markets	Change of at least half of one's vendors, entering or leaving a market served and/or the creation of a new market ($100 million+).
Changes in user experience	A change in user experience of two hours a day
Changes in the amount of customers	If an organizations serves at least 50% more customers.
Disruptive impact	If one or more competitors are forced to operate at losses, and/or exit markets or a reduction of more than $100 million in transactions costs.

Research to technology induced changes by Lucas et al. (2013) classify changes as transformational when it impacts at least three out of seven dimension on either an individual, firm or societal level above the given threshold.

From a technological perspective we're currently at a crossroad of a new wave in IT: measured by the number of connected devices (Frank, Roehrig, & Pring, 2014), which is described as social, mobile, analytics and cloud. These technologies drive current business innovations and are considered the underlying technologies of digital transformation (Al-Debei & Fitzgerald, 2010; Bharadwaj et al., 2013).

Hence we speak of digital transformation if it is a transformation is a social, mobile, analytics or cloud induced change that significantly affects three or more dimensions on individual, firm, and/or societal level.

An important aspect of digital transformation is the change in customer demand and behavior due to digital technologies. Several researches have observed that digital technologies are becoming more embedded in our daily lives (Aral, Dellarocas, & Godes, 2013; Oestreicher-Singer & Zalmanson, 2013).

As a result we are increasingly experiencing the world through and by information technology (2006, p. 690).

This had led to increased customer informedness (Hennig-Thurau et al., 2010; Smith & McKeen, 2008), changed purchase decisions (Clemons, 2008; Kauffman et al., 2010) and an increased ability to evaluate products and services online.

Information is no longer controlled solely by organization, but democratization of content is taking place through reviews and blogs shared through social media (Aral et al., 2013; Clemons, 2008) and it's becoming increasingly more important (Zhu & Zhang, 2010).

In addition consumer expect easy usability of (digital) products (Smith & McKeen, 2008; Yoo, 2010) available through various channels 24/7 (Andal-Ancion, Cartwight, & Yip, 2003; Weill & Woerner, 2013).

Organizations needs to react and are doing so, products are improving greatly (Fitzgerald et al., 2013; Li, 2015) and more accessible.

Organizations understand their customer better (Li, 2015) and develop new types of relationships with their customers (Kurniawati, Shanks, & Bekmamedova, 2013; Westerman et al., 2011).

Organizations develop new revenue models (Granados & Gupta, 2013; Li, 2015) and adjust their internal processes, resources and costs accordingly (Agarwal & Dhar, 2014; Bharadwaj et al., 2013; Markus & Loebbecke, 2013; Westerman et al., 2011). Next to the internal adjustment new interfaces facilitate increased tightening of supply chains and enable new ways of competitors, vendors and supplier to cooperate (Bharadwaj et al., 2013; Li, 2015)

4. Survey measurements and hypotheses

To measure the impact of digital transformation on organizations' their business an operationalized measurement framework was used for the survey. This measurement frameworks consists of the nine business model constructs from the Business Model Canvas (Osterwalder & Pigneur, 2010) with several elements per constructs.

The following tables show the measures used in the survey along with the literature based hypotheses. Respondents were asked to indicate the expected change of digital transformation on a symmetric 7 point Likert-scale.

Value proposition
The bundle of products and services that create value for a specific customer segment

Table 2: Value proposition measures

	Please indicate the expected change (strongly decrease – strongly increase)	hypothesis
VP_1	Creation of new products and services	Increase
VP_2	Combination of existing products and services	-
VP_3	Performance of products and services	Increase
VP_4	Customization of products and services	Increase
VP_5	Price of products and services	-
VP_6	Accessibility of products and services	Increase
VP_7	Convenience of products and services.	Increase

Customer segment
The distinct segments of customers based on need, behaviors and/or attributes with the aim to identify profitable customers.

Table 3: Customer segment measures

	Please indicate the expected change (strongly decrease - strongly increase)	hypothesis
CS_1	Identification of customer needs	Increase
CS_2	Identification of customer attributes	Increase
CS_3	Identification of customer behavior	Increase
CS_4	Segmentation of markets	Increase
CS_5	Accommodation to customer needs	Increase
CS_6	Accommodation to customer attributes	Increase
CS_7	Accommodation to customer behavior	Increase

Channels
The way how a company communicates with and reaches its customers to deliver the value proposition.

