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MANAGING GROWTH OPPORTUNITIES IN THE DIGITAL ERA – AN EMPIRIC PERSPECTIVE OF VALUE CREATION

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Abstract: In times of market valuations beyond 1 trillion USD for digital companies such as Alphabet and Amazon, capital markets concentrate on growth opportunities at the core of the market value of equity. The presented study aims to identify the key drivers of growth, thereby including its novelty to transfer the classic financial theory of PVGO into today´s digital world. In an empiric analysis, the methodology of multi-variate regression models sourced from S&P500 companies between 2007 and 2017 is applied. The main results surprise managerial decision makers across industries and imply a tectonic shift from profitability to investment driven decisions in digital markets. As a conclusion, senior business practitioners who intend to create market value of equity based on growth, are best advised to invest in intangible assets and digital markets – even at levels of negative profitability.

Key words: digitalization, growth management, growth opportunities, investment management, value creation management.

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Introduction

It is the motivation of the study to analyze the drivers of value creation to derive investment decisions in today´s world of digitalization, based on the present value of growth opportunities PVGO.
Originally, Miller and Modigliani (1961) define that the value of growth opportunities is based on the required rate of return earned on future investments to exceed the firm´s cost of capital. Myers (1977) describes tangibles assets as units of productive capacity, while intangible assets are considered options to expand additional units. The sum of the option values is reflected as PVGO.
Growth opportunities are also referred to as real options (Trigerogis and Ioulineou, 2013; Trigeorgis and Lambertides, 2014; Trigeorgis and Reuer, 2016; Ioalineou et al., 2018) or enterprise goodwill (Podhorska et al., 2019; Svabova et al., 2020). Today´s corporate multinational managers apply the logic of opportunities or real options in financial practice, associated with the extended definition of positive risk management responding to volatile market environments.

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From a strategic management perspective, the Boston Consulting Group has continuously presented „value creators" and „value exploiters" in annual rankings (Reeves et al., 2015). In their study, „value creators" are defined as companies creating a higher PVGO as a percentage of market capitalization than the median of the S&P500 industry peer group, while „value exploiters" are companies below the median.

As the analysis indicates, large corporates face inertia as a negative effect of their size scaling options and do not pursue future growth opportunities aggressively enough. They are stuck on cost reductions to maintain profitability levels. Based on a legacy of success, the core business of those value stock companies is "overexploited" whereas the disruptive market dynamics suggest innovating to obtain scaling growth opportunities, expressed in PVGO as a degree of exploration. The strategists name Amazon and Alphabet as being able to execute "dual discipline" even at scale. Both digital pioneers "explore" and "exploit" value in parallel, as they act in a world of increasing returns (Arthur, 1989). Incumbents […] embrace digital business models (Koch and Windsperger, 2017; Govindarajan, 2018) and digitize their physical assets (Gandhi, 2016) outperform their peers (Bughin and Catlin, 2017).

Clearly, there is a profound scientific motivation to investigate the validity of Myers (1977) original PVGO concept in today´s digital era in an empiric way. Consequently, it is the ambition to contribute to the current research of value creation management by identifying the drivers of PVGO, applied in practice as an indicator of value exploration.

Literature review

The literature review follows the scientific question of the relevance of the PVGO concept in a selected overview of the most frequently cited studies in a chronologic manner.

Myers and Turnbull (1977) extend the original idea of PVGO as they refer to the payoff of shareholders depending on endogenous availability of projects, as the "assets depend on future discretionary investment by the firm." They distinguish between assets-in-place as tangible, non-discretionary, sunk costs whereas future investments are intangible, discretionary investments. Furthermore, they define discretionary investments as variable expenses, such as research and development costs. They explicitly connect the distinction between both asset types: real assets inhibit a market value independent of the firm´s strategy, while real options are the opportunity to purchase real assets on possibly favorable terms, measured as positive net present value.

