THE PERFORMANCE DEVELOPMENT OF SOFTWARE-AS-A-SERVICE VENTURES

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ABSTRACT

The transition to software-as-a-service (SaaS) business models has significantly affected software providers' operations. SaaS business models have allowed digital ventures to scale their product on the marketplace rapidly. They also provide a viable business model to entrepreneurs conscious of expanding their business' size and showing lower growth expectations. However, there are significant differences regarding the performance development of SaaS ventures. This project aims to investigate the performance development of SaaS ventures regarding two critical performance measures: their ability to grow the value they create for customers and their ability to capture a share of that value as profit. An empirically validated System Dynamics model has been developed based on growth process theories, which explain the dynamic changes of companies while they grow, and utilising two case companies. The model approximates ventures' abilities to create and capture value as well as accounting measures used in empirical studies to approximate these theoretical performance outcomes. Model simulations show that SaaS ventures that maintain a fixed number of employees have natural performance levels of value creation and the share of value captured towards which they develop over time. Companies growing their employee number can achieve higher levels of value creation in the long term. However, they also experience lower and often negative shares of value captured in the short term, reducing the venture's financial resources during the period of growth. Thus, managers and entrepreneurs need to ensure that their SaaS ventures can sustain the lower ability to capture value during the growth period until the venture returns to its natural performance level. SaaS entrepreneurs also need to ensure that the share of value captured towards which their venture will develop over time is positive. Otherwise, contrarily to many practitioners' belief, SaaS ventures are at risk of scaling up losses rather than growing themselves profitable.

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INTRODUCTION

The transition to software-as-a-service (SaaS) business models has significantly affected software providers' operations. SaaS solutions are software products provided via the internet to users in exchange for a subscription fee. Besides the functionality of the provided software features, SaaS users value the reduced up-front costs for software, eliminated infrastructure investments, ease of use, and immediate access from multiple devices (Marston *et al.*, 2011; Walther *et al.*, 2012; Trenz, Huntgeburth and Veit, 2019; Rodrigues, Ruivo and Oliveira, 2021). For SaaS providers, the operating model provides a highly scalable business model with minimal variable costs (Trenz, Huntgeburth and Veit, 2019).

However, despite these benefits for users and providers, significant performance differences can be observed among SaaS ventures, and the literature's understanding of SaaS venture's performance is limited (Floerecke, 2018; Zaheer *et al.*, 2019). Many authors have pointed to companies' ability to create value for their customers and capture a share of that value as profit (Walther *et al.*, 2012; DaSilva *et al.*, 2013; Labes, Hanner and Zarnekow, 2017; Trenz, Huntgeburth and Veit, 2019). While the literature also points at the business model as the driver of value creation and capture, these performance levels do not develop in lockstep. For example, due to economies of scale, switching costs, and learning effects, many companies scale up their customer base (Nielsen and Lund, 2015; Huang *et al.*, 2017; Kleinschmidt, Peters and Leimeister, 2019). By scaling up their user base, these SaaS ventures increase the value they create. However, despite scaling up, many SaaS ventures remain unable to capture sufficient revenue and fail (Trenz, Huntgeburth and Veit, 2019). This diversity of development in value creation and capture has also been noted in other samples of digital ventures and new companies in general (Davidsson, Steffens and Fitzsimmons, 2009; Steffens, Davidsson and Fitzsimmons, 2009; Govindarajan, Rajgopal and Srivastava, 2018; Sun and Ertz, 2021). Authors have called for holistic and systemic approaches to further investigate these performance differences and developments (Trenz, Huntgeburth and Veit, 2019; Floerecke, Lehner and Schweikl, 2020).

Therefore, this project investigates the performance development of SaaS ventures using System Dynamics modelling. It aims to reveal the mechanisms that affect value creation and capture and explain SaaS ventures' dynamics and diverse performance development. To account for company performance holistically and over time, a System Dynamics model has been developed based on the two growth process theories and by adapting these theories for the SaaS context. The next section of this paper presented the methodology of developing, testing, and using the model. The third section described the developed model and its underlying theory. Subsequently, the model is validated using the data of two SaaS ventures. The

empirically validated model is then simulated to investigate the development of SaaS ventures' ability to create and capture value. These simulations reveal that companies with a fixed employee size have natural performance levels towards which they develop over time in a goal-seeking manner. Companies that grow their number of employees to achieve ambitious growth goals shift their rate of value creation upwards. However, they also suffer from lower shares of value captured during the period of growth. When these companies cease to pursue growth goals, their rate of value creation will move towards a higher natural performance level, while their share of value captured returns to their original fraction.

METHODOLOGY

A System Dynamics model was developed based on established theory and literature, tested using case studies of digital ventures, and simulated. System Dynamics has been selected as a modelling methodology because it explicitly considers time and allows for a longitudinal analysis of company development (van Oorschot et al., 2013). It also fits to the utilised theories, which represent growth as a complex, dynamic, and cumulative process (Garnsey, 1998; Sterman, 2001; Levie and Lichtenstein, 2010), and it is not constrained by the perfectly accurate measurement of variables (Langley, 1999) such as value creation and capture.

Firstly, a System Dynamics model was developed utilising the literature on growth paths theory and dynamic states theory. Building the model based on established theory ensures that the model is generally applicable and theoretically informed (Langley, 1999; Sterman, 2000). Because these two theories provide general insights into the development of companies, the literature on SaaS and digital ventures has been utilised to adapt, specify, and contextualise the growth process theories. The outcome of this process was a System Dynamics model with two levels of detail (Coyle, 1996). A causal loop diagram illustrating the most important feedback loops affecting value creation and capture and a formal simulation model. The causal loop model is presented in the next section to illustrate the model; due to its size, the equations of the formal model are presented as a supplement to this paper with the SDM-Doc tool (Martinez-Moyano, 2012).

Secondly, the System Dynamics model is tested. The model has been verified using a structure verification test, a parameter verification test, a boundary adequacy test, a dimensional-consistency test, and an extreme conditions test (Forrester and Senge, 1979; Barlas, 1996; Sterman, 2000; Morecroft, 2015). Two case companies have been identified to validate the model and test its ability to represent the development of SaaS ventures' performance outcomes. Annual reports of these companies are used to parameterise the model for each company and evaluate the outputs of the model's subsystems to historical data about the company (Homer, 2012).

Lastly, hypothetical scenarios are simulated to generate data using the model and produce insights beyond those emerging from case companies. Switches have been implemented in the model to activate and deactivate feedback loops (Coyle, 1996). Three different scenarios have been tested to investigate the development of companies without changes in employee numbers, those changing their employee inputs to achieve growth goals, and those transitioning from growth-based to fixed-input states.