Table 4: Channels measures

	Please indicate the expected change (strongly decrease - strongly increase)	hypothesis
CH_1	Customer awareness of an organization's products and services	Increase
CH_2	Possibility to evaluate an organization's value proposition for customers	Increase
CH_3	Ways and means of purchasing products and services	Increase
CH_4	Ways and means of delivering products and services	Increase
CH_5	Ways and means of post-purchase customer support	Increase

Customer relationships
The types of relationships a company establishes with specific customer segments.

Table 5: Customer relationships measures

	Please indicate the expected change (strongly decrease - strongly increase)	hypothesis
CR_1	Usage of personal assistance	No change
CR_2	Usage of dedicated personal assistance	No change
CR_3	Usage of self-service	Increase
CR_4	Usage of automated services	Increase
CR_5	Usage of communities	Increase
CR_6	Usage of co-creation.	Increase

Key activities
The actions a company must take to operate successfully. Similarly the activities are required to create and offer a value proposition, reach markets, maintain relationships, and earn revenues.

Table 6: Key activities measures

	Please indicate the expected change (strongly standardize- strongly diversify)	hypothesis
KA_1A	Development of products and services	Standardize
KA_1B	Management of products and services	Standardize
KA_2A	Marketing of products and services	Standardize
KA_2B	Selling of products and services	Standardize
KA_3	Delivery of products and services	Standardize
KA_4	Customer service	Standardize
KA_5	Management processes	-
KA_6	Support processes	-
	Please indicate the expected change (strongly integrate- strongly separate)	
KA_7A	Development of products and services	Integrate
KA_7B	Management of products and services	Integrate
KA_8A	Marketing of products and services	Integrate
KA_8B	Selling of products and services	Integrate
KA_9	Delivery of products and services	Integrate
KA_10	Customer service	Integrate
KA_11	Management processes	-
KA_12	Support processes	-

Key resources
The assets required to create and offer a value proposition, reach markets, maintain relationships, and earn revenues.

Table 7: Key resources measures

	Please indicate the expected change (strongly decrease - strongly increase)	hypothesis
KR_1	Usage of physical resources	Decrease
KR_2	Usage of intellectual resources	Increase
KR_3	Usage of human resources	-

Key partnerships
The network of suppliers and partners that allow an organization to operate

Table 8: Key partnerships measures

	Please indicate the expected change (strongly decrease - strongly increase)	hypothesis
KP_1	Number of suppliers	-
KP_2	Number of channel intermediaries	-
KP_3	Number of complementary vendors	-
KP_4	Shared responsibility between key partners	Increase
KP_5	Cooperation between key partners	Increase

Revenue streams
The cash a company generates from different customer segments.

Table 9: Revenue stream measures

	Please indicate the expected change (strongly decrease - strongly increase)	hypothesis
RS_1	Usage of asset sale	No change
RS_2	Usage of usage fees	Increase
RS_3	Usage of subscription fees	-
RS_4	Usage of lending/renting/leasing	No change
RS_5	Usage of licensing	Increase
RS_6	Usage of brokerage fees	Decrease
Rs_7	Usage of advertising	Increase

Cost structure
The cost incurred in creating value, maintaining customer relationships and generating revenue

Table 10: Cost structure measures

	Please indicate the expected change (strongly decrease - strongly increase)	hypothesis
Cost_1	Fixed costs	Decrease
Cost_2	Variable costs	Increase
Cost_3	Total costs	Decrease

5. Survey results

The data was collected through a self-administered online survey between the last week of June and first two weeks of July 2015. Respondents were contacted via an e-mail distribution. One reminder was send three days later. The final sample included 92 senior level+ consultants from Cognizant, 72 completed the entire survey. They originated from 20 different countries, mainly the US, India, Germany, and the UK and reported an average digital transformation expertise of 5.14 out of 7. No differences in outcomes were found between respondents that rated an expertise of four and above and those who rated below four.

In order to describe the magnitude of change the mean values of the measure are used in line with the ordinal scales of the survey. Where 1.00-1.99 indicates strong decrease, 2.00-2.99 a moderate decrease, 3-3.99 a slight decrease, 4.00-4.99 a slight increase, 5.00-5.99 a moderate increase, and a 6.00-7.00 strong increase. For each measure the p-value is displayed. If $p<0.05$ a measures statistically differs from no change (answer "4") and a change is expected. To determine the p-value a t-test is used for the normally distributed data and a Wilcoxon rank test is used for the non-normally distributed data. The asterisk sign (*) indicates if data is assumed normally distributed.