Investments in future opportunities, which Myers (1977) refers to as PVGO, contribute by large to the company´s equity value range. Even decades later, the economist defines PVGO as "[…] value of the firm options to invest and expand […]" (Brealey et al., 2010, p. 283). The authors refer to Alphabet as a growth

stock, as roughly 50% of the stock price stems from value based on investors´ expectations of Alphabet´s future investment opportunities. As growth stocks are quickly expanding, their PVGO is assigned to the profitability of new investments.
As Brealey et al. (2010) emphasize, volatility increases the value of the option. PVGO justifies a higher share price, because the value of native digital companies is dominantly attributed to the positive effect of volatility (Damodaran, 2005) and its upside potential based on the real options approach (De Andrès-Alonso et al., 2006).
In the years of the dotcom hype, Schwartz and Moon (2000; 2001) acknowledge in their study on the digital pioneers Amazon and Ebay, that high growth and high volatility lead to high market value of equity, whereby a high sensitivity is identified. The originating concept of profitability has been substituted by a focus on top-line growth of sales.
Danbolt et al. (2011) demonstrate the limitations of the PVGO model, as they identify the disparity between future growth opportunities and "the failure to deliver superior earnings".
In general, the track record of PVGO studies (Amram and Kulatilaka, 2000; Manyika et al., 2018) shows a continued interest to allocate the drivers of value creation grounded on the PVGO concept. In combination with the dominating market valuations and related equity premiums (Fama and French, 2002) of digital pioneers (Andreessen, 2011; Malik, 2015) in the recent past, the limitations of growth have been the subject of academic discussion (Arthur, 2016; Buckup, 2018).
Additionally, Chintakananda and McIntyre (2014) allude to the network effects of digital players like Microsoft and Apple to generate exclusive growth opportunities in form of real options. Following the analogy of a growth opportunity as an intangible asset (Myers and Turnbull, 1977), the latest studies validate that those intangibles contribute positively to the company´s performance (Binh et al., 2020).
Makrominas (2017) also found out that on average recognized intangibles are positively associated with PVGO, however the relationship is highly non-linear and more strongly pronounced in companies with lower accumulation of research and development capital. Also Tahat et al. (2018) and Jones (2018) see a strong evidence on the role of intangibles in boosting firms' performance, and an influence of research and development expenditures on the stock market in general.
Banerjee and Majumdar (2020) used different selection procedure and divided stock markets' companies in digital versus traditional business companies and analyzed the influence of accounting based measured versus economic based indicators of value as measured by stock return. They found out that growth in earnings per share is the best value driver for both specified groups, however dividend per share and return on equity are significant indicator of value creation for traditional model companies.

Data and method

The data base is set on the values of Thomson Reuters on July 22nd, 2017 of the US stock index S&P500. In case the data set within the time horizon between 2007 and 2017 has been incomplete, due to IPOs, mergers and acquisition transactions or delisting, the companies have been excluded from the empiric data set. It is explicitly noted that the unicorn company Facebook had to be excluded based on its IPO in 2012. As it is of utmost importance to obtain a high-quality data set in order to gain relevant scientific insights, the resulting data set of 445 companies suffices statistic requirements of sample size (Green, 1991).

In this empiric study, the PVGO formula of Brealey et al. (2010) is transferred from a share price to the level of market value of equity in order to adjust for a wide range of a differing number of shares by corporation. The market value of equity MVE can be explained as the number of shares multiplied with its share price. The twofold approach of MVE under the premise of growth is defined as the sum of PVGO and PVEA.

$$MVE = PVEA + PVGO \quad (1)$$

The present value of existing assets, PVEA, is best explained as is the capitalized value of average earnings under a no-growth policy. It is expressed as a perpetuity formula with INCOME discounted at the market capitalization rate of the capital asset pricing model CAPM. While academics suggest applying earnings-per-share EPS, the availability of the sourced data would have only allowed for EPS with positive profitability. Alternatively, the key performance indicator INCOME is chosen as it also offers data for a satisfying data set.

$$PVEA = INCOME / CAPM \quad (2)$$

The source of the risk-free rate according to CAPM are the rates of marktrisikopraemie.de between 2007 and 2017, while the market risk premium is based on a linear regression of ratio of the daily share price change in relation to yearly share price changes, multiplied with its beta factor. This factor reflects the individual volatility of a stock compared to its index, here the S&P500. The beta factor has been calculated based on daily, discrete returns, simulating an immediate possible buy or sell transaction without compound effect.

The residual second element PVGO is defined as the present value of growth opportunities. In general, it summarizes the value of all future expected cash flows stemming from internal projects with a positive net present value, earning more than the market capitalization rate CAPM.

