

Exploratory Study on Digital transformation: Capabilities and Expected Performances

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Abstract. Nowadays many firms encounter the macro-level changes called digital transformation and research on it has drastically increased since 2014. In response to this emerging phenomenon, this study explores how firms prepare for digital transformation and what do they expect from it. More specially, based on the survey from 439 Korean scaleup firm (high-growth firm), we suggest the concepts to necessary capabilities for and expected performance improvement through digital transformation. Our study illustrates that how a firm's perceptions on those concepts varies upon firm size and industry type. Additionally, our study offers a clue for 'digital divide' that can potentially threaten the survival of numerous firms.

Keywords: digital transformation, capabilities, performance improvement, firm size, industry type

1 Introduction

In recent years, the business world has encountered the macro-level changes sourced from of digital transformation. While digital transformation is not a completely new topic to many entities across the areas, the growing body of research has been shown since 2014 (see Figure 1, Google trend). However, as mentioned above digital transformation comes with unprecedented changes and convergence across various technological domain and industrial sectors, it can be a double-edged sword to both incumbents and new ventures. Although it can potentially provide diverse and constructive collaboration opportunities to many firms (Luo, 2021), it can also threat the business of many firms as existing technological standards and business systems will be drastically either changed or challenged (Oh & Rhee, 2008).

In response to this mixed expectation on digital transformation, this study explore how firms are currently viewing digital transformation in terms of preparation and desirable outcomes. More specifically, by using the Korean high-growth firm data, we first offer the results of survey implying what types of capabilities those high-growth firms perceive as key capabilities to cope with changes sourced from digital transformation and what types of firm performances they anticipate to achieve. Then, we shift our attention to important firm-specific characteristics, firm size and industry type that can matter when firm adopt marco-level changes (Li et al., 2018; Eller et al., 2020; Siachou et al., 2021; Savastano et al., 2019;

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Vogelsang et al., 2018; von Leipzig et al., 2017; Martín-Peña et al., 2020; Ribeiro-Navarrete et al., 2021), and provides a comparative analysis. The results indicate that firms' perception of and preparations for digital transformation vary upon firm-specific characteristics. We also find that some firms might suffer from digital divide (bipolarization of digital capability).

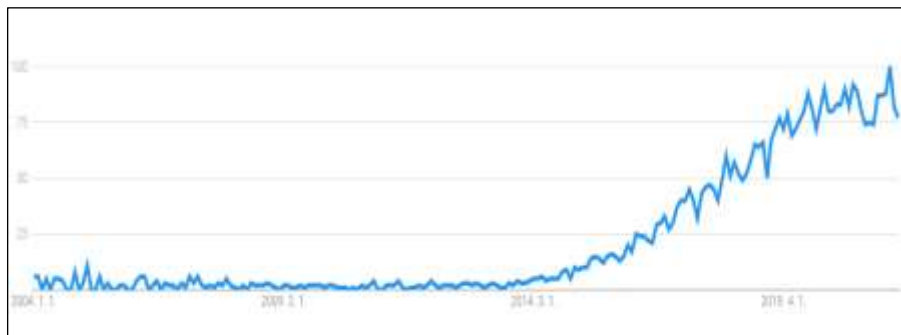


Fig. 1. Interest in Digital Transformation
Source: Google Trend.

2 Research Design

2.1 Selection of capabilities and performance

To design survey, we select the following three capabilities: (1) business capability that refers to a firm's ability for task management, process improvement, and data management (2) digital capability, which is defined as a firm's technological capability for programming, software development, and data analysis (3) soft capability that refers to a firm's capability for problem-solving, collaboration, and creativity management. Those capabilities are necessary to achieve innovation (Teece, 1986, 2018). The reason we focus on these three capabilities is that a firm's ability to cope with macro-level changes ultimately depends on how a firm develop necessary technologies, how a firm apply those technologies to real business activities and how a people in those firms manage these transitional processes. Regarding anticipated performances that firms eventually aim to achieve, we develop three performance dimensions, which are (1) profitability growth (2) new product development and (3) new partnership.