Value proposition

A strong increase in new products and services, customization of products and services and convenience of products and services is expected. A moderate increase is expected in the combination, performance, and accessibility products and services. In addition a slight decrease in the price of products and services is expected.

Table 11: Expected change in value proposition elements

	N	Mean	Std.	Min.	Max.	Median	p-value
VP_1	92	6.14	0.806	4	7	6	.000
VP_2	92	5.54	1.226	1	7	6	.000
VP_3	92	5.80	0.917	2	7	6	.000
VP_4	92	6.08	1.019	2	7	6	.000
VP_5	92	3.29*	1.125	1	7	3	.000
VP_6	92	5.92	1.179	1	7	6	.000
VP_7	90	6.16*	0.847	4	7	6	.000

Customer segment

Identification of customer needs, attributes, and behavior is expected to increase strongly. Next to a moderate increase of accommodation to customer needs attributes, and behavior and segmentation of markets.

Table 12: Expected change in customer segment elements

	N	Mean	Std.	Min.	Max.	Median	p-value
CS_1	91	6.10	0.920	3	7	6	.000
CS_2	91	6.14	0.914	4	7	6	.000
CS_3	91	6.27	0.817	4	7	6	.000
CS_4	91	5.69	1.244	2	7	6	.000
CS_5	91	5.80*	0.897	3	7	6	.000
CS_6	91	5.81*	0.829	3	7	6	.000
CS_7	91	5.88*	0.867	3	7	6	.000

Channels

A moderate increase is expected in the customer awareness of an organization's products and services, possibility to evaluate an organization's value proposition for customers, ways and means of purchasing products and services, ways and means of delivering products and services, and ways and means of post-purchase customer support.

Table 13: Expected change in channels

	N	Mean	Std.	Min.	Max.	Median	p-value
CH_1	86	5.72*	0.978	3	7	6	.000
CH_2	88	5.58	1.014	1	7	6	.000
CH_3	88	5.99*	0.916	3	7	6	.000
CH_4	88	5.94*	0.975	3	7	6	.000
CH_5	88	5.90*	0.923	3	7	6	.000

Customer relationships

When it comes to customer relationships strong increases in the usage of self-service and automated services are expected. Moderate increased are expected in the usage of communities and co-creation and no statistical significant change is expected in the usage of personal assistance and dedicated personal assistance.

Table 14: Expected change in customer relationships elements

	N	Mean	Std.	Min.	Max.	Median	p-value
CR_1	84	4.23*	1.689	1	7	4	.223
CR_2	84	4.06*	1.710	1	7	4	.751
CR_3	84	6.19	0.871	4	7	6	.000
CR_4	84	6.24	0.859	3	7	6	.000
CR_5	84	5.89	1.018	2	7	6	.000
CR_6	84	5.71	1.001	2	7	6	.000

Key activities

Key activities are measured on two dimension; level of standardization and (1-6) level of integration (7-12). Moderate diversification of marketing and selling of products is expected. A slight diversification is expected in the delivery of products and services. No statistical significant change is expected in the development and management of products and services, management of customer services, management processes, and supporting processes. A moderate integration of management process if expected and a slight integration of activities are expected for; the development and management of products and services, marketing and selling of products and services, delivery of products and services, management of customer services, and supporting processes.

Table 15: Expected change in key activity elements

	N	Mean	Std.	Min.	Max	Median	p-value
KA_1A	79	4.15	1.861	1	7	5	.278
KA_1B	79	4.11	1.915	1	7	5	.357
KA_2A	79	5.23	1.860	1	7	6	.000
KA_2B	79	5.18	1.831	1	7	6	.000
KA_3	79	4.67	1.920	1	7	5	.002
KA_4	79	4.34	2.006	1	7	5	.081
KA_5	79	4.06	1.828	1	7	4	.422
KA_6	79	3.90	1.991	1	7	5	.206
KA_7A	79	3.44	1.781	1	7	3	.004
KA_7B	79	3.23	1.694	1	7	3	.000
KA_8A	79	3.47	1.954	1	7	3	.009
KA_8B	79	3.35	1.935	1	7	3	.002
KA_9	79	3.38	1.734	1	7	3	.002
KA_10	79	3.23	1.797	1	7	2	.000
KA_11	79	3.03	1.577	1	7	3	.000
KA_12	79	2.94	1.659	1	7	2	.000

Key resources

A moderate increase of the usage of intellectual resources is expected along with a slight decrease in usage of physical resources. No statistically significant change is expected to occur in the usage of human resources.