The independent variable PROFITABILITY is selected to empirically evaluate the hypothesis that today´s growth opportunities transfer into future realized cash flows. It is defined as the ratio of INCOME in relation to SALES.

$$PROFITABILITY = INCOME / SALES \quad (3)$$

Sales and associated growth rates may serve as an early indicator of future value creation, as the example of Amazon´s valuation by Schwartz and Moon (2000) from the dot.com era indicates. The authors explain the growth of market valuation

by the growth of sales levels. In addition to the relevance of sales exemplified with Amazon, Rajgopal et al. (2003) refer to the development of sales as well. They apply the variable NETWORK SALES based on the reasoning of positive network effects of Shapiro and Varian (1999) to adequately reflect the exponential effects of top-line growth. Thus, the identical formula has been applied

NETWORK SALES = (SALES2 – SALES)/ SALES (4)

Both afore-mentioned variables are expressed as a ratio in terms of sales to account for the varying nature of the businesses in the different sectors as well as the respective size of the company.

Digital Companies

The DIGITAL COMPANIES in Table 1 are chosen to correspond to the subgroup of all S&P500 companies assigned to the Thomson Reuters Business Sector Code of "Software & IT Services". To account for the outstanding relevance of Amazon, the company is added to the group of DIGITAL COMPANIES. As an overview, the list of these digital companies subject to specific empiric investigation is provided as follows, while the remaining 415 companies of the S&P500 are defined as non-digital:

Table 1: Overview of selected 30 digital companies

ACCENTURE CLASS A, ACTIVISION BLIZZARD, ADOBE SYSTEMS, AKAMAI TECHNOLOGIES, ALPHABET A SERIES, AMAZON, ANSYS, AUTODESK, AUTOMATIC DATA PROC., CA, CADENCE DESIGN SYS., CITRIX, COGNIZANT TECHNOLOGY SOLUTIONS CLASS A, DXC TECHNOLOGY, EBAY, ELECTRONIC ARTS, F5 NETWORKS, GARTNER CLASS A, IBM, INTUIT, MASTERCARD, MICROSOFT, NETFLIX, ORACLE, RED HAT, SALESFORCE.COM, SYMANTEC, SYNOPSYS, TOTAL SYSTEM SERVICES, VERISIGN

The split categorization of all 445 companies into digital or non-digital is technically coded with a regression dummy variable in SPSS.

As it is the ambition to gain insights what drives the present value of growth opportunities PVGO, the independent variables PROFITABILITY, NETWORK SALES, PVEA and DIGITAL are chosen. Moreover, these variables of the selected 445 companies from the S&P500 are available for each year from 2007 until 2017. Hence, a total of 24,475 observations for the regression analysis is given.

Building on the economic nature of a time lag between future opportunities PVGO and existing opportunities PVEA, it is of interest to incorporate the shift in the regression models. A time shift of three years is chosen, rooted in the argument of a common business practice to project economic forecast and performance along this time horizon across industries. Furthermore, it coincides with the standard reporting and forecast perspective in business reporting, due to the rule of thumb in

management practice that projects are expected to have a positive return of investment after three years at the latest.

The approach of the regression analysis is comprised of two steps: First, the viability of the time shift referring to the transfer of future growth opportunities PVGO to existing assets PVEA is tested in form of a set of ten multilinear regressions. Therefore, the independent variable PVEA2017 is regressed on the dependent variables PVGO2007 - PVGO2016. In this context, it is assessed which time shift is most meaningful. Hence, the time shift between PVEA and PVGO is increased consecutively for each year. The results indicate that a time shift of three years has the highest explanatory power and is consequently selected for the multilinear regression. Building the model, it would be ideal to apply the independent variables of PROFITABILITY, NETWORK SALES and PVEA based on forecasts of analysts. As those are not available, it is assumed that the reported values serve as a proxy for those forecasts. Finally, a set of eight regression models for the years t 2010 until 2017 to be empirically tested is established.

$$PVGO_t = \alpha + ß1 * PROFITABILITY_{t+3} + ß2 * NETWORK\ SALES_{t+3} + ß3 * PVEA_{t+3} + ß4 * DIGITAL \quad (5)$$

In a second step, the significant model with the highest adjusted R squared and therefore the best explanatory power is selected for a detailed analysis of the corresponding correlation matrix and resulting values of the model summary.

