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Start-Ups as Adaptable Stable Systems Based on Synchronous Business Models

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Abstract: Business models have been a popular topic in research and practice for more than twenty years. During this time, frameworks for formulating business models have been developed, such as the business model canvas. Moreover, different business model frameworks have been proposed for different sectors. Yet, these frameworks have the fundamental shortcoming of not addressing directly and persistently the primary objective of start-ups: to survive in changing environments. The aim of the action research reported in this paper is to overcome that fundamental shortcoming. This is an important topic because the majority of start-ups do not survive. In this paper, first principles for survival in changing environments are related to business models. In particular, action research to reframe start-ups as adaptable stable systems based on synchronous business models is reported. The paper provides three principal contributions. The contribution to business model theory building is to relate survival first principles revealed through natural science research to business models. Reference to first principles highlight that survival depends on maintaining both external adaptability and internal stability through synchronization with changing environments. The second contribution is to business model practice through describing a simple business modeling method that is based on the scientific first principles. The third contribution is to provide an example that bridges the rigor–relevance gap between scientific research and business practice.

Keywords: adaptability; business model; ecological fitness; entropy; environment; growth; stability; start-ups; survival; synchronous

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1. Introduction

It has been argued that nature-based methods can contribute to increasing the resilience of human organizations in a changing world [1,2]. First principles include basic propositions about nature that have been revealed through scientific research [3]. For example, first principles of how organisms survive in changing environments. One basic proposition is that survival in changing environments depends upon balancing adaptability and stability [4–8]. Organisms that are well-adapted with their environments can be described as having high ecological fitness [9]. In other words, they have a good fit with their environment. Organisms that are best adapted with their environments can survive with least action and have surplus energy available to enable their growth [10]. For organisms to be well-adapted to their environments, they need to have reciprocal back-and-forth exchanges of learning and development with their environments [11]: ideally, synchronous exchanges of learning and development. This involves organisms having internal models of how they will survive in environments. Internal models are shaped by open boundaries and survival parameters. Organisms that do not continue to develop their internal models through learning with their environments will not survive [12]. For example, without understanding of their environments, they will experience high information uncertainty, much physical disorder, and useless energy expenditure lost in unproductive actions: all of which can undermine their internal stability [13].

In this paper, action research [14,15] is reported that involved survival first principles being applied in a simple business modeling method. The action research is reported in the remaining five sections of the paper. Next, in Section 2, the action research methodology is explained. In Section 3, literature review, internal model formulation and operation are explained in terms of first principles. In addition, survival is explained in terms of synchronization for adaptable stability. In Section 4, implementation of first principles in the new method is described. In Section 5, the method is related to different stages of start-ups lifecycles, and to other methods for business modeling. In conclusion, in Section 6, principal contributions are stated, and directions for future research are proposed. By providing survival first principles for changing environments, the paper goes beyond extant business model theory and practice that is based on organizational studies [16,17]. Furthermore, this paper goes beyond business model studies that have framed interaction between businesses and environments in terms of open innovation [18,19], and beyond studies that have advocated for consideration of ecological sustainability in business models [20,21]. By contrast, the focus here is on fundamental principles for survival that have been revealed by natural sciences research [22,23]. The aim of the paper is to address the fundamental shortcoming of extant business model methods that do not address directly and persistently the primary objective of start-ups: to survive in changing environments. Nonetheless, it is not intended to suggest that the business modeling method explained in this paper should replace existing methods. Rather, that the method presented here could complement existing methods.

2. Action Research Methodology

Action research adds change to the traditional research objectives of improving description, explanation, and prediction of complex phenomena. Action research is appropriate when complex phenomena can be improved through change [14,15]. Apropos, the survival rate of start-ups is very low. Moreover, evaluating which start-ups will be successful is so difficult that it can be more effective to allocate start-up funding randomly rather than on the basis of analyzing start-ups' plans [24,25]. Hence, new business model methods are needed to facilitate start-ups' survival and growth. The action research involved iterations of review of natural science findings concerned with survival in changing environments; formulation of the new method; and obtaining feedback on the new method from start-up experts. Feedback was obtained through meetings during which the latest version of the new method was discussed with experts. In addition, experts provided feedback via emails. Experts opined that natural science first principles are relevant to their own organizations and to the start-ups that they support through their programmes. Their feedback provided suggestions for improving the usability of the method.

3. Literature Review

3.1. Internal Models

Natural science research indicates that the formulation of an internal model involves establishing boundaries and parameters. In particular, organisms construct their own constraining boundary conditions in order to be able to do the work needed to survive. Work has been described as the constrained release of energy into a few degrees of freedom [26]. If the release of energy is not constrained, most of the energy would be dissipated rapidly as entropy. For practical purposes, entropy can be considered to be information uncertainty that leads to physical disorder, which entails useless energy expenditure that is lost in unproductive actions. By contrast, constraining the release of energy enables more work to be done with the same amount of energy. Establishing constraining boundary conditions enables organisms to differentiate themselves from the environment while being open to exchanges of information, matter, and energy with the environment [27].