While these three steps are presented linearly, they formed a continuous circle of model development and simulation. Each step builds on the others, with continuous learning and iterations, to develop, simulate, and apply the model. In each iteration of this continuous development cycle, more is learnt about the influences on value creation and capture, and their development over time.

MODEL OVERVIEW

A System Dynamics model was develop utilising the literature on growth paths theory and dynamic states theory. Based on these two growth process theories, value creation and capture depend on the venture's business model, which the management alters based on their dominant logic. The performance outcomes, business model, and dominant logic are discussed and modelled as six subsystems (Figure 1).

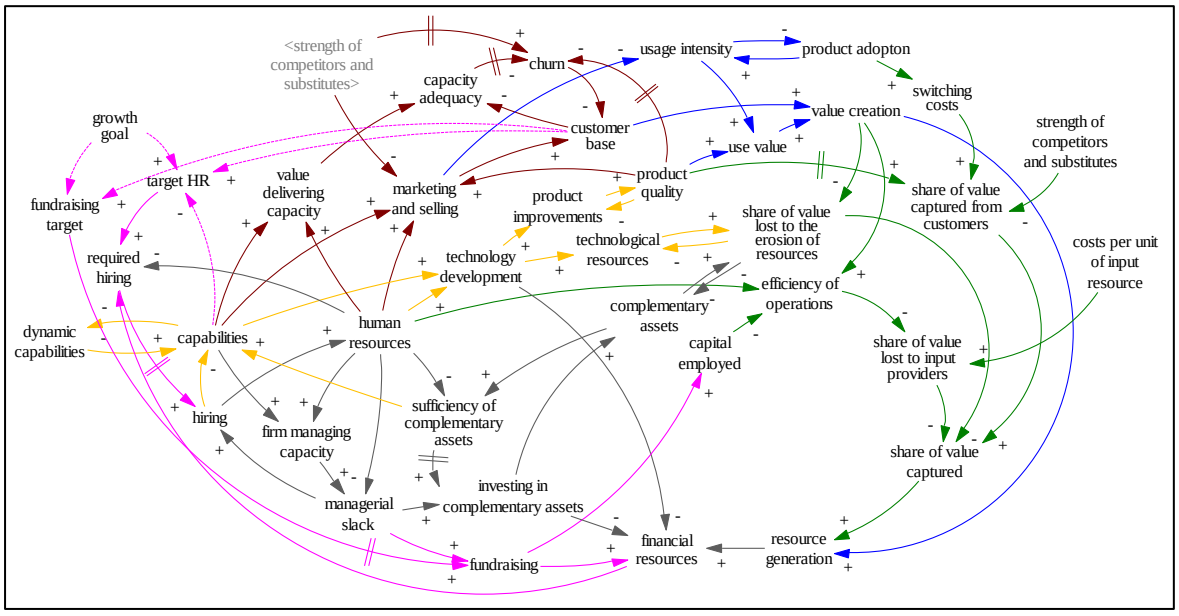

Figure 1: Overview of model

Because growth process theories are general and not context-specific, the elements have been adapted for the SaaS context to develop a System Dynamics model.

Performance outcomes

SaaS ventures need to create value and capture a share of that value to sustain themselves during the growth process and *generate resources* that can be reinvested to grow (Garnsey, 1998; Levie and Lichtenstein, 2010). The first two subsystems conceptualise and formalise these two performance outcomes.

The first subsystems considered the mechanisms through which SaaS ventures create value for their customers (Figure 1, blue coloured). *Value creation* refers to the total amount of customer value created over a period of time (Amit and Zott, 2001; Levie and Lichtenstein, 2010). One driver of value creation is the *use value* of the venture's product. In a physical context, it reflects the utility derived by a customer per unit of product (Porter, 1985, 1991; Peteraf and Barney, 2003; Lepak, Smith and Taylor, 2007). Because SaaS companies provide their products over time, the use value also needs to be conceptualised as the value created for a customer per period, which depends on the venture's *product quality* and *usage intensity* of customers. This usage intensity develops with customer learning and *adopting more features of the product*, purchasing further licenses, and spending more time using the software. However, the usage intensity is limited by the available features, number of licences needed, and time available (Afuah and Tucci, 2000; Amit and Zott, 2001; Harmon, Raffo and Faulk, 2004; DaSilva *et al.*, 2013; Haile and Altmann, 2016). Because the use value reflects the value created per customer, another driver of value creation is the *customer base*, which many digital ventures aim to grow significantly through scaling up (Zott and Amit, 2010). Previous empirical studies have used revenue as a proxy to approximate value creation and its growth (Porter, 1985; Stam, Garnsey and Heffernan, 2006; Steffens, Davidsson and Fitzsimmons, 2009). Therefore, this subsystem also derives revenue using value creation and the share of value captured from customers (Lepak, Smith and Taylor, 2007). The instantaneous rate of revenue generation calculated in the model has been transformed to a rolling annual average to compare the revenue calculated in the model with case companies' financial statements (Forrester, 1984; Oliva, Sterman and Giese, 2003).

The second subsystem illustrates how digital ventures capture value from customers and lose value to input providers and resource erosion (Figure 1, green coloured). Metaphorically, whereas the created value presents "the overall size of the value pie" and the maximum value a company can capture, the *share of value captured* represents the fraction of the pie that a company receives and maintains as profit (Zott and Amit, 2010, p. 218). One influence on the share of value captured is the fraction of value captured from customers, which depends on the venture's *product quality* relative to the *strength of competitors and substitutes* (Porter, 1991; Peteraf and Barney, 2003; Garnsey, Dee and Ford, 2006; Lepak, Smith and Taylor, 2007). *Switching costs* that develop while customers learn, adapt, and customise features of

a product also need to be considered in the SaaS context (DaSilva *et al.*, 2013). However, the venture also loses shares of the value it captures from customers to inputs providers and the erosion of resources (Porter, 1985; Peteraf and Barney, 2003; Stam and Garnsey, 2006; Zott and Amit, 2007). The *fraction of value lost to input providers* reflects the venture's operating expenses as a fraction of the value created. This fraction depends on the two inputs considered in the model, *human resources* and *capital employed*, and the *costs of a unit of inputs* (Porter, 1985; Peteraf and Barney, 2003; Stam and Garnsey, 2006; Zott and Amit, 2007). The fraction of value lost to the erosion of resources reflects depreciation expenses as a fraction of the value created (Nelson and Winter, 1978; Dierickx and Cool, 1989; Porter, 1991; Knott, Bryce and Posen, 2003). The two assets that erode over time considered in the model are the venture's *technological resources* and *complementary assets*. Using those resource inputs, the model calculates the share of value captured as well as the net profit margin and return on assets as accounting performance measures that can be compared to historical company data when expressed as rolling annual averages (Forrester, 1984; Oliva, Sterman and Giese, 2003; Steffens, Davidsson and Fitzsimmons, 2009; Delmar, McKelvie and Wennberg, 2013; Zhou, Park and Ungson, 2013).