Research Results

In the first step, a set of eight regressions is chosen to empirically benefit from the availability of the long-term data. Integrating the time shift, the independent variables PROFITABILITY2010-2017, NETWORK SALES2010-2017 and PVEA2010-2017 in combination with the fixed dummy variable DIGITAL are selected. Besides, varying dependent variables between PVGO2007 and PVGO2014 are tested in order to match the consecutive time shift of 3 years. Because of clarity, the selected results focusing on the significance and explanatory power are summarized in Table 2.

Table 2: Set of multilinear regressions on PVGO 2007-2016, selected results

Model	1	2	3	4	5	6	7	8
Dependent variable	PVGO 2014	PVGO 2013	PVGO 2012	PVGO 2011	PVGO 2010	PVGO 2009	PVGO 2008	PVGO 2007
Year of independent variables	2017	2016	2015	2014	2013	2012	2011	2010
R Square	0.566	0.471	0.466	0.252	0.249	0.141	0.085	0.190
Adjusted R Square	0.562	0.466	0.461	0.245	0.242	0.133	0.077	0.183
ANOVA Regression Sig.	.000[b]	.000[b]	.000[b]	.000[b]	.000[b]	.000[b]	.000[b]	.000[b]
Constant Sig.	0.007	0.003	0.087	0.001	0.001	0.018	0.001	0.000
PROFIT-ABILITY Sig.	0.000	0.003	0.000	0.000	0.000	0.000	0.389	0.895
NETWORK SALES Sig.	0.000	0.007	0.000	0.000	0.493	0.000	0.073	0.000
PVEA Sig.	0.000	0.000	0.001	0.011	0.000	0.950	0.000	0.000
DIGITAL Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.092	0.000

Comparing all adjusted R Square values, the first model has the highest value with an explanatory power of 56.2% of the variance in the regression. As the significance levels indicate, the confidence interval of 95% is met. As a result, the multilinear model has a higher level of explanatory power, especially in the more recent time range. Yet, the models 5, 6, 7 and 8 show insignificance with regards to some coefficients. The variety in results indicates that the relevance of the investigated value drivers fluctuates over time. In summary, the independent variables of 2017, based on PROFITABILITY, NETWORK SALES and PVEA in a digital setting, best explain PVGO of 2014. At this point, the quality of the empiric testing is adequate to pursue a more detailed analysis of the multilinear regression model 1 in the adjacent second step.

Table 3: Detailed results of multilinear regression model 1 on PVGO_2014

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,752[a]	0.566	0.562	38828158.6118
a. Predictors: (Constant), Digital=Digital, PVEA_2017, Network_Sales_2017, Profitability_2017				

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig
1	Regress-ion	866588471061739000	4	216647117765435000	143.7	.000[b]
	Residual	664863022423651000	441	1507625901187420.0		
	Total	1531451493485390000	445			
a. Dependent Variable: PVGO_2014						
b. Predictors: (Constant), Digital=Digital, PVEA_2017, Network_Sales_2017, Profitability_2017						

Coefficients					
Model		Unstandardized Coefficients		Standard. Coefficients	t
		B	Std. Error	Beta	
1	(Constant)	6008016.943	2202619.17		2.728
	Profitability_2017	-13685334.016	1307783.63	-0.532	-10.465
	Network_Sales _2017	0.219	0.05	0.158	4.143
	PVEA_2017	-0.162	0.03	-0.242	-4.425
	Digital=Digital	42314189.325	7236020.84	0.184	5.848

Table 3 displays the econometric results of the regression in SPSS. According to the adjusted R Square, this multilinear regression model hereby explains 56.2% of the variance. The ANOVA table and the coefficients show that the results of the regression are significant, as they are denoted at 0.000 and 0.007, respectively, for the constant. There is a sufficing level of linearity incorporated in the model. The significance of the modelled values is < 0.05 α, at a confidence interval of 95%.

As a result, the statistical tests indicate the existence of a relationship between the independent variables and PVGO2014 as the dependent variable. Precisely, the regression model confirms the significance of all independent variables to impact the value of PVGO2014.