For example, a hunter–gatherer band distinguishes itself from other hunter–gatherer bands and other species. Such differentiation is essential to survival in deciding what will be hunted/gathered, and in the arrangement of work for efficient hunting and gathering that provides an energy surplus. For hunter–gatherer bands and for business organizations, the positioning of boundaries can depend upon comparison of differences between the transaction costs of doing work internally versus buying work done in the environment—for example, whether to construct a shelter or to occupy a cave; whether to make inside a business or to buy from the market [28].

Organisms and organizations can shape their boundaries and how they will release energy to do work through a bricolage process, which involves choosing what is most useful from whatever existing things happen to be available. Bricolage with existing things can be directed towards creating new things that involve new interactions between work, energy, and entropy. This, in turn, can lead to exponential growth in opportunities for new things as more existing things become available for bricolage. For example, the potential uses of one existing thing can be combined in many different ways with the many potential uses of other existing things. Potential uses of existing things can include many new uses that are different to their original uses [29,30]. This can lead to the creation of complements and substitutes for existing things. What is created emerges unpredictably from different organisms' and different organizations' different perspectives [31,32].

Exchanges with the environment take place on what can be described as survival parameters. Consider, for example, a band of hunter–gatherers that is well-adapted to its environment. To survive, they need water, food, and shelter. As the hunter–gatherer band is well-adapted with its environment, its members know exactly how to obtain water, food, and shelter close by. Hence, they can obtain water, food, and shelter with the least action and minimal energy expenditure, which leaves them with surplus energy that they can use to grow the size of their hunter–gatherer band. For the hunter–gatherer band, water, food, and shelter can be considered to be three survival parameters around which many everyday activities are arranged. Energy availability can be considered to be their controlling survival parameter. This is because while there may be some flexibility on individual survival parameters, such as how long they can survive without water or food or shelter, they cannot survive without having at least some energy available to try to obtain water, food, and shelter. Together, the four parameters provide the basis for the hunter–gatherer band's internal model of how it will survive in the world. Such parameter-based structuring can be applied to many phenomena [33].

Internals models provide the basis for generating patterns of interaction with the world. In particular, iterations of predictions and actions are made on survival parameters with the overall goal of minimizing uncertainty about how to survive. For example, three survival parameters for businesses can be customer base, product sales, and user experience. Their control parameter can be cash flow. This is because while there may be some flexibility in individual survival parameters, they cannot survive without having positive cash flow to pay for the many activities involved in growing a customer base, making product sales, and achieving positive user experience.

Businesses will make predictions about how many sales they expect on their product sales survival parameter. There will be no prediction error on the product sales survival parameter if sales forecasts are matched by actual sales. However, all survival parameters must be considered together when seeking to minimize uncertainty about how to survive. For example, there can be high uncertainty about survival even if sales forecast is matched by actual sales, but if user experience of the sold products is very bad. Then, the customer base could shrink and cash flow could be negative because of costs such as product recalls.

Maintaining synchronization with the environment involves making predictions about what will happen in interactions with the environment and addressing prediction errors between what is expected to happen and what does happen. Natural science research indicates that three types of actions can be taken iteratively to reduce prediction errors: i.e., to reduce differences between what is expected to happen and what actually happens—updating beliefs, shifting focus, or changing work [13,34]. Actions can be updating beliefs about how to survive, such as updating beliefs about how wide a range of products to offer. Actions can include shifting focus of attention in trying to survive, such as paying more attention to existing customers from whom sales are low. Actions can involve changing work done in order to survive, such as improving invoicing procedures to improve cash flow. Each individual action can contribute to changing business and/or environment to maintain synchrony and improve fit between business and environment.

As summarized in Figure 1, updating beliefs, shifting focus, and changing work can be directed towards improving capabilities to compete, to cooperate, and/or to construct in the environment. Construct refers to processes by which an organism alters local environment and/or undertakes wider ecosystem engineering in order to increase potential for survival by making more of the kind of space it needs for itself. In particular, construction can increase the flows of information, matter, and energy for the organism [9]. Construction may be carried in competition against others or in cooperation with others as necessary to improve fitness [35].