2.2 Sample collection

We implemented a survey based on the list of scaleup firms in Korea. To collect the sample firms, we first draw on the Korea Enterprise Data (KED) database subscribed by Science and Technology Policy Institute (STEPI), and gather the initial sample firms that have shown 20 percent increase in sales with more than 10 employees during the period of 2016-2018. This initial sample include 3,391 scaleup firms. Then, we sent email survey to all these firms and a total of 439 survey was received with response rate of 13%. We classified those 439 firms based on two categories, firm size and industries. Regarding the former category, while 86 firms (20%) belong to a large firm, 353 firms (80%) were Small and Medium Enterprises (SMEs). In relation the latter category, while manufacturing industries comprised 44% of the sample (194 firms), non-manufacturing firms such as service consist 56% of the sample (245

firms). We designed a survey questionnaire by referring to 2019 ScaleUp Survey of Scaleup Institute, the UK private sector, not-for-profit company (s).

2.3 Analysis

Collected data were analyzed with a focus on the following four matters: (1) importance of digital transformation and preparations, (2) expected change digital transformation would bring to the industry and main products, (3) capabilities necessary to prepare for digital transformation, and (4) anticipated performance improvement from digital transformation. Digital transformation is a macro-trend phenomenon that affects all industries and many firms, but individual firms may have different views depending on their characteristics or the industry to which they belong. Therefore, this study applies the classification method according to firm size and industrial characteristics for each of the aforementioned matters.

3 Results

Table 1 shows firms' perception on "capabilities considered important to prepare digital transformation" depending on firm size and industry type. In all capability types, small-medium size firms show more than 50% of "neutral" views and low level of 'Positive' views, indicating that small and medium size firms have pessimistic perspective on needs of those capabilities. Similarly, compare to manufacturing firms, non-manufacturing firms have more 'Neutral' and 'Negative' perspective on the value of each capability.

Table 1. Do you think this capability is important to prepare digital transformation?

		Business capability (%)			
		N	Negative	Neutral	Positive
Category 1	Large	86	5.9	43.0	51.2
	Small-Medium	353	18.1	51.6	30.3
Category 2	Manufacturing	194	12.4	51.0	36.6
	Non-Manufacturing	245	23.2	61.9	14.9

		Digital capability (%)			
		N	Negative	Neutral	Positive
Category 1	Large	86	5.9	44.2	50
	Small-Medium	353	22.7	50.1	27.1
Category 2	Manufacturing	194	14.4	52.6	32.9
	Non-Manufacturing	245	29.4	58.2	12.4

		Soft capability (%)			
		N	Negative	Neutral	Positive
Category 1	Large	86	7	43.0	50
	Small-Medium	353	19.9	51.8	28.3
Category 2	Manufacturing	194	13.4	53.6	33
	Non-Manufacturing	245	25.7	59.8	14.5

Source: Own processing

Table 2 shows firms' expectation on "performance improvement through digital transformation. Compared to small-medium firms, large firms show more optimistic view and less pessimistic view on each performance dimension. Similarly, compared to non-manufacturing firms, manufacturing firms show more optimistic view on each performance dimension.

Table 2. What types of performance you want to improve through digital transformation?

		Profitability growth (%)			
		N	Pessemistic	Neutral	Optimistic
Category 1	Large	86	24.5	54.7	20.9
	Small-Medium	353	54.1	35.7	10.2
Category 2	Manufacturing	194	45.8	38.7	15.5
	Non-Manufacturing	245	37.1	50.5	12.4

		New product development (%)			
		N	Pessemistic	Neutral	Optimistic
Category 1	Large	86	25.6	59.3	15.1
	Small-Medium	353	55.8	36.5	7.6
Category 2	Manufacturing	194	45.9	41.8	12.4
	Non-Manufacturing	245	40.7	51.0	8.3

		New partnership (%)			
		N	Pessemistic	Neutral	Optimistic
Category 1	Large	86	26.7	55.8	17.4
	Small-Medium	353	56	37.1	6.8
Category 2	Manufacturing	194	47.4	40.2	12.3
	Non-Manufacturing	245	40.1	52.1	7.8

Source: Own processing

After explore the general perspective of firms on each dimension of capability and performnace, we conduct sets of OLS regression to get further insights on the relationship between those capabilites and performances. Table 3 shows summary statistics and indicate that each dimension of capabilites and performances is highly correlated. Hence, we maily focus on the direct relationship between each capability and performance.