Table 136: Expected change in key resources elements

	N	Mean	Std.	Min.	Max.	Median	p-value
KR_1	76	3.26	1.436	1	7	3	.000
KR_2	76	5.84	1.007	2	7	6	.000
KR_3	76	3.91*	1.471	1	7	4	.587

Key partnerships

Due to digital transformation a moderate increase in the cooperation and shared responsibility of key partners is expected as well as a moderate increase in the number of suppliers and complementary vendors. No statistically significant change is expected to occur in the number of channel intermediaries.

Table 17: Expected change in key partnerships elements

	N	Mean	Std.	Min.	Max.	Median	p-value
KP_1	76	4.85	1.679	2	7	5	.000
KP_2	76	4.34	1.894	1	7	5	.079
KP_3	76	4.95*	1.450	1	7	5	.000
KP_4	76	5.57	0.984	2	7	6	.000
KP_5	75	5.85	0.954	3	7	6	.000

Revenue streams

With regards to revenue collection a moderate increase of the usage of pay per usage and subscription fees and a slight increase in the usage of renting/lending/leasing, licensing, and advertising are expected.

A slight decrease in the usage of brokerage fees is expected which and no statically significant change is expected to occur in asset sales.

Table 148: Expected change in revenue streams elements

	N	Mean	Std.	Min.	Max.	Median	p-value
RS_1	72	4.19*	1.507	1	7	4	.139
RS_2	72	5.29*	1.388	2	7	5	.000
RS_3	72	5.21*	1.528	2	7	5.50	.000
RS_4	72	4.81*	1.460	2	7	5	.000
RS_5	72	4.89*	1.400	2	7	5	.000
RS_6	72	3.60*	1.329	1	7	3	.000
RS_7	72	4.81*	1.450	2	7	5	.000

Cost structure

Due to digital transformation a slight decrease in fixed and total cost are expected and a slight increase in variable costs is expected.

Table 159: Expected change in cost structure elements

	N	Mean	Std.	Min.	Max.	Median	p-value
Cost_1	72	3.01*	1.250	1	6	3	.000
Cost_2	72	4.42	1.527	1	7	5	.014
Cost_3	72	3.39*	1.205	1	7	3	.000

Next to the expected effects there are 34 there are moderate correlations (r=0.4-0.6) between the different framework constructs. The correlations are purely statically and indicate that changes in elements occur simultaneously. Value proposition, customer segments and channels show quite some moderate correlations. The correlations coefficients and p-values can be found in the appendix.

6. Discussion

Based on the literature research it can be concluded that digital transformation is a social, mobile, analytics or cloud induced change that significantly affects three or more dimensions on individual, firm, and/or societal level. In the near future there could, and probably will, be new waves of digital technologies that drive digital transformation. As such the digital technologies that fall under the concept of digital transformation will change and the definition of digital transformation should change accordingly.

The research findings show that digital transformation is expected to change organizations across many different fronts as almost all nine business model constructs have at least one element that is expected to change moderately or even stronger. Some business model constructs even have moderately or strong expected changes across all underlying elements. The greatest impact will be to organizations' their value proposition, the customer segments they can identify and serve, the way organizations reach their customers, and the resources they use. As this research shows many different changes are expected across different business model elements. Throughout the variety of changes there is a single group that benefits the most; customers. When looking at the research outcomes regarding value proposition customers' their value for money increases a lot. Products and services are expected to increase in customization, performance, accessibility and convenience whilst prices are expected to decrease a little.

Customers additionally benefit from the increased numbers of new products and services introduced to the marketplace. The research outcomes regarding channels and customer relations show that customers' their communication and interaction with organizations is expected to improve. There will be greater awareness of the products and services in the market and it will become easier to evaluate them. Furthermore customers are given more possibilities in purchasing, delivery and customer support and levels of service through self- and automated services will increase. Moreover organizations will empower customers by expanding current mutual beneficial elements such as co-creation and communities.

For organizations this means that they should adopt a very strong customer focus and in invest digital capabilities while remaining agile enough to respond to changing social and technological environments to ensure they will not become obsolete in the marketplace. Organizations can to do so by taking the following measures:

- Invest in analytic capabilities to allow "hyper" customization of services and products,
- Invest in a flawless omni-channel customer experience with self and automated services and,
- Explore and adopt an enterprise-wide cloud-based strategy.