Business model

Business models define the architecture used by a company that "creates and delivers value to customers, and then converts payments received to profits" (Teece, 2010, p. 173). Thus, a company's business model determines value creation and the share of value captured as the two central measures of company performance (Teece, 2010; Zott and Amit, 2010; Standing and Mattsson, 2016; Guo *et al.*, 2020). Business models are composed of resources, activities, and capabilities, and link the venture to its environment. Resources are assets owned or controlled by the firm (Barney, 1991; Grant, 1991, 1996; Teece and Pisano, 1994; Amit and Zott, 2001; Penrose, 2009). The performance outcome subsystems require the venture's customer base, technological resources, and complementary assets as inputs. The three business model subsystems derive these resources through the venture's activities and capabilities.

The third subsystem determines the venture's technological resources, which feed into the value creation and capture subsystems (Figure 1, yellow coloured). Through *technology development,* the venture's employees increase its *technological resources*, which are recognised on the venture's balance sheet as intangible assets (Porter, 1991; Penrose, 2009; Garnsey, Lubik and Heffernan, 2015; Miozzo and DiVito, 2016). The new development also causes *product improvements*, increasing the product quality and use value created per customers. However, due to technology s-curves, the better the product quality already, the lower the impact of new development on

improvements (Tidd, Bessant and Pavitt, 1994; Dosi, Nelson and Winter, 2000; Smith, 2015). While technological resources erode over time, new technology is developed by the venture's human resources depending on their *capabilities*[1]. The model adopts the definition of capabilities as measures of employee productivity used in evolutionary economic that growth paths theory builds on. These capabilities develop over time through learning, which is expressed by the venture's *dynamic capabilities*. However, productivity improvements are limited to best practice (Porter, 1996; Dosi, Nelson and Winter, 2000; Eisenhardt and Martin, 2000; Bessant, Phelps and Adams, 2005; Bingham, Eisenhardt and Furr, 2007; Phelps, Adams and Bessant, 2007). Moreover, capabilities erode through *hiring* because new employees lack firm-specific skills and knowledge (Slater, 1980; Garnsey, 1998; Tan and Mahoney, 2005; Stam, Garnsey and Heffernan, 2006; Penrose, 2009; Miozzo and DiVito, 2016; Harbermann and Schuilte, 2017). Capabilities also depend on the adequate equipment of employees with complementary assets (Garnsey, 1998; Stam, Garnsey and Heffernan, 2006; Gabrielsson and Gabrielsson, 2013).

The fourth subsystem determines the venture's customer base, which depends on two activities (Figure 1, red coloured). Firstly, the venture's human resources may acquire new customers through m*arketing and sales*. The success of these marketing activities depends on their capabilities and the product quality compared to competitors (Garnsey, 1998; Bhide, 2000; Garnsey, Lubik and Heffernan, 2015; Hesse and Sternberg, 2017). Secondly, the customer base decreases through *churn*, the fraction of customers that discontinue the use of the venture's product every year. It depends on the *capacity adequacy* and the relative product quality to competitors and substitutes (Warren, 2002; Oliva, Sterman and Giese, 2003; Currie, Joyce and Winch, 2007; Tyrväinen and Selin, 2011). The capacity to service customers depends on human resources engaged in servicing customers and their capabilities. The outcome of this subsystem is the number of customers, which many ventures discuss in their annual report.

The fifth subsystem considers the management of three of the firm's resources (Figure 1, grey coloured). Firstly, the venture's *firm managing capacity* to manage its total human resources depends on its human resources managing the firm and their capabilities. The management also expands its human resources through *hiring*. Secondly, the management ensures the *sufficiency of complementary assets*. The venture's human resources determine the complementary assets required to equip these employees adequately. If complementary assets are insufficient, the

[1] The formal model distinguishes between four different types of human resources (technology development, marketing and sales, customer service, and firm managing) and their capability levels.

management will purchase more complementary assets with its financial resources. Finally, the management raises new funds to pursue growth plans. The outcomes of this subsystem are thus the venture's human resources, complementary assets, and capital employed. However, all activities changing these outcomes – hiring, fundraising, investing – can only be executed if *managerial slack* is available, i.e. the *managerial capacity* is not fully utilised to manage the firm's existing human resources (Penrose, 1995, 2009; Garnsey, 1998; Hugo and Garnsey, 2001, 2002, 2005; Garnsey, Dee and Ford, 2006; Stam and Garnsey, 2006; Garnsey, Lubik and Heffernan, 2015).

Dominant logic

The final subsystem considers the dominant logic that expresses the growth goals of the management and entrepreneurs (Figure 1, purple/pink coloured). The literature has observed two different types of dominant logic: managers that want to grow and managers that prefer their employee number to remain fixed. SaaS entrepreneurs that want to grow often strive to scale up their customer base. They may form a *growth goal* and then determine the human resources required to acquire and service additional customers and manage additional employees. The difference between their current and *target human resources* determines the *required hiring*, which the managers execute when they are not fully occupied with managing the existing employees. In addition, the venture might raise new capital to pursue growth plans. The more ambitious its plans, the higher the *fundraising target*. On the other hand, ventures that do not aim to grow their customer base will not continuously update their target human resources. These ventures maintain a fixed target of human resources. Lastly, when forming hiring goals, managers also consider if the venture's financial resources are adequate and will reduce hiring if the venture cannot afford it or is waiting to raise capital. Moreover, the venture may even lay off employees if the venture is in financial problems (Schumpeter, 1928; Kotter and Sathe, 1978; Eisenhardt and Schoonhoven, 1990; Stuart and Abetti, 1990; Fransman, 1994; Garnsey, 1998; Nicholls-Nixon, 2005; Steffens, Davidsson and Fitzsimmons, 2009; Hansen and Hamilton, 2011; Huang *et al.*, 2017; Zaheer *et al.*, 2019).

MODEL VALIDATION

The model has been tested with two SaaS companies. The outputs of each subsystem have been compared to the historical data of the case companies. Below each case company is introduced, and the outcomes of the value creation and value capture subsystems are compared to historical case data.