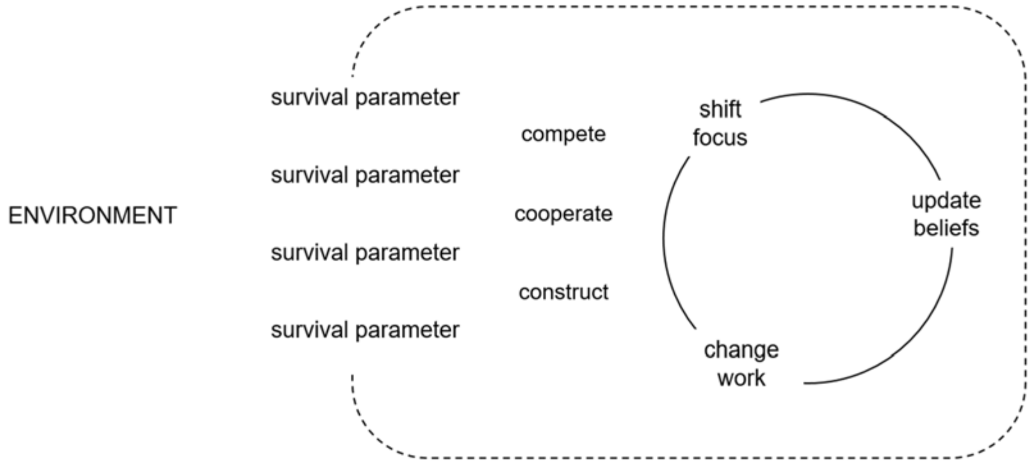

Figure 1. Internal model comprising open boundaries and survival parameters that synchronizes with the environment by updating beliefs, shifting focus and/or changing work.

3.2. Synchronization for Adaptable Stability

Overall, long-term survival depends upon synchronous back-and-forth reciprocal exchanges of organism–environment learning and development. Such synchronous systems can be described in terms of rhythmogenesis. That is the generation of rhythms found in biological systems in which coupling provides feedback [36]. This corresponds with the notion of the so called dance of change, which involves organizations making external changes and internal changes in order to survive [37]. If businesses' internal models are well-adapted to their environments, they will not experience information uncertainty on their survival parameters that leads to physical disorder and entails unproductive energy expenditure, which can undermine internal stability [38]. For example, they can have adequate customer base, product sales, and user experience with minimal energy expenditure, which leaves them with surplus energy that they can use to grow their businesses.

However, survival depends upon neither overfitting nor underfitting internal models through iterations of actions during back-and-forth exchanges with the environment [39]. Rather, internal models need to resemble the environment [40]. Overfitting can involve an internal model becoming too complicated because it is changed in response to every unexpected small sensory input from the environment. This can happen because sensory input from the environment is inherently noisy. Conversely, underfitting can occur when an internal model does not adequately resemble the environment in which an organization intends to survive. Overfitting can lead to internal models being too complicated, but under-fitting can lead to internal models being too simple. Both of which can increase risks from interactions with the environment.

Survival risks are increased if the internal model is not aligned with the causes of sensory inputs from the environment. For example, a nonlinear internal model will tend to have poor predictive performance when a business is trying to survive in a linear environment (i.e., overfitting) or vice versa (i.e., underfitting). Also, there can be ambiguous sensory inputs if iterations of actions lead to there being imprecise alignment between internal model and external environment. This can hinder accuracy in predictions about what is expected to happen and accuracy in perception of what has happened [41,42].

As well as an internal model losing synchrony with the environment through overfitting or underfitting, there can be loss of model synchrony because iterations of predictions and actions come to be focused on the past rather than on the changing present. This phenomenon can be found at the level of microbiology [43] and can be considered as an organism becoming stubborn [12]. From the point of view of business, this phenomenon can be referred to as lock-in where businesses base their current actions on entrenched paths of past actions [44], even when there is increasing evidence that actions are failing [45].

Such rigidity can be more likely when an organism or an organization considers itself to be threatened [46]. This can be because internal models provide the basis for generating perceptions. In particular, perceptions about the world are made through combination of sensory stimuli coming from the world, such as light coming to the eyes, and internal representations built through prior experience [47,48]. This can be summed up with phrases such as, 'we don't see things as they are but as we are' [49]. Internal representations can have a determining influence over what we would like to see in the environment [41] and over how we interpret sensory inputs from the environment [42]: neither of which necessarily provides accurate information about the environment. This may be because humans evolved as hunter–gatherers to emphasize memories of knowledge considered most important for survival [50].

When an internal model is not synchronous with the environment, prediction errors on individual survival parameters and overall uncertainty about how to survive can increase until a business fails. For example, a business can be uncertain why product sales do not meet its sales forecast when it believes that its new product range has a variation for every possible customer's every possible taste (i.e., overfitting) or that its one new product is best for all customers (i.e., underfitting) or that there is no need to change its products because they have been market leaders in the past (i.e., no fitting). In any case, this can lead to physical disorder in rushed actions such as crisis product campaigns and haphazard cash raising, which undermines internal stability. This disorder entails unproductive energy expenditure that can leave little energy remaining for productive work actions. If this continues, a business will lose resources, and organizational stress can increase until the business fails [51,52]. Thus, as summarized in Table 1, survival depends upon avoiding over fitting, under fitting, or no-fitting the internal model with the environment.

Table 1. Internal Model Adaptation for Synchrony with the Environment.

Maladaptation	Adaptation
Underfitting	Increase survival parameters and inter-relationships between them
Overfitting	Reduce survival parameters and inter-relationships between them
No fitting	Change boundaries, survival parameters, and inter-relationships

On the one hand, adaptive fitness depends on being efficient enough to survive with least action and thus have surplus energy available to enable growth. On the other hand, focusing only on efficiency, for example through underfitting, can lead to organisms and organizations being too efficient for their own good. This is because they can become too brittle to deal with environmental disturbances [53,54]. Hence, adaptive fitness also depends upon not overfitting but having a wide-enough variety of internal states to be able to adapt with changing external environments [55,56]. Accordingly, internal models need to be open to cycles of expansion and reduction [57], and as summarized in Table 1, internal model maladaptation needs to be addressed through internal model adaptation.