Table 3. Summary Statistics

		Mean	S.D.	1	2	3	4	5
1	Business capability	3.24	0.99					
2	Digital capability	3.15	1.00	0.89				
3	Soft capability	3.21	1.00	0.89	0.91			
4	Profitability growth	2.41	1.05	0.41	0.42	0.40		
5	New product development	2.34	1.01	0.38	0.39	0.37	0.90	
6	New partnership	2.34	1.00	0.37	0.38	0.36	0.89	0.96

N = 439

Source: Own processing

Table 4-7 show the result of OLS regression. As expected, while each capability has significant and positive relationship with each anticipated performance, Table 5 shows interesting results. In case of large firms, no capability has significant impact on new product development. This may indicate that large firms view digital transformation as instrument to renovate business model and network rather than merely developing new product. The findings presented in Table 4-7 does not necessarily mean the impact of those capabilities on three types of performances are confirmed. Rather, it reflects how people in firms perceive or believe the association between capabilities and performances. However, it is still meaningful and valid to understand how various firms interpret encountering situations and changes brought by digital transformation.

Table 4. OLS regression on firm performances (Small & Medium Firms)

		Profitability		
<i>Independent variables</i>				
Business capability	0.417***			0.256*
	0.050			0.119
Digital capability		0.403***		0.173
		0.050		0.126
Soft capability			0.392***	0.001
			0.051	0.127
<i>N</i>	353	353	353	353
		New product development		
<i>Independent variables</i>				
Business capability	0.404***			0.244
	0.049			0.116
Digital capability		0.387***		0.129
		0.049		0.123
Soft capability			0.385***	0.051
			0.050	0.124
<i>N</i>	353	353	353	353
		New partnership		
<i>Independent variables</i>				
Business capability	0.371***			0.211+
	0.048			0.114
Digital capability		0.362***		0.169
		0.048		0.121
Soft capability			0.352***	0.009
			0.049	0.123
<i>N</i>	353	353	353	353

Source: Own processing

Table 5. OLS regression on firm performances (Large Firms)

		Profitability		
<i>Independent variables</i>				
Business capability	0.291**			-0.569
	0.107			0.348
Digital capability		0.386***		0.679+
		0.109		0.366
Soft capability			0.332**	0.258
			0.102	0.371
<i>N</i>	86	86	86	86
		New product development		
<i>Independent variables</i>				
Business capability	0.068			-0.50
	0.101			0.3361
Digital capability		0.134		0.451
		0.105		0.353
Soft capability			0.106	0.178
			0.097	0.358

<i>N</i>	86	86	86	86
New partnership				
<i>Independent variables</i>				
Business capability	0.122 0.103			-0.665+ 0.338
Digital capability		0.212* 0.106		0.611+ 0.356
Soft capability			0.172+ 0.099	0.246 0.360
<i>N</i>	86	86	86	86

Source: Own processing

Table 6. OLS regression on firm performances (Manufacturing Firms)

Profitability				
<i>Independent variables</i>				
Business capability	0.388** 0.076			0.101 0.171
Digital capability		0.393*** 0.076		0.021 0.181
Soft capability			0.377*** 0.073	0.268 0.189
<i>N</i>	194	194	194	194
New product development				
<i>Independent variables</i>				
Business capability	0.356*** 0.074			-0.509 0.336
Digital capability		0.352 0.074		0.451 0.353
Soft capability			0.106 0.097	0.178 0.358
<i>N</i>	194	194	194	194
New partnership				
<i>Independent variables</i>				
Business capability	0.337 0.074			0.036 0.170
Digital capability		0.360*** 0.074		0.182 0.181
Soft capability			0.356*** 0.073	0.161 0.188
<i>N</i>	194	194	194	194

Source: Own processing

Table 7. OLS regression on firm performances (Non-Manufacturing Firms)