Alpha

Alpha is a UK-based company that provides communication software that integrates into customer relationship management and human resource management

platforms. Alpha's customers use the software to improve their marketing, sales, customer service, and human resource departments' productivity. Six years of data are available for Alpha. The company switches from a growth-focused dominant logic to a fixed-input dominant logic after two years and a quarter of simulations. With that change in dominant logic, the company also targets a new customer segment that uses the product more intensively. In both states, Alpha's value creation should be expected to increase. During its first dominant logic, Alpha's increasing customer base is a driver of value creation. Even during its fixed-input dominant logic, Alpha's customer base may increase as it still maintains a fixed number of marketing employees. Moreover, the increasing usage intensity of its new target segments increases usage intensity further.

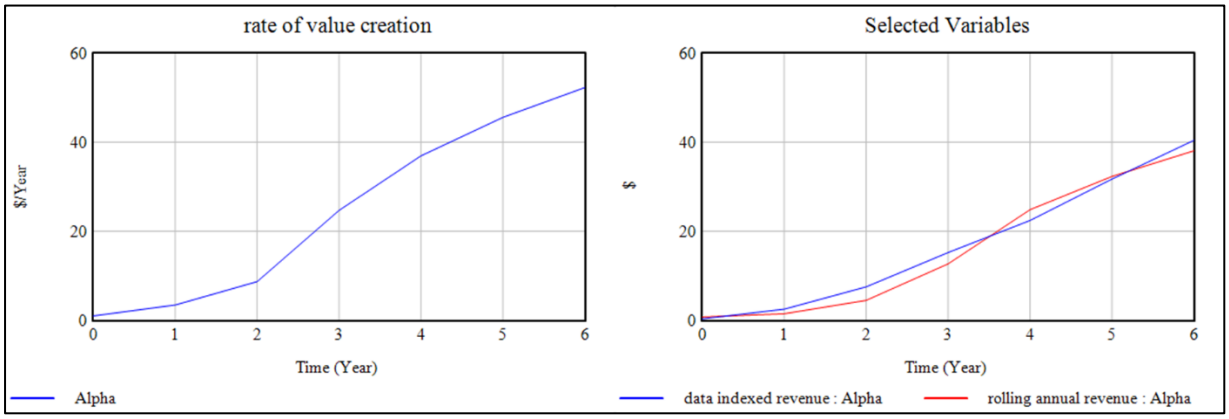

Figure 2: Value creation outcomes for Alpha[2]

Consistent with theory, value creation of Alpha increases throughout the years of investigation (Figure 2). The development of value creation is also reflected in the venture's revenue, which the model calculates through the rate of value creation and the share of value captured from customers. Alpha's revenue growths similar to the rate of value creation but remains at a lower amount. This relationship is expected and explained by conceptualising value creation as the upper limit for revenue in the model development sections. The revenue calculated within the model approximates revenue reported by the venture well. Some of the value captured from customers as revenue is shared and passed on to input providers. While value creation increases throughout the years, human resources and capital inputs increase during the first dominant logic. Therefore, it is not possible to make predictions about the performance development based on theory because the development depends on the balance of changes in value creation and input compensation. However, with a

[2] The left graph illustrates value creation calculated in the model. Value creation in empirical studies is often approximated using revenue, illustrated in the right graph, which the model calculates based on value creation and the share of value captured. Revenue calculated in the model (red line) is compared to the indexed historical revenue of Alpha (blue line). The same applies to Figure 4 for company Beta.

more fixed size and increasing value creation, the share of value captured should increase during the second and third growth state.

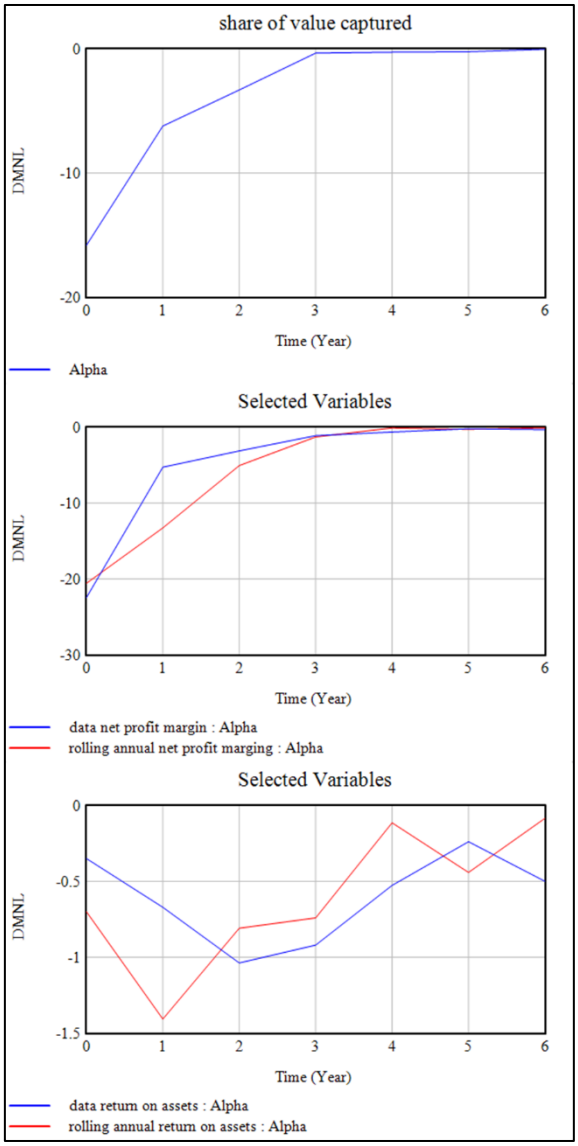

Figure 3: Value capture outcomes for Alpha[3]

Throughout the years of simulation, the model and net profit margin indicate improvements in performance outcomes while the venture loses resources every year (Figure 3). After one year of simulation, Alpha loses about five times its revenues. However, its share of value captured and net profit margin improve towards zero in a goal-seeking manner. Therefore, the model and historical data confirm the theory during the second dominant logic, where predictions were possible. However, the

[3] The first graph illustrated the share of value captured calculated in the model, which empirical studies usually approximate using net profit margins (second graph) or return on assets (third graph). The model also calculates these profitability ratios (red lines) to compare it to historical case data (blue lines). The same applies to Figure 5 for company Beta.

return on assets does not follow this behaviour. It fluctuates around -0.5 and -1, indicating that the venture loses between half and all its assets per year. While the model can approximate Alpha's fluctuating return on assets, it does not seem to be a suitable indicator of the share of value captured.