Overall this research contributes to existing literature as it's a unique study that addresses the expected effects of digital transformation across the entire spectrum of organizations' their business models across industries.

The findings of this research regarding increased customer segmentation, increased personalization of products and services, and increased online customer-organizations interaction confirms previous findings of Li (2015), Piccinini et al. (2015), and Westerman et al. (2011). Moreover it takes their research findings one step further by providing quantified expected effects instead of qualitative findings.

Furthermore this research shows that multiple other business model elements are expected to be impacted as well. It is worth noting the majority of these findings correspond with studies that have focused on these elements with only one underlying technology considered.

Additionally by pinpointing the exact expected changes of digital transformation this research should help organizations to build and substantiate digital transformation business cases more accurately and efficiently allowing for reliable and factual investment decisions. This is much needed as only half of the organizations create a business case for their digital transformation initiatives and only 25% compute key performance indicators (Fitzgerald et al., 2013).

7. Recommendations

Several recommendations can be made for future research. First of all, the results are expected effects based on expert opinions. It's not certain these outcomes will actually occur. Future research – through i.e. comparative case studies - could validate whether the expected changes are actually occurring or have occurred.

Second this research is performed in a cross-industry setting. Effects of digital transformation can and probably will differ between industries. Research specifically aimed a certain industries could provide unique insights and results can be compared to this research in order to determine differences in effects.

Last, several significant correlations are found between different elements. Due to the nature of this research these correlations are pure statistical, no causality is assumed. Known causality would provide value insights in what elements influence certain effects. Determining the causality through experimentation or observations would be an excellent way to identify the mechanics behind digital transformation.

8. Limitations

The results of this research are based on the expert opinions of consultants from a singular Information and Technology firm. Strictly speaking the results only apply to this setting.

Furthermore the results are based on a certain "view" of digital transformation; results do therefore not or partially apply to other interpretations of digital transformation.

In addition respondents might be biased due to the fact that they are able to influence each other's opinions. 65% of the respondents either both practice and location with at least one other respondent.

Although it's not certain this potentially violates the assumption of independence of measurement. Moreover there's a difference between the definition of digital transformation used in this research and the one used in the survey. The survey definition is the internal organizational definition that does not specify the technologies and the transformational aspect.

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Appendix

Note only correlations of 0.400 and above are presented. * indicates that p <0.05, ** indicates that p <0.01, and ***indicates that p <0.001.

VP = value proposition, CS = customer segment, CH= channels, CR = customer relations, KP = key partnerships, KR = key resources, RS = revenue streams, Cost = cost structure.

Measures	Correlation	Measures	Correlation	Measures	Correlation
VP_7 - CS_6	0.424***	**VP_3 - CH_3**	0.457***	**VP_7 - CR_3**	0.415***
VP_7 - CS_7	0.423***	**VP_3 - CH_4**	0.494***	**VP_3 - KR_2**	0.514***
VP_1 – CH_3	0.424***	**VP_3 - CH_1**	0.410***	**VP_7 - KR_2**	0.411***
VP_1 – CH_4	0.423***	**VP_7– CH_3**	0.452***	**VP_5 - Cost_3**	0.427**
VP_1 – CH_3	0.424***	**VP_7– CH_4**	0.432***		

Measures	Correlation	Measures	Correlation	Measures	Correlation
CS_1 – CH_3	0.489***	**CS_3 - CH_4**	0.414***	**CS_3 - CH_5**	0.429***
CS_2 – CH_3	0.515***	**CS_5 - CH_4**	0.458***	**CS_4 – KP_1**	0.434***
CS_3 – CH_3	0.473***	**CS_6 - CH_4**	0.508***	**CS_4 - KP_3**	0.408***
CS_1 - CH_4	0.452***	**CS_7 - CH_4**	0.507***	**CS_2 - RS_3**	0.441***
CS_2 - CH_4	0.517***	**CS_2 - CH_5**	0.447***	**CS_3 - RS_3**	0.413***

Measures	Correlation
CH_4 - KR_2	0.448**
CH_4 - RS_3	0.471***
CH_5 - RS_3	0.414***

Measures	Correlation
CR_6 - KP_4	0.492**

Measures	Correlation
KR_1 - Cost_1	0.436**