4. Results

Figure 2 shows a screenshot of the whole Excel sheet for the simple business model method, which is based on the first principles explained in the preceding sections.

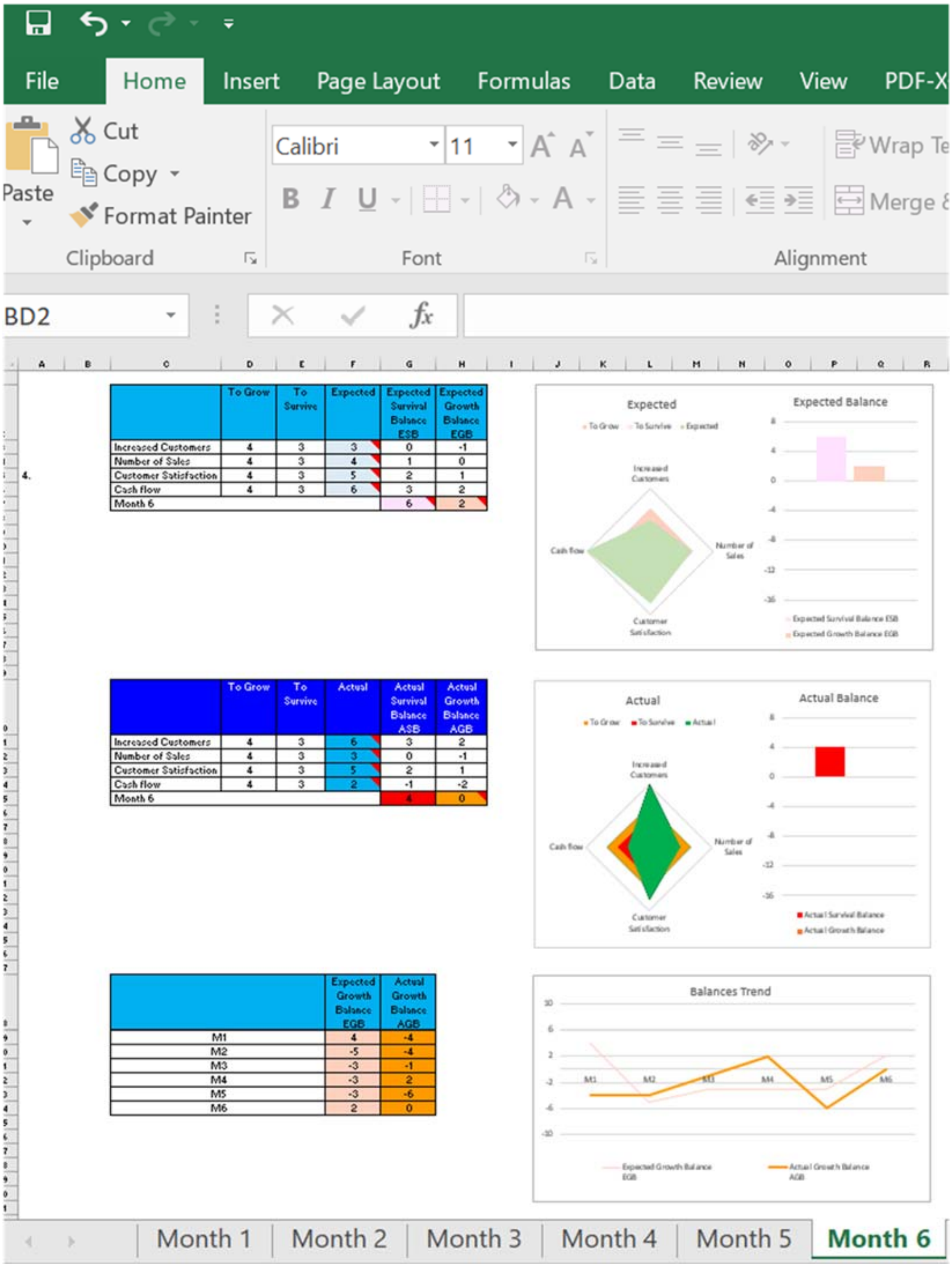

Figure 2. Business modeling method based on survival first principles.

To frame is to address certain aspects of a topic. Framing affects evaluations and decisions [58,59]. The framing of the simple method addresses directly and persistently the need to achieve at least survival performance on survival parameters. In particular, users make predictions on survival parameters and take actions to correct prediction errors on survival parameters. This is essential for maintaining synchronization with changing environments that is necessary for ecological fitness. Start-ups must be adaptive to address prediction errors on survival parameters arising from changes in the environment. At the same time, minimizing prediction errors on survival parameters can facilitate start-ups' internal stability. Figure 3 shows an example of radar charts and bar charts generated when using the simple method.