Next, all t values are ≠0, hence the relevance of the model remains valid. As the resulting values of the variance inflation factor VIF are <10 (Kutner et al., 2005). As a consequence, all tolerance values are >0.1 and thus validate the model. Furthermore, the highest value of the condition index in the collinearity statistics is 3.75 < 30, thus the case of multi-collinearity can be excluded.

The constant in the unstandardized coefficients shows the intercept with the y-axis at 6,008,016.94 USD. The value can be interpreted that for every USD decrease of profitability, the PVGO value increases by 13,685,334.02 USD. As the standardized ß1 coefficient of -0.532 has the highest absolute value of all ß coefficients, it can be concluded that the impact of the negative profitability on PVGO is stronger than those of the other independent variables.

Besides, every USD decrease of PVEA impacts PVGO by an increase of 0.16 USD. Furthermore, 1 USD increase in NETWORK SALES contributes to PVGO with an increase of 0.22 USD. The fourth independent variable of a digital company is remarkable: The assignment of the company to the digital category has an impact on its PVGO by 42,314,189,325 USD. Clearly, the notion of growth is a remarkable premium to pay for shares of IT services companies.

In summary, model 1 can be specified as follows:

$$1.\ PVGO_{2014} = 6{,}008{,}016.94 - 13{,}685{,}334.02 * PROFITABILITY_{2017} + 0.219 * NETWORK\ SALES_{2017} - 0.162 * PVEA_{2017} + 42{,}314{,}189{,}325 * DIGITAL \quad (6)$$

The following example of a digital company illustrates the importance of the software industry, reflected in the variable DIGITAL as well as the negative correlation between actual profitability and PVGO. In the example of a digital company planning a future negative profitability of -30%, a negative PVEA of -9,000,000 USD and Sales of 30,000,000 USD, the equation leads to the determination of $PVGO_{2014}$ as follows:

$$PVGO_{2014} = 6{,}008{,}016.94\ USD - 13{,}685{,}334.016*(-0{,}30)\ USD + 0.219 * (-9{,}000{,}000)\ USD - 0.162 * 29{,}999{,}999\ USD + 42{,}314{,}189{,}325\ USD = 60{,}468{,}035.74\ USD \quad (7)$$

In conclusion, one can claim that companies in a digital market with negative profitability create value in terms of growth opportunities PVGO.

By contrast, non-digital companies maximize their corresponding market value of equity based on value streams from existing assets, PVEA based on stable and solid profitability levels. Digital companies are forced to growth, while industrial companies are focused on profitability. As the economist Arthur (1996) notes with reference to the monopolistic position of Microsoft, a truly "bifurcated" state at the threshold between the era of industrialization and digitalization can be observed.

Clearly, the negative ß coefficients of PROFITABILITY and PVEA allow the interpretation that companies whose market value of equity is driven by PVGO, are expected to reinvest their returns to pursue further growth opportunities. A level of negative profitability and PVEA with a time shift of three years is valued and appreciated with sky-rocketing market valuations for digital companies and a subsequent concentration of capital. This empiric evidence supports the findings of Danbolt et al. (2011) that PVGO of technology driven markets like software and IT services cannot be taken to predict profitability.

These research results are subject for wider discussion. At first glance, the negative relationship of PROFITABILITY and PVEA to contribute to PVGO are a surprising result. It has been the initial assumption, that PVGO is an anticipation of future PVEA. As an empiric fact, the negative notation signals that the capital markets interpret negative profitability and PVEA as a sign of future value growth: investments into future growth opportunities are prioritized over profitability.

If the capital markets are convinced of future economic success, the corresponding measure of appreciation is PVGO. In practice, companies create value and influence short-term stock prices at promising future opportunities combined with negative profitability. One prominent example is the presentation of new vehicle series of Tesla, when capital-intense investments to substantiate growth while accepting negative profitability are communicated to signal future growth opportunities to shareholders.

While the PVGO theory alludes to the idea that today´s growth will be translated into tomorrow´s profitability, the empiric results of the study illustrate the opposite. In the digital markets, negative profitability creates market value of equity, as the examples from the Silicon Valley demonstrate.

