Developmental stages towards Scale Up: Framework and evidence

Yancy Vaillant
Professor of Strategy, Entrepreneurship, and Innovation
Department of Strategy, Entrepreneurship & Innovation, TBS Education
1 Place Alphonse Jourdain, 31068 Toulouse Cedex 7, France
Email: y.vaillant@tbs-education.es

Oscar F. Bustinza
Professor of Management
Facultad de Ciencias Económicas y Empresariales
Department of Management I, Universidad de Granada
Campus Universitario de Cartuja C.P. 18071 (Granada), Spain
Email: oscarfb@ugr.es

Ferran Vendrell-Herrero
Senior Lecturer in International Management
Strategy Group, University of Edinburgh Business School, University of Edinburgh
29 Buccleuch Place, Edinburgh. EH8 9JS.
Email: fvendrel@ed.ac.uk

Résumé :

La mise à l'échelle est une forme de forte croissance de l'entreprise soutenue par la numérisation, l'extensibilité et la reproductibilité. Alors que la mise à l'échelle est normalement liée aux nouvelles entreprises, nous proposons que les entreprises établies soient également sujettes à l'acquisition de conditions favorables à la mise à l'échelle. Nous élaborons un cadre en plusieurs étapes pour développer les conditions de mise à l'échelle dans les organisations établies en nous appuyant sur les théories des systèmes de valeurs, de la conception organisationnelle et de la croissance de l'entreprise. Notre conceptualisation propose un modèle en quatre étapes qui comprend la reconnaissance de la transition systémique dans la génération de valeur, l'adaptabilité organisationnelle, le renouvellement stratégique et la mise à l'échelle. En utilisant des données d'enquête primaires sur plus de 500 entreprises manufacturières, les résultats de notre modèle d'équation structurelle soutiennent fortement nos prédictions théoriques.

Mots-clés :
Value system, Permeability, Strategic Renewal, Scale Up, Structural Equation Modelling.

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1. INTRODUCTION

The exponential growth of firms known as scale up has caught the attention of academics, managers, and politicians (Piaskowska et al., 2021; Reuber et al., 2021). While this concept based on high replicability and digitalization is gaining traction in entrepreneurship research where it is presented as a superior form of start-ups (Sleuwaegen & Ramboer, 2020), it is less analysed from an organizational perspective. In this paper, we seek to answer the question of if, and how, established organizations can develop scale up capabilities. To do this, we develop and test a four-phase model.

An essential first step towards generating firm growth capabilities is understanding the value system in which the company participates (Jacobides et al., 2018). Being able to recognise the systemic evolution of an industry is the basis for incumbent firms to take proactive measures towards establishing proper scale up conditions (Cattani et al., 2013; Gomes et al., 2021; Miller et al., 2019). To better fit the industry's new wider value system and be able to exploit its emergent opportunities, incumbent firms must then be able to quickly extend their business structure in ways that are more characteristic of growth start-ups than mature firms (Carnes et al., 2017). As such, they must adapt their boundary architecture and reform their internal structure to gain greater agility (Billinger, 2007; Rigby et al., 2016). Such an adaptation engenders a strategic shift from incumbent-cantered to disruptor-centred business models (Snihur et al., 2018). Strategic renewal is therefore another step prior to organizational scalability because even the most adaptable incumbent companies can have trouble in the face of such profound change if their strategic trajectory is misaligned (Jacobides & Billinger, 2006).

Being capable of implementing changes at the right time will allow to plant the technological and functional seeds that will lead to the scalability of supply and its replicability in different markets (Hanelt et al., 2021).

Therefore, i) value-system recognition; ii) organizational adaptability; and iii) strategic renewal, are all potential developmental stages that an incumbent firm must successfully cross to reach iv) scale up.

In this paper, we not only propose a conceptual model of the different steps that incumbent organizations must take to generate scale up capabilities, but also test the theoretical predictions with a covariance-based Structural Equation Model (CB-SEM) (Hair et al., 2011). Through a questionnaire-based survey carried out with more than 500 Spanish manufacturing companies, the results of the study validate our model. Furthermore, the model suggests that the mediating effects of organisational adaptability between the recognition of systemic change and strategic renewal, and of strategic renewal between organisational adaptability and scale up, are total. This implies mandatory progression and that scale up cannot be reached by skipping an intermediate step.

The study presented in this paper follows the recommendation of McKelvie & Wiklund (2010) for more research oriented towards generating a better understanding of how scale is achieved (growth) rather than simply addressing how much firms grow. The paper also answers the calls by Stampfl et al. (2013) for further research into the environmental conditions for strategic scalability resulting from the digital transition of the economy. The study responds to the calls of Shepherd & Patzelt (2020) for more research into organisational scaling and how management can facilitate scaling, as well as calls by Piaskowska et al. (2021) for research into the scale up conditions of mature and incumbent firms.