Figure 3. Expected performance compared to actual performance on survival parameters.

Figure 3 shows an example of radar charts and bars charts that are generated by entering 1, 2, 3 or 4 for performance on survival parameters: customer base, product sales, user experience, and cash flow. Figure 3 shows that the start-up has prediction errors. In particular, start-ups' expectations about customer base were not achieved, but actual product sales and actual user experience were better than expected. Figure 3 shows the quartile representations used in the method in which 4 represents enough for growth, 3 represents enough for survival, 2 represents not enough for survival over more than one prediction period, and 1 represents not enough for survival within one prediction period. For example, if cash flow of 78 thousand is needed for growth that month, entering 4 represents 78 thousand, entering 3 represents 58.5 thousand, entering 2 represents 39 thousand, entering 1 represents 19.5 thousands; 1, 2, 3, 4 are quartile representations, which can be applied to all survival parameters irrespective of measurement units. For example, customer base can be measured in terms of number of customers, product sales can be measured in terms of number of sales, user experience can be measured in terms of experience ratings, and cash flow can be measured in terms of currency units. Here, quartile representations are heuristic representations, that is rule-of-thumb representations, which have been developed during human evolution and are still effective today [60,61].

Figure 4 shows variations over six months between what is expected to happen and what actually happens. Such varying prediction errors can be commonplace as organizations seek to maintain synchronization with environments that are changing continually.

	Expected Growth Balance EGB	Actual Growth Balance AGB
M1	-2	-3
M2	-5	-4
M3	-3	-1
M4	-3	2
M5	-3	-6
M6	2	0

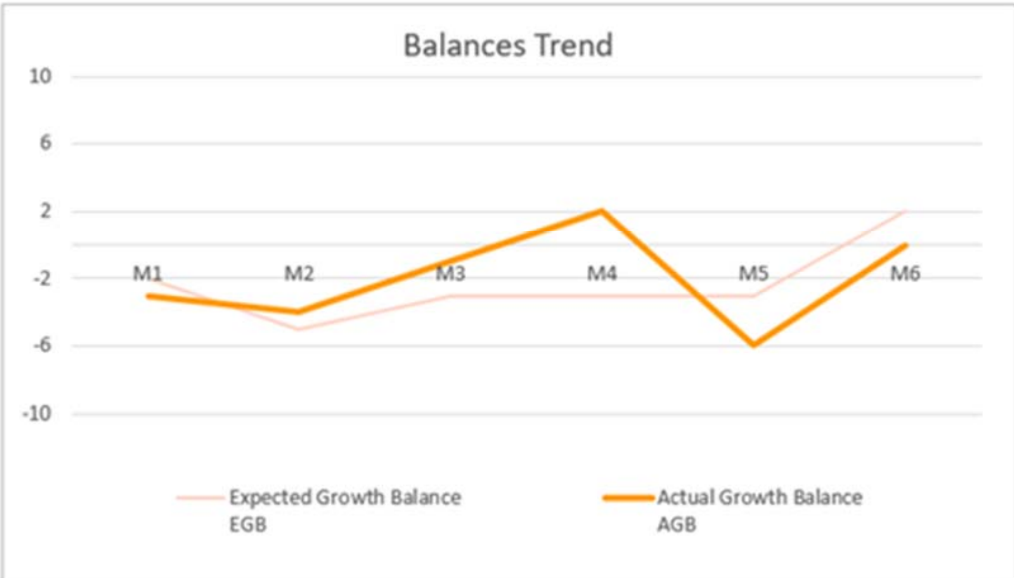

Figure 4. Trend in differences between expected performance compared to actual performance.

The tables and charts in this business modeling method may seem to be simplistic. However, simplicity is preferable in nature [62], in science [63], and in practice [64]. Moreover, the tables and charts in the simple method are consistent with human perception having evolved to be focused on ecological fitness that is necessary for survival [65]. Furthermore, the simple representations used in the method are consistent with communication science that has revealed the importance of matching format to task [66], and with the use of visual representations to improve the relevance of science to practice [67].

As shown in Figure 5, in accordance with first principles, the interactive training slides that accompany the simple method provide advice on the three options for addressing prediction errors: updating beliefs, shifting focus, and/or changing method of work. This is done with practical examples—in particular, Update Business Model: for example, expand or reduce the scope of the business model in terms of survival parameters for customer base, product sales, user experience, and cash flow; Shift Focus: for example, shift focus to pay more attention to those existing customers from who sales are low or to pay more attention to a new market segment of customers; Change Method of Work: for example, improve delivery procedures to improve customer satisfaction and/or improve invoicing procedures in order to improve cash flow. The use of different examples in the interactive training slides is in accordance with the use of contrasting cases during instruction in order to improve learning [68].