Profitability				
<i>Independent variables</i>				
Business capability	0.461**			0.23
	0.058			0.149
Digital capability		0.462***		0.347*
		0.056		0.158
Soft capability			0.427***	-0.104
			0.058	0.155
<i>N</i>	245	245	245	245
New product development				
<i>Independent variables</i>				
Business capability	0.398***			0.206
	0.056			0.145
Digital capability		0.401***		0.324*
		0.055		0.154
Soft capability			0.366***	-0.117
			0.057	0.151
<i>N</i>	245	245	245	245
New partnership				
<i>Independent variables</i>				
Business capability	0.385***			0.197
	0.055			0.144
Digital capability		0.386***		0.283+
		0.054		0.153
Soft capability			0.357***	-0.081
			0.056	0.149
<i>N</i>	245	245	245	245

Source: Own processing

We conduct additional analysis to explore more detailed picture of how firm size and industry type conjontly influence the relationship between capabilities and expected performance. While most of main effect of individual capability show significant and positive effect of each expected performance, full model illustrate more interesting findings. (We do not report the main effect of individual capability here due to the space limit). Table 8 shows that large-manufacturing firms and smal-medium non-manufacturing firms demonstrate some statistically signifianct results. Interestingly, in case of large-manufacturing firms, business capability and firm profitability are negatively related. This finding does not mean business capability for digital transformation leads firms experience to lower profitability. Instead it implies that people in large-manufacturing firms does not view business capability as a key determinant of profitability in the era of digital transformation. However, they consider digital capability as a positive and key determinant of it.

Table 8. OLS regression on three dimensions of firm performance

Profitability				
<i>Independent variables</i>	SMEs MFG	Large MFG	SMEs non-MFG	Large non-MFG
Business capability	0.229 (0.182)	-1.257** (0.446)	0.260 (0.160)	-0.0365 (0.497)
Digital capability	-0.023 (0.198)	1.000* (0.401)	0.303+ (0.166)	0.456 (0.882)
Soft capability	0.210 (0.212)	0.500 (0.363)	-0.115 (0.161)	0.030 (0.993)
<i>N</i>	160	34	193	52
New product development				
<i>Independent variables</i>	SMEs MFG	Large MFG	SMEs non-MFG	Large non-MFG
Business capability	0.178 (0.178)	-0.642 (0.437)	0.270+ (0.153)	-0.495 (0.488)
Digital capability	-0.114 (0.195)	0.628 (0.393)	0.280+ (0.159)	-0.105 (0.865)
Soft capability	0.347+ (0.208)	0.093 (0.356)	-0.126 (0.154)	0.737 (0.975)
<i>N</i>	160	34	193	52
New partnership				
<i>Independent variables</i>	SMEs MFG	Large MFG	SMEs non-MFG	Large non-MFG
Business capability	0.171 (0.175)	-1.423** (0.453)	0.230 (0.154)	-0.137 (0.471)
Digital capability	0.046 (0.191)	1.172** (0.407)	0.249 (0.160)	-0.0132 (0.836)
Soft capability	0.161 (0.204)	0.457 (0.369)	-0.0814 (0.155)	0.342 (0.941)
<i>N</i>	160	34	193	52

Source: Own processing

Discussion

Our study provide unique insights in several ways. First, we offer useful concepts to evaluate capabilities for and expected outcome of digital transformation. In our survey, three important capabilities for digital transformation (business, digital, soft capabilities) and three expected performance improvement (profitability, new product development, new partnership) are addressed. More importantly, our study demonstrate how those concepts are differently perceived to an individual firm. While large size firms and manufacturing firms show more positive perspective on digital transformation in terms of both capabilities and expected outcomes, those firms demonstrate some interesting patterns such as negative or no effect (in fact, perceived expectation) of business capability on performances.

More importantly and interestingly, by investigating firm size effect and industry effect, our study offer a clue for ‘digital divide’ that can potentially threaten the survival of numerous firms that fail to adopt relevant skills and capabilities to prepare digital transformation. As digital transformation will come with unprecedented degree of convergence across industrial sectors, the negative effect of digital divide can create tremendous inequality among firms (e.g., large firm vs. small firm). This may recall for policy maker considering some policy efforts for balanced development.

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