The managerial implication of this main result can be described as drastic: Companies which inhibit strong PVGO values are therefore motivated to not only not follow a strict zero dividend policy but rather invest in future growth opportunities with the trade-off of negative profitability and negative PVEA, respectively. In case a company´s market value of equity strongly depends on PVGO with a minimal PVEA value, the company could be not only incentivized but even pressured into maximizing investments with the ambition to create value.

Conclusion

In this paper, the articulated ambition of the identification of the drivers of PVGO and investigation of the validity of the PVGO concept in the digital era has been achieved.

As it can be concluded from the empiric study, an exclusive club of digital pioneers has successfully achieved to create market value of equity at new levels based on a promising growth perspective, thereby accumulating an immense concentration of capital. Apparently, the capital markets value negative profitability coupled with presence in software and IT related markets, as the existence of future growth opportunities in times of digitalization. Moreover, profitability without growth is interpreted as a lack of future investment opportunities.

Therefore, investment decisions of corporate industrial management are a paradox: on the hand, strong profitability enables the access to capital. On the other hand, the industrial corporates face the headwind of digital technologies disrupting market boundaries and reshaping industries.

Hence, the following recommendation can be derived: Industrial companies that do not want to be type casted as extinct with devastating market valuations, must pursue intangible investment opportunities in digital markets embracing volatility. Corporate managers are best advised to solve the paradox of profitability and growth in the digital markets.

Certainly, there are limitations of the study. First, the stated assumptions regarding the time shift impact the empiric results. The adjustment of macro- and microeconomic variables could lead to a different optimal time shift. Second, the substitution of the forecasted figures with reported values can be considered as the most essential as no analysts` forecast will ever achieve a prediction accuracy of 100%.

Future avenues of study include an extension of the scope of companies on a global scale. While the Silicon Valley in the United States leads the race of value creation in digital markets, especially Chinese digital companies follow a similar routes of sky-rocketing market valuations based on capital concentration in the Asian markets (Hansell et al., 2018).

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ZARZĄDZANIE SZANSAMI WZROSTU W ERZE CYFROWEJ - EMPIRICZNA PERSPEKTYWA TWORZENIA WARTOŚCI

Streszczenie: W czasach wycen rynkowych przekraczających 1 miliard USD dla firm cyfrowych, takich jak Alphabet i Amazon, rynki kapitałowe koncentrują się na możliwościach wzrostu leżących u podstaw rynkowej wartości kapitału własnego. Prezentowane badanie ma na celu zidentyfikowanie kluczowych czynników wzrostu, w tym jego nowości w przenoszeniu klasycznej teorii finansowej PVGO do dzisiejszego cyfrowego świata. W analizie empirycznej zastosowano metodologię modeli regresji wielowariantowej pochodzących od firm S & P500 w latach 2007–2017. Główne wyniki zaskakują osoby podejmujące decyzje kierownicze w różnych branżach i implikują wstrząsowe przejście od rentowności do decyzji opartych o inwestowanie na rynkach cyfrowych. Podsumowując, starsi praktycy biznesu, którzy zamierzają tworzyć wartość rynkową kapitału własnego w oparciu o wzrost, najlepiej poprzez inwestowanie w wartości niematerialne i prawne oraz rynki cyfrowe - nawet na poziomie ujemnej rentowności.

Słowa kluczowe: digitalizacja, zarządzanie wzrostem, możliwości wzrostu, zarządzanie inwestycjami, zarządzanie tworzeniem wartości.

管理數字時代的增長機會-價值創造的經驗視角

抽象:在Alphabet和Amazon等數字公司的市值超過1萬億美元的時代，資本市場專注於股權市場價值核心的增長機會。提出的研究旨在確定增長的主要驅動力，從而包括將PVGO的經典金融理論轉移到當今數字世界的新穎性。在經驗分析中，採用了從2007年至2017年間來自S&P500公司的多元回歸模型的方法。主要結果使整個行業的管理決策者感到驚訝，並暗示著在數字市場中從獲利能力轉向投資驅動型決策的結構性轉變。結論是，打算根據增長創造股票市場價值的高級商業從業人員，最好被建議投資無形資產和數字市場，即使處於負盈利水平。

關鍵詞:數字化，增長管理，增長機會，投資管理，價值創造管理