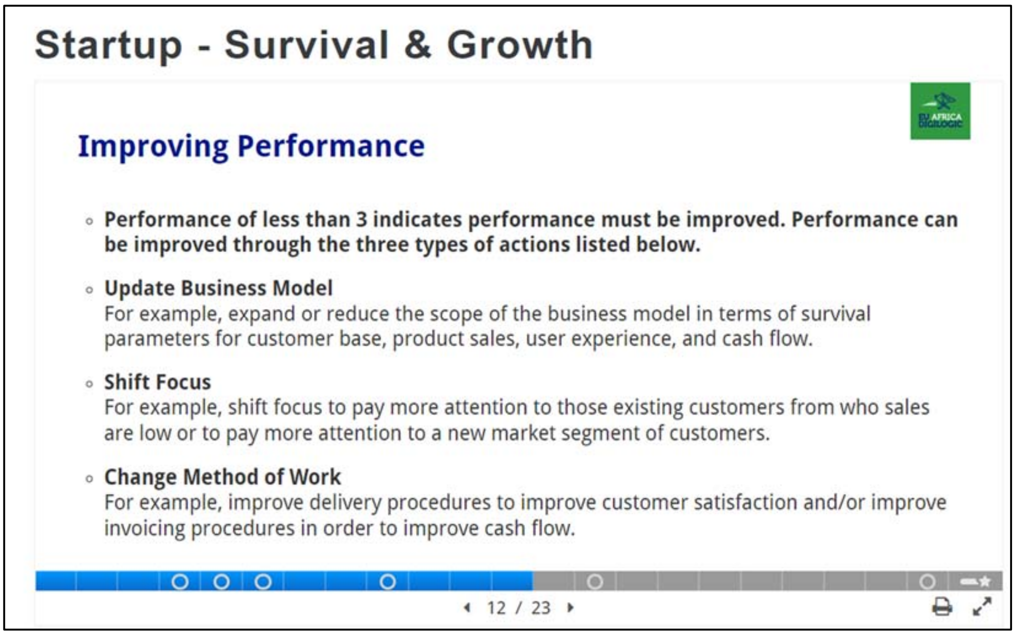

Figure 5. Interactive training slides: Actions to achieve synchrony by addressing prediction errors.

In accordance with first principles, as shown in Figure 6, the interactive training slides that accompany the simple method provide advice on the need to avoid underfitting, overfitting, and no fitting. For practical understanding, this is done without using the fitting terminology. Instead, users are advised that updating the business model should not lead to there being too few or too many survival parameters; that focus should be on alignment with the current environment not on the business' past boundaries, past survival parameters, and/or past activities; and that changing methods should not lead to there being too few or too many activities involved in work to achieve performance on survival parameters.

As shown in Figure 7, the interactive training slides include questions to test learning about the method. Correct answers are indicated with green highlighting, a green tick and plus one. Incorrect answers are indicated by red highlighting, a red cross, and minus one. Incorrect are accompanied by this statement: Please reread the slides to learn correct answers and try again. The interactive training slides can be navigated one-by-one by use of the backwards arrow and the forwards arrow as necessary. Alternatively, users can be move between the sections of the interactive training slides by use of the circles on the bar above the backwards and forwards arrows.

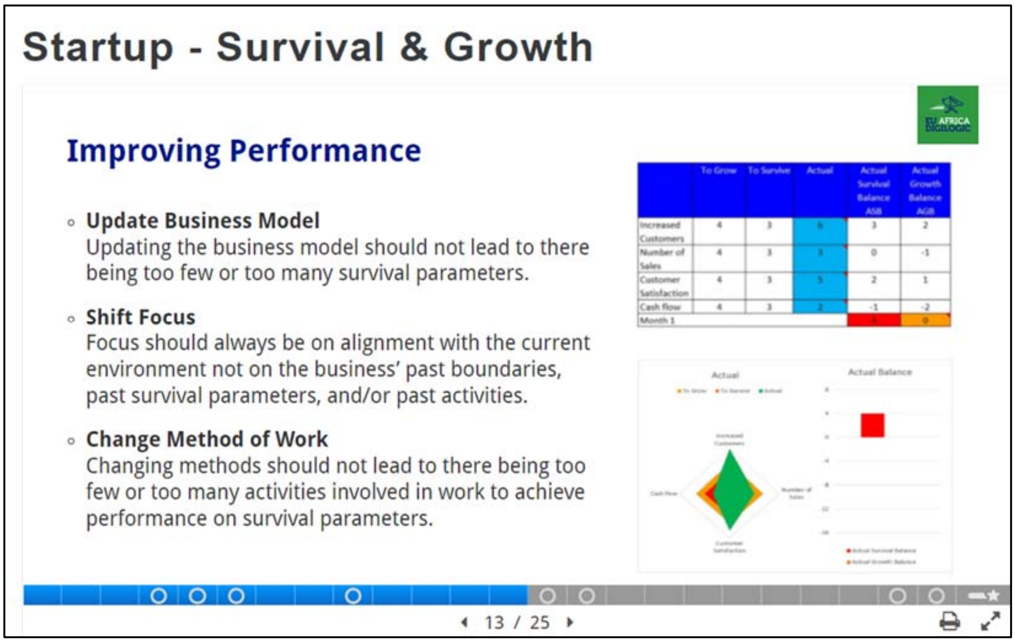

Figure 6. Interactive training slides: Practical steps to avoid underfitting, overfitting, and no fitting of business model.