The paper presents three important contributions to organizational strategy. First, the article extends research into the scale up phenomenon, largely discussed in entrepreneurship

(Shepherd & Patzelt, 2020), to the field of established organizations. This change of context is important because it allows both a generalization of the concept and a detailed analysis of the organizational changes required. Second, the article combines three apparently unconnected literature streams such as value (Huemer & Wang, 2021), organization design (Jacobides et al., 2015), and firm growth (McKelvie & Wiklund, 2010). This connection allows us to propose a novel conceptual framework that has great potential to influence thinking and practice in organizational regeneration and technological adoption. Finally, the article offers formulas to operationalize all the relevant constructs robustly, which allows not only to validate the model, but also to open-up new research opportunities to further develop this incipient but growing area of study.

2. CONCEPTUAL MODEL AND RESEARCH HYPOTHESES

2.1 Setting the Context

Digitalisation is deeply transforming business and industry by making scalability accessible to many industries and business models that were previously considered unsuitable for scale up (Stampfl et al., 2013). Scalability is the extent to which a business may achieve its desired value creation and capture targets when user/customer numbers increase and their needs change, without adding proportionate extra resources (Stampfl et al., 2013).

This is significant, as the importance of scale up capabilities for a firm is no longer just an economic issue but has become strategic in nature (Jacobides et al., 2018). Together with the supply and demand side scale-economies to be gained, scaling-up also opens-up several value-adding capabilities for companies that can become the basis for competitive advantage.

However, it is often much easier for new entrants to adopt scalable business models, from conception, than for incumbent firms to transform their strategic and organisational foundations to set themselves on a new scale-up trajectory (Menz et al., 2021). Start-ups identify an

opportunity within a value system and position themselves by adopting the appropriate scalable business model. Incumbents are bonded by their infrastructural, managerial, and strategic legacy. They must embark on complex and often traumatic transformation to reorient their trajectory so as to develop the adequate prior conditions needed to achieve such scalability. Much has been studied about scalability at start-up (Davidsson & Henrekson, 2002; Mason & Brown, 2013), scalable business models (Stampfl et al., 2013; Zhang et al., 2015), and activity configurations of scaling firms (Piaskowska et al., 2021; Reuber et al., 2021), but research has not yet addressed the scalability conditions required for mature incumbent firms to scale-up and reach competitiveness within connected value system configurations.

Entrepreneurial scalability is directly linked to opportunity discovery and value generation capacity (Mason & Brown, 2013). But for incumbent firms, the path is not so direct. For scaling-up conditions to take form within established firms, any prior strategic trajectory must be renewed towards a higher growth-compatible orientation through the implementation of a scalable business model. But for such strategic renewal to be effectively implemented, firms must first show organizational adaptability through the reconfiguration of their internal structures and boundary designs so as to exploit opportunities generated from value system reconfiguration and install the necessary agility for renewal and scalability. But first, the incumbent firm aspiring to carry-out internal reconfigurations that can lead to effective strategic renewal to reach scalability conditions, must be able to recognise and position itself within an industry that has/is transitioned towards new systemised value boundary conditions (Zott & Amit, 2010; 2013).

2.2 Value system recognition – Organisational adaptability

The stimulus for internal transition and modification of the boundary conditions of firms come from the transformation of industry (Menz et al., 2021). It is not so much the firm that

transitions, it is the industry that forces the transition of the firm. Digitalization and technological advancements have led increasingly connected actors to become complementors as the value of their products or services are dependent on those of other firms with whom they interact within a value system. The industry's value chain will experience functional disaggregation and separability of processes as well as separability of products, services, and complements along its value chain (Jacobides & Billinger, 2006). The systemised value boundary conditions of the wider industry will therefore change the existing opportunity set. Firms, even peripheral ones, can connect to a system's central platform to not only generate complementary value and innovation, but also gain access, directly or indirectly, to the value system's customers (Jacobides et al., 2018).

In such value systems, providers of complementary innovations, products, or services become interdependent despite not being bound by contract. Nor are they part of a classical buyer-supplier value chain or integrated productive hierarchies (Jacobides et al., 2018). Value systems capture the link between a core product, its components, and its complements, which jointly add value for customers. Beyond the boundaries of a single industry, the system is conceived as an economic community of interacting actors that all affect each other through their activities and are bond by shared fate (Menz et al., 2021). Individual members' performance is tied to the overall performance of the system (Jacobides et al., 2018).