Beta

Beta is a US-based company that offers communication software for businesses and their teams. Beta claims that its SaaS product helps its customers to improve productivity and reduce costs. Three years of data are available for Beta, during which the company develops through two dominant logics. After two and a half years of simulations, Beta switches from a growth-focused dominant logic to a fixed-input dominant logic. While the venture should increase its value creation due to its increasing user base during its first dominant logic, growth may slow down during the second dominant logic because the venture no longer increases its human resources to acquire additional users.

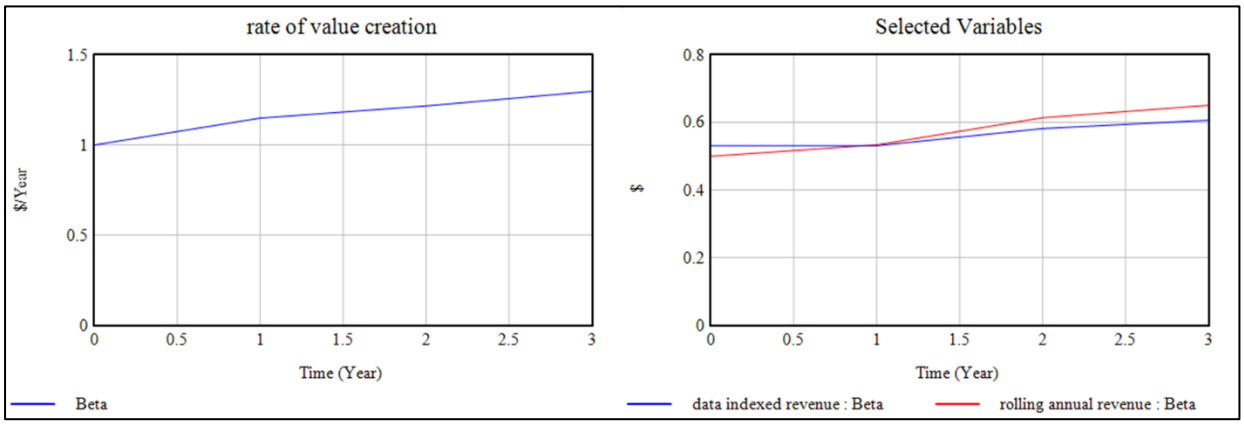

Figure 4: Value creation outcomes for Beta

As expected, value creation and revenue in the model and historical revenue increase slightly and slow down during the final year (Figure 4). Due to increasing value creation and inputs in the first dominant logic, no predictions can be made about the development of the share of value captured during the first growth state. However, due to increasing value creation and lower inputs during the second dominant logic, the share of value captured should increase during the final year.

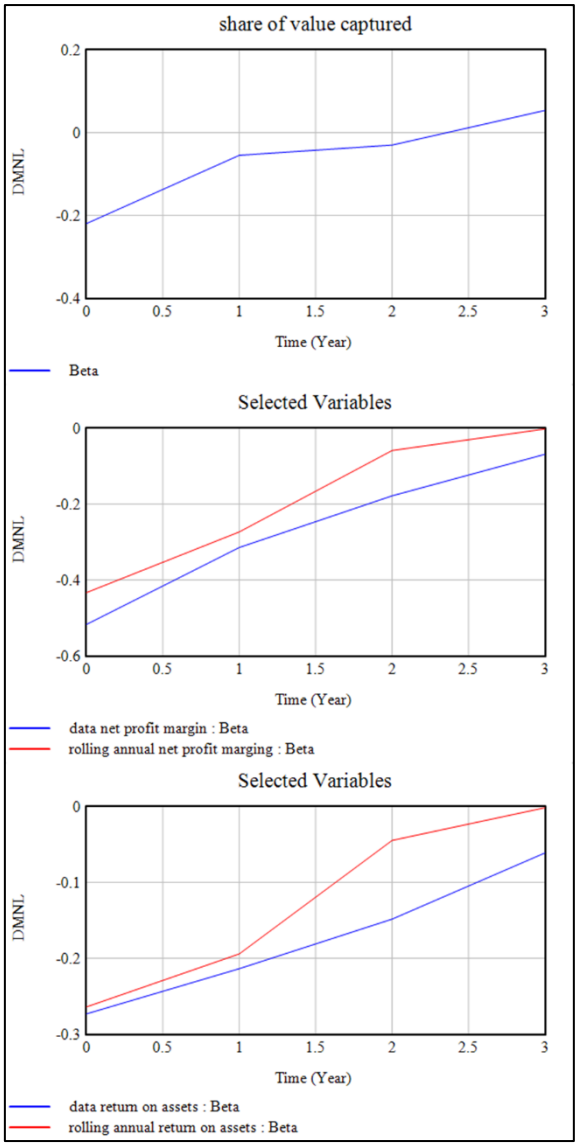

Figure 5: Value capture outcomes for Beta

During all years, the share of value captured increases (Figure 5). Except for the initial year, the model approximated empirical measures of the share of value captured well. While they develop similarly to the share of value captured, an initial difference can be observed that can be explained by the transformation of instantaneous rates to annualised accounting figures when no full year of data is available in the model yet.

MODEL SIMULATION

This research project has set out to investigate the performance development of SaaS companies. So far, this paper has pointed out three situations that require particular attention. Firstly, those ventures with a dominant logic holding the number of employees constant because the managers and entrepreneurs do not strive for growth. These ventures have a fixed number of employees in their operations. Secondly, those ventures with dominant logics in which the number of employees is

continuously increased to achieve customer growth goals. In the model, these different dominant logics have been implemented using a switch that activates a feedback loop (Coyle, 1996) between customers and human resource targets. Both case companies have already shown these two dominant logics. However, they also indicate that companies turn from growth-based to fixed-input dominant logics over time. The performance development of these three situations is explored below through simulation of hypothetical scenarios.

Companies with fixed-input dominant logics

Hypothetical scenarios are simulated with constant human resources over five years. A base case has been constructed (green line), and two additional scenarios have been created based on this base case. In the first one, input costs have been increased (blue line); in the second one, capability improvement rates have been increased (red line). These simulations have revealed a goal-seeking development of performance outcomes (Figure 6). This mechanism reaffirms the diversity of performance outcomes noticed in the literature, finds similarities between companies' performance developments, and outlines a pitfall for researchers investigating company performance.