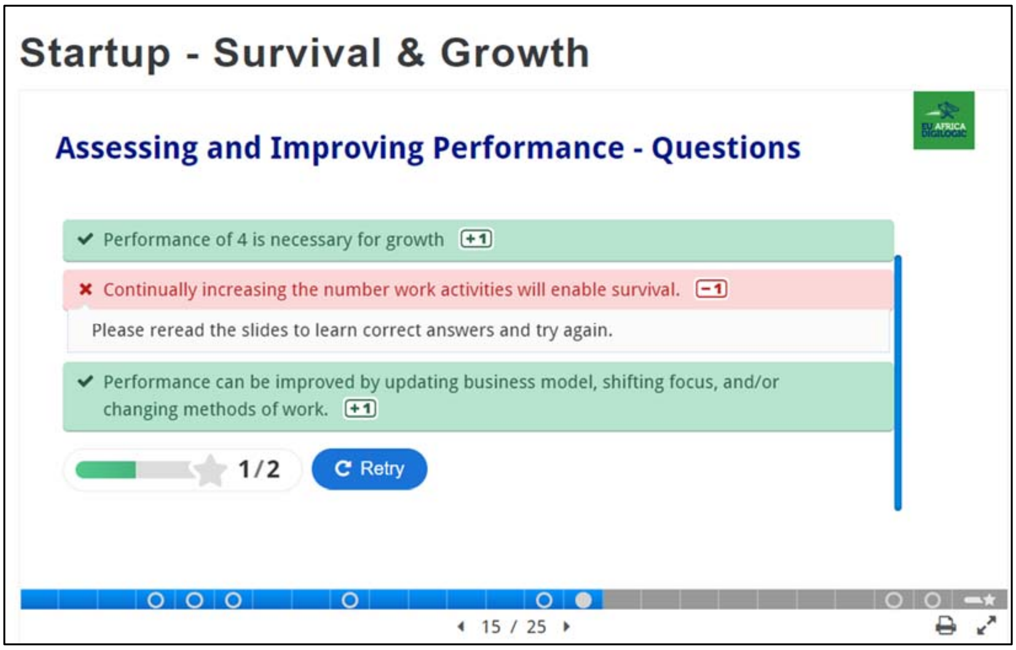

Figure 7. Interactive training slides: Example of question slide.

5. Discussion

In terms of first principles, the lifecycle of a start-up can be framed in terms of arrival of the fittest and survival of the fittest [9,69]. From the point-of-view of organizational studies concerned with start-up lifecycles stages [70], arrival of the fittest can be related to ideation stage and transition stage. Survival of the fittest can be related to the subsequent stages of scaling and exit [71]. For a start-up, arrival in a competitive environment with a higher level of fitness than other organizations can involve several activities, including formulating a business model and identifying customers to enabling iterative testing of the business model as the start-up endeavors to transition towards scaling [72]. When seeking to arrive as the fittest in a competitive market, existing business modeling methods such as the business model canvas can be used iteratively to define value proposition, cost structure, revenue streams, key partners, key resources, key activities, customer segments, customer relationships, and distribution channels [19]. Such definition can involve ideation with a variety of techniques, such as the use of visualizations that can clarify market systems [73] and others that can reduce the influence of preconceptions that can limit innovation [74].

Despite the many strengths of the business model canvas, it does not facilitate performance measurement [75]. Instead, start-ups can define a multitude of key performance indicators (KPIs) [76]. This can correspond with overfitting an internal model to the external state of a changing environment [39]. Alternatively, start-ups can use a standard balanced scorecard with only a few summary criteria, but which can still involve a multitude of performance measurements [77]. By contrast, the simple method explained here is intended to facilitate measurement of performance on those parameters that are fundamental to survival. This is done on individual survival parameters, such as customer base, product sales, user experience, and cash flow. However, the overall measurement, through the charts shown in Figures 3 and 4 is of synchrony with the environment. Thus, although the method is simple, it goes beyond the well-established practice of start-ups measuring their activities in terms of many KPIs, which do not immediately indicate the extent of synchrony with its environment.

As start-ups seek to survive as the fittest during scaling towards the exit stage of initial public share offering, private sales, etc., they may move from informal structure to formal structure. In doing so, there can be crises of bureaucracy amidst change from founding generalists taking ad hoc actions to specialists being employed to follow documented procedures [71], for example within quality management systems [78]. This change from informal to formal can involve change from a business model being founders' mental model to the business model being a simplified representation of the start-up's activities or even a detailed explanation of how business is conducted [79]. The simple method shown here is not in conflict with such changes from informal to formal. This is because it is focused on performance on survival parameters, rather than on the activities that are carried out to achieve performance on survival parameters.

Furthermore, the relevance of the simple method shown here is not restricted by any size of start-up from ideation to exit. This is because it is based on first principles that are applicable from the level of particles to organizations [56,80]. In particular, prediction errors on survival parameters arise from information uncertainty about how to survive, for example uncertainty about how to achieve sufficient product sales to survive. Irrespective of start-up stage or size, information uncertainty about how to survive will lead to physical disorder, which entails useless energy expenditure lost in unproductive actions. If prediction errors are not reduced through updating beliefs, shifting focus, or changing work, organizations of any stage or size can be overwhelmed by what has been described in the system dynamics literature as firefighting [81]—in other words, by becoming trapped in a quagmire of deadline pressure, overtime working and energy depletion.

In the most fundamental terms, making prediction errors on survival parameters indicates that living things, here start-ups, do not know how to counteract locally the universal trend towards maximum entropy [26]. Information uncertainty about how to survive can be stated in terms of information-theoretic entropy as defined by Claude Shannon in the 1940s [82]. For example, if there is an information-theoretic entropy of 2.58 bits, there is the statistical mechanics entropy of physical disorder from there being six equiprobable but different ways in which work could be carried out. If only one of those six different ways of carrying out the work is correct, there will be the thermodynamic entropy of potentially useful thermodynamic energy becoming practically useless thermodynamic energy as it is lost in five failed attempts out of six attempts to carry out the work. Statistical mechanics entropy describes the disorder of a system, with entropy increasing as the number of states available to the system increases [83]. Statistical mechanics entropy was defined by Ludwig Boltzmann in the 1870s and Max Planck in the 1900s. This was preceded by definition of thermodynamic entropy by Rudolf Clausius in the 1860s based on observations that much energy is lost due to dissipation and cannot be converted into useful work. Thermodynamic entropy can be regarded as a measure of chaos in a thermodynamic system [84]. Irrespective of the stage of evolution or size of a living thing, it cannot survive dissipation into the environment of the energy it needs to do work necessary for its survival. Rather, living things need to have boundaries that are open to the environment but constrain their release of energy into a few degrees of freedom [26,27]. This is necessary to be able to adapt to external changes while maintaining sufficient internal stability to make most efficient use of energy through least action [10,85,86].

A further fundamental reason why the simple method shown here is relevant to start-ups of any stage or size is that the stage or size of a start-up cannot lead to constant synchrony with the competitive market in which it intends to survive and grow. This is because competitive markets are environments that will change unpredictably. Competition in markets will change unpredictably because the potential uses of existing things can be combined in many different ways with the many potential uses of other existing things. Potential uses of existing things can include many new uses that are different to their original uses [29,30]. This leads to the creation of complements and substitutes for existing things. What is created emerges unpredictably from different organizations' different perspectives [31,32]. Hence, it is not realistic to anticipate that start-ups will initially make prediction errors on survival parameters but then come to have no information uncertainty about how to survive. Rather, new sources of information uncertainty will arise from changing competition. Moreover, it will arise from increasingly widespread climate-related environmental changes [87–92]. Accordingly, start-ups will continue to need to address prediction errors on survival parameters throughout their lifecycles by updating beliefs, shifting focus, or changing work.

6. Conclusions

Living systems can facilitate their survival by balancing adaptability and stability through synchronization with environments. This paper reports action research that involved survival first principles being applied in a simple business modeling method, which can support start-ups in being adaptable stable systems that are synchronous with their environments. In particular, synchrony involves the use of business models to predict performance on survival parameters and taking actions to address prediction errors of actual performance not matching expected performance.

The paper provides three principal contributions. The contribution to business model theory building is to relate survival first principles to business models. Referring to survival first principles revealed through natural sciences research is apposite as organizational research has not ameliorated the persistently high failure rate of start-ups around the world. Furthermore, it is timely as start-ups experience increasing unpredictability around them due to climate-related environmental changes. Accordingly, it is now more important than ever to recognize that survival and growth depends upon synchrony with changing environments. The contribution to business practice is to describe a simple business modeling method that is based on the scientific first principles. As the simple method uses standard basic software and is easily explained through a few slides, it is accessible throughout start-up lifecycles to a wide range of potential users in any sector. This is important in order to address directly and persistently the primary objective of start-ups: to survive in changing environments. The third contribution is to provide an example that bridges the rigor–relevance gap between scientific research and business practice. It is an example that encompasses basic research, e.g., [22,23] use-inspired basic research [40,57] and pure applied research, which illustrates the value of fundamental research and the unpredictability of how it will eventually come to be useful.

The reported study is limited by the simple method not having been combined with existing methods. Apropos, future research could investigate potential for existing methods to inform definition of open boundaries, survival parameters, and activities to achieve necessary performance on survival parameters. Subsequently, research could investigate the potential for existing methods to support shifting focus and/or changing methods of work. Such research could investigate potential for relating the sparse representations of the business modeling method explained in this paper with the rich picture technique and other existing methods that can facilitate shared visualization of start-ups' interactions with changing environments.

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