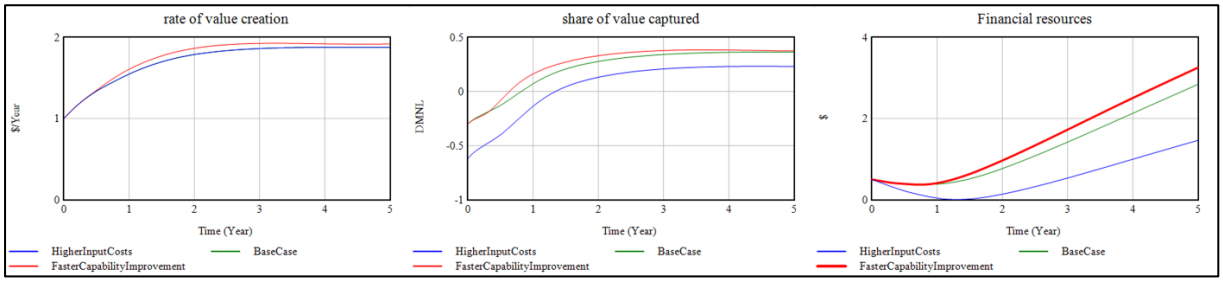

Figure 6: Performance development of companies with a fixed-input dominant logic

The simulations confirm the diverse performance levels of SaaS ventures. Previous literature has suggested that the performance development of companies is diverse. While some but not all companies are able to grow their customer base and the value they create, only some are also able to turn this growth into an ability to capture value (Davidsson, Steffens and Fitzsimmons, 2009; Steffens, Davidsson and Fitzsimmons, 2009; Govindarajan, Rajgopal and Srivastava, 2018; Trenz, Huntgeburth and Veit, 2019; Sun and Ertz, 2021). The simulation confirms this diversity in abilities to capture value and abilities to grow. Different performance levels and different amounts of time are required to achieve them in a goal-seeking manner when the model inputs, such as input costs or capability improvements rates, are changed. These two additional scenarios are just two of many variables that could have been changed and caused different performance levels.

While acknowledging the diversity of performance outcomes during their development and their final levels, the simulations also illustrate similarities among

those diverse companies. All companies develop towards "natural performance levels" in a goal-seeking manner. Thereby, even companies that do not strive to grow may increase the value they create and capture. Even with fixed human resource inputs and low growth ambitions, the model (Figure 1) explains the growth in value creation by the existing human resources acquiring new customers, improving the technology, and increases in customer's usage intensity. However, these value drivers are limited by balancing feedback loops in the individual subsystems: the customer base is limited to the capacity to service customers, the technology development is limited by the maximum technological quality of the technology s-curve, and the usage intensity is limited in the value creation subsystem. While capacity limits and the rates of technology development and customer acquisition increase through improving capabilities over time, these improvements are limited by a balancing feedback loop too.

Finally, the simulation illustrates a pitfall for researchers investigating company performance. Performance outcomes are diverse even for the same company employing the same strategy and business model. For example, a researcher investigating the base case during the first year of simulation would attribute a high ability to grow and low ability to capture value to the company. However, looking at the same company with the same strategy and business model during the final year of simulation shown in Figure 6, a researcher would identify a low ability to grow but a high ability to capture value. Thus, researchers need to take a longitudinal and dynamic perspective to company performance because fluctuations in the short term may be due to managerial decisions made a few years earlier.

Companies with growth-based dominant logics

The next set of simulations investigate the performance development of companies with growth-based dominant logics. The fixed-input base case has been simulated (green line), and two additional scenarios have been created with different customer growth goals (blue line with a 10% target growth rate and red line with a 25% target growth rate). Compared to the base case with fixed employee inputs, the growth-focused ventures increase the value they create. However, ventures with ambitious growth goals show an immediate decrease in the share of value captured (Figure 7). The fraction then increases but towards a lower level than the base case. This lower fraction reduces the venture's financial resources compared to the base case.

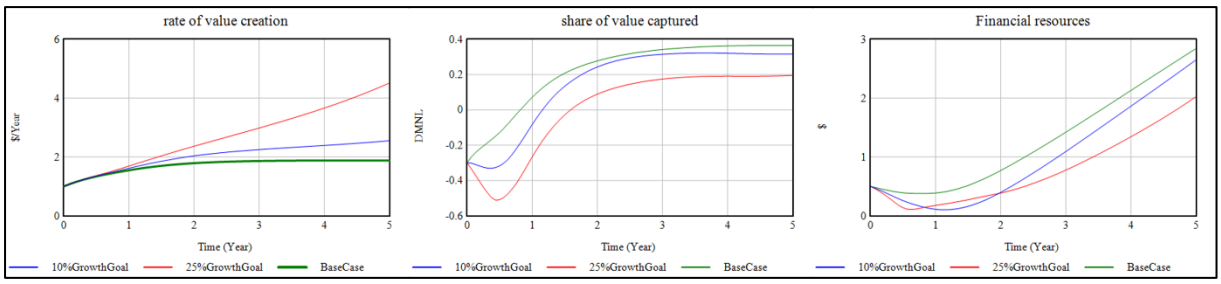

Figure 7: Performance development of companies with a growth-focussed dominant logic

Companies with a growth-based dominant logic increase the value they create. They are not constrained by all the limits that affect companies with a fixed-input dominant logic and can grow their customer base and rate of value creation. They do so by hiring additional marketing and selling employees to acquire more customers, hiring additional customer service employees to service those new customers, and hiring new firm managing employees to manage the firm. Thereby, these firms increase the rates at which they acquire new customers and push their capacity constraints upwards.

However, while the companies can increase the value they create, their share of value captured suffers. Firstly, the venture's share of value captured immediately decreases due to timing differences between inputs that the venture must pay for and growth in the rate of value creation. Secondly, compared to the base case with fixed inputs, the two growth-focused ventures develop towards a lower share of value captured. The model explains these lower levels through the lower capabilities of the average employee. Every time new employees are hired to achieve updated growth goals, capabilities fall due to employees' lack of firm-specific knowledge. Therefore, more employees are required to acquire, service, and manage a growing firm than in a fixed-inputs firm with better-developed capabilities. The share of value captured also develops towards a set level. However, this is not a goal-seeking mechanism but rather a dynamic equilibrium. On the one side, capability improvements and capacity filling up should improve the share of value captured. On the other hand, the continuous expansion lowers capabilities and creates new idle capacity. These opposing forces balance and the share of value captured remains at a steady level. The higher the growth rate, the stronger the forces pushing the share of value captured down and the lower the share of value captured at which the system stabilises. Thus, growing companies face a trade-off between growing the value they create and capturing a share of that value. Particularly in high growth cases, this trade-off poses a risk of bankruptcy. While the high growth case in Figure 7 maintains low levels of financial resources, a slightly higher growth rate would have caused the firm's financial resources to fall below zero. In practice, this would mean bankruptcy for the venture because it is unable to pay its suppliers and employees.

Transitions from growth to fixed-input dominant logics

Due to market constraints, fulfilled ambitions, or internal constraints, companies need to transition from a growth-based to a fixed-input dominant logic (Levie and Lichtenstein, 2010; Brown and Mawson, 2013). The scenarios used to simulate growth-based dominant logics have been used to investigate this transition. During the first five years, companies are operating under the same conditions as the growth-based scenarios (green line for the base case with fixed inputs throughout the simulation; blue line with a 10% target growth rate and red line with a 25% target growth rate during the first five years of simulation). After five years, their number of marketing employees have been fixed at their level at that point. The simulation is then run for another five years with these fixed levels (Figure 8).

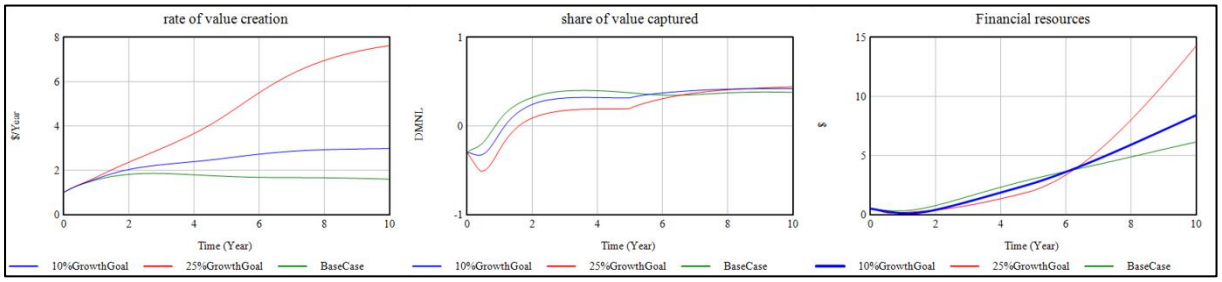

Figure 8: Performance development of companies transition between dominant logics

While the growth-based simulations have illustrated the immediate trade-off between growth in value creation and the share of value captured, the simulations including the transition illustrate the long-term trade-off between value creation and the share of value captured. Once the companies return to a fixed size growth state, their performance outcomes develop in a goal-seeking manner again. However, their rate of value creation after the period of growth develops towards a higher level of value creation. Moreover, their share of value captured returns to a value close to their original level. Metaphorically, companies capture a similar fraction of a much bigger pie after growing. In absolute amounts, the value they capture as profit is thus larger, which is also reflecting in the significantly rising financial resources compared to the base case. Moreover, the slightly higher share of value captured than in the base case illustrates that growth does positively affect the share of value captured after the growth process due to economies of scale. Combined, the higher rate of value creation and slightly higher share of value captured cause significantly faster grow in the venture's financial resources once the company transitions to a fixed-inputs state and ceases to target ambitions growth rates. Thus, periods of growth pay off once the venture stops growing. Companies must decide whether the higher rate of value creation established by growing and slightly higher share of value captured after growing outweigh the lower share of value captured during the growth process and avoid the risk of bankruptcy during the growth period mentioned above.

DISCUSSION AND RECOMMENDATIONS

This paper has developed a System Dynamics model based on growth paths theory and dynamic states theory to investigate SaaS ventures' growth in value creation and their share of value captured. The model has been empirically validated using the historical data of two SaaS ventures and has been simulated for hypothetical scenarios of three theoretically and practically relevant conditions. These simulations illustrate that companies with a fixed number of employees have natural performance levels towards which they develop over time. By increasing their headcount to grow their rate of value creation, ventures will suffer a lower share of value captured during the period of growth. After periods of growth, a venture's share of value captured returns to their natural performance level while their rate of value creation will develop towards a higher level. These findings illustrate two important aspects of company performance: the development towards natural performance levels of SaaS companies and performance trade-offs between growth and profitability.

Development towards natural performance measures

The findings indicate that companies develop towards natural performance levels for their rate of value creation and their share of value captured if they maintain a fixed number of employees and do not pursue more ambitious growth goals. Thereby, this project connects two different streams of research. One stream of previous research has focussed on companies' performance levels and the factors that determine these levels, which the model considers and implements. For example, in strategic management, which is concerned with competitive advantage and profitability, factors affecting the share of value captured have been identified. The two most common approaches are the industry-structure and the resource-based view (Steffens, Davidsson and Fitzsimmons, 2009; Grant, 2016). In the industry-structure approach, competitive advantage depends on external factors such as the level of competition or the bargaining power of input providers (Porter, 1985, 2008). In the resource-based view of strategic management, company performance depends on resources owned or controlled by a company and their characteristics, such as their relevance and rarity (Wernerfelt, 1984; Barney, 1991). While strategic management focused on the share of value captured as a central performance outcome, entrepreneurship focuses on growth. Numerous factors enhancing growth have been identified, such as the quality of the venture's product, its growth goals, or its capabilities (Siegel, Siegel and Macmillan, 1993; Davidsson, Achtenhagen and Naldi, 2010). The recommendations of these static, factor-based approaches have been implemented in the model. They can be used by managers to improve the performance levels of their ventures. For example, the simulations have shown that companies with high input costs show lower shares of value captured. Similarly,

competition and substitute products are considered in the model. Moreover, the quality of resources such as the product quality and capabilities have been considered in the model. They enhance both growth in value creation and the share of value captured. By altering these variables, i.e. developing better resources or positioning themselves better in their respective environment, managers of SaaS companies can improve their performance levels.

Another stream of research considers the performance development of companies. In such approaches, reinforcing mechanisms have been pointed out. For example, growth leads to network effects, learning effects, and economies of scale, which improve profitability, generating funds that can be reinvested for further growth and improved profitability. While this spiral leads to reinforcing growth for some companies, it may also be a spiral of death for those companies that lose resources throughout their growth process (Argenti, 1976; Garnsey, 1998; Hugo and Garnsey, 2001; Garnsey, Stam and Heffernan, 2006). Such developmental spirals are implemented in its model as feedback loops, for example, through the financial resources determine the human resource targets of the firm. For managers, these mechanisms imply that they need to ensure that reinforcing feedback has positive rather than destructive effects on their performance outcomes and that reinforcing loops are not inhibited by balancing loops.

However, the developed model goes beyond just considering both approaches. It shows that the static, factor-based view and the dynamic view on company performance are complementary and work simultaneously. The project has confirmed that performance levels for companies exist, and companies' individual levels may differ diversely. These levels depend on external factors such as competition and input costs, and internal factors such as resources and capabilities of the firm. However, the model also shows that the venture's strategy as part of its growth goal affects performance outcomes. On the other hand, this project also shows that companies may diverge from their natural level. Companies with fixed sizes develop to their performance levels over time through the feedback loops. Thereby, growth is not reinforcing, but rather, companies are limited by balancing feedback that causes the goal-seeking development of performance outcomes. For managers of SaaS companies, development towards performance levels mean that they must design business models with positive natural performance outcomes. Contrarily to the belief of many practitioners, SaaS ventures cannot grow themselves profitable. Instead, it becomes critical to get their business model design right to achieve positive shares of value captured when the venture reaches its natural performance levels. Otherwise, the venture will remain loss-making. While it is difficult for managers to identify these performance levels ahead of time, the model presented in this paper allows approximating them based on assumptions, for

example, about customers' maximum usage intensity or maximum productivity levels. Moreover, ventures may validate and improve their business model using fixed inputs to their operations before scaling up. Companies can also diverge from these natural performance levels during and through periods of growth, which increase the value creation of SaaS companies while leading to temporary lower shares of value captured.

Trade-offs between growth in value creation and the share of value captured

The findings illustrate the short- and long-term relationships between growth in value creation and the share of value captured. These theoretical performance measures have commonly been measured using sales or employment growth and profit margins or return on assets (Porter, 1985; Stam, Garnsey and Heffernan, 2006; Steffens, Davidsson and Fitzsimmons, 2009. However, the literature is inconclusive regarding the relationship between these two types of performance. Some argue that there is a positive relationship between growth and profitability measures, which authors attribute to, for example, economies of scale, learning effects, network effects, of first-mover advantages (Katz and Shapiro, 1985; Chandler and Jansen, 1992; Davidsson, Steffens and Fitzsimmons, 2009). Other studies have found adverse effects of growth on profitability, for example, due to the challenges of growth creating organisational turbulence and resource constraints (Nicholls-Nixon, 2005; Greve, 2008). And yet others have found no statistical relationship at all (Markman and Gartner, 2002) or more complex relationships between the two performance outcomes (Capon, Farley and Hoenig, 1990; Davidsson, Steffens and Fitzsimmons, 2009; Steffens, Davidsson and Fitzsimmons, 2009). Due to these conflicting relationships, the question of the growth-profitability relationship remains open, particularly for digital and SaaS ventures (Kraus *et al.*, 2018; Zaheer *et al.*, 2019; Zaheer, Breyer and Dumay, 2019).

This project provides further evidence regarding the growth-profitability relationship of SaaS ventures using longitudinal analysis. In the simulations, all views – positive, negative, no relationship – can be observed for the same company with the same strategy. For example, in the growth-based set of simulations, a negative relationship between growth in value creation and the share of value captured can be observed during the first six months. For the next two and a half years, a positive relationship can be observed as both performance measures increase. Afterwards, the share of value captured remains at its dynamic equilibrium while the venture's value creation grows, suggesting no relationship between the two variables. Thus, instead of focussing on statistical relationships between the two performance types, researchers need to investigate the mechanisms that drive the two performance levels and pay particular attention to the temporal order of events.

This project illustrates these mechanisms through feedback loops. They indicate a negative relationship between growth and profitability during the period of growth but beneficial effects after periods of growth. During the period of growth, a timing difference between resource inputs required for growth and the growth in value creation causes an immediate decrease in the share of value captured. While the share of value captured improves afterwards, the higher the growth rate, the lower the share of captured during growth. These lower rates negatively affect financial resources, and managers must thus ensure that their SaaS ventures raise sufficient capital to survive the growth period until they generate resources through their activities. However, the increased size after the period of growth is beneficial to the venture. Due to economies of scale, the venture now captures a slightly larger fraction of a much larger value pie. Thus, managers of SaaS ventures must determine if the long-term benefits of growth outweigh the short-term disadvantages.

CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

This paper has set out to investigate the performance development of SaaS ventures regarding their ability to create value for customers and capture a share of that value. It has developed and validated a System Dynamics model. Simulating the model illustrated that there are natural performance levels for companies with a fixed size, which are only altered through economies of scale after periods of growth. Additionally, simulations reveal short-term trade-offs between growing the rate of value creation and the share of value captured, while periods of growth are beneficial for companies once they have stopped growing.

This research contributes to the research on factors affecting company performance, the development of company performance, and trade-offs in performance measures through a holistic and longitudinal System Dynamics methodology. It combines factors-based approaches of performance levels with developmental approaches. As in previous literature, these performance levels may be diverse. The existence of performance levels and the goal-seeking development towards them have implications for researchers investigating the performance of SaaS companies. Researchers should investigate performance longitudinally because the same company with the same business model may show very different performance characteristics at different points in time. Moreover, researchers may aid SaaS entrepreneurs and managers to achieve necessary improvements in business model design by identifying the variables that managers and entrepreneurs can change to optimise performance levels. Such research may use, for example, sensitivity analysis in simulations. Secondly, this research shows an immediate and long-term trade-off between growing the rate of value creation and the share of value captured. Because different relationships between growth in value creation and the share of value

captured can be overserved for the same company with the same strategy, research needs to consider temporal elements and investigate this performance relationship longitudinally.

This research illustrates that value creation and capture should be approximated using revenue and profit margins in future research. While previous empirical studies have used revenue as a proxy for value creation, many scholars used return on assets rather than profit margins as a proxy for the share of value creation. Validating the model with two companies has revealed that return on assets may not always be an appropriate proxy for SaaS companies. These differences between the theoretical share of value captured and return on assets can be explained by the nature of return on assets. It calculates the venture's ability to use its resources recognised on its balance sheet to generate further resources. Theoretically, this differs from the share of value captured, which expresses the resources generated as a fraction of the value created, not the resources already owned. Moreover, return on assets might be a particularly poor proxy for SaaS companies, which are asset-light because they do not require, for example, production equipment.

For practitioners, the findings of this research project indicate that they must design business model with positive natural performance outcomes. Neglecting economies of scale, the share of value captured cannot be altered without improving the business models. To design such business models and optimise them, they may be inspired by the established literature on strategic management and entrepreneurship, which cover a range of factors that affect performance levels, including competition, input costs, or resources and capabilities. Before pursuing growth, managers should evaluate if growth is beneficial in the long term and ensure that their ventures can withstand the temporary strain on financial resources during the period of growth. Like optimising their company's natural performance levels, they may also strive to minimise the negative impact of growth on their short-term performance.

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