Where and how firms compete will be affected as their industry evolves into such a value system (Massa et al., 2017). What, where, when, why, how, and how much consumers purchase will similarly be impacted. As a result, firms active within this transitioning value system will be forced to evolve their competency configuration in order to keep-up with the changing key success factors of both industry and market (Porter, 1979). Such industry changes will lead firms to adapt their own boundary conditions and internal structure to better fit the industry's new wider value system. Jacobides (2005) concluded that industry evolution has significant

structural implications for all related firms. Based on this line of thought, we hypothesise the following:

***H1**: The recognition of an industry's value system evolution positively relates to both dimensions of organizational adaptability: (i) structure and (ii) architecture.*

2.3 Organisational adaptability – Strategic renewal

Organisational adaptability, in terms of structural redesign and architectural boundary reform, is needed for strategic renewal (Jacobides & Billinger, 2006). The business model renewal that will permit incumbent firms to set themselves onto a scalable strategic trajectory that is more in sync with the digitally induced transformation of the economy is unlikely to be achievable without prior internal organisational adaptations. Billinger (2007) studied how firms use boundary redesign to adapt and strategically renew in the face of the systemic transition of the economy. They identified a series of organisational and process requirements for the creation of flexible, adaptable structures which they termed as vertically permeable. They focused on how firms can use their boundary design as a tool to improve their strategic prospects, namely through specialisation. Analysing the strategic rather than economic determinants of firm structure and boundary conditions, these authors concluded that transitioning incumbent firms must internally redesign themselves to become more responsive and better capitalise on new market opportunities (Billinger, 2007).

Internal reconfigurations often become the main means of strategic renewal as it enables firms to re-invent themselves from providers of goods or services to providers of solutions (Storbacka et al., 2013). Through such organisational restructuring they are better able to fend off commoditization, segregate markets, better able to implement scalable business models, and be competitive within the evolving value systems.

In the case of incumbent firms searching to adapt to a transitioning value system, divesting resources and reducing some of the bureaucracy in their organisational structure, allowing them to increase flexibility, will enhance their ability to implement strategic renewal (Carnes et al., 2017). Organizational complexity, inertia, and undue scope must be revised if scalable business models are to be developed in mature firms. It is not enough for a firm's technology to be scalable, the entire organisation has to have scalability conditions (Stampfl et al., 2013). Incumbent firms need to be able to quickly extend their business structure in ways that are more characteristic of growth start-ups than mature firms. As such they must restructure their internal organization in order to gain greater agility (Rigby et al., 2016).

The role of technology is a critical determinant of the boundaries of the firm, its functioning, and its effective capacity to strategically renew through the implementation of scalable business models (Menz et al., 2021). Greater monitoring, control, optimisation, and automation capacity from smart technologies allows firms to implement autonomous processes that can greatly improve the agility and strategic renewal capacity of businesses (Porter & Heppelmann, 2014). The scalability of technical infrastructure giving capacity to support more users without suffering performance decline is also part of the organisational restructuring that incumbent firms must undertake prior to implementing business model scalability (Stampfl et al., 2013).

Jacobides et al. (2018) posit that modularity in product and process better allows firms to take part in value systems. Internal structures apt for modularity help firms to better coordinate themselves through such systems. More modularisation has been associated with a greater prevalence of inter-firm coordination within value systems, distinct from the use of alliances, supply chains, or market-based interactions (Jacobides et al., 2018). Technological modularity allows interdependent components of a system to be produced by different producers, with limited coordination required. By restructuring towards a more modular layout, organizations

become able to develop strategies that benefit from "*a large degree of autonomy in how they design, price, and operate their respective modules, as long as they interconnect with others in agreed and predefined ways*" (Jacobides et al., 2018: 2260). This organizational adaptability sets the basis for strategic renewal that can eventually consolidate the scale up conditions generated by the transitioning value system. It is therefore hypothesized that:

***H2a**: Organizational adaptability ((i) structure and (ii) architecture) positively relates to strategic renewal.*

The ability to act upon perceived opportunities depends on the presence of matching resource configurations and productive structures within the firm (McKelvie & Wiklund, 2010). It is this matching that determines the capacity for strategic change, not simply the identification of opportunity or the will of management to act upon it (Sirmon et al., 2011). For incumbent firms, the limitations for such matching come about from pre-existing routines that constrain the ability to recombine current resources needed to embark on a new business model trajectory. Organisational adaptation is therefore essential for these mature firms to be able to engage in transitional value systems with renewed strategies.

Strategy is path dependent and generally closely intertwined with the firm's existing architecture (McKelvie & Wiklund, 2010). Organisational adaptations are a necessary means of obtaining the productive agility and boundary conditions that are necessary for a firm to establish business model scalability. Organisational reconfiguration implies a transformation of the capability frontiers and a shift in the productive opportunity set of the firm. To be able to successfully implement a scalable business model in response to the establishment of a value system within its industry, incumbent firms must first lay down the adapted structural tracks upon which its renewed strategic path will scale.

As such, Sirmon et al. (2011) observe that in mature firms, bureaucratic structures that suppress change need to be orchestrated in order to achieve effective strategic engagement. To be able to strategically respond to digital disruption and adequately transition to emerging value systems, firms cannot precipitate themselves onto business model innovations that their structure and architecture will not support. Such transition must pass through adequate organisational adaptation. The resulting hypothesis is therefore formulated:

***H2b**: Organizational adaptability ((i) structure and (ii) architecture) fully mediates the relationship between the recognition of an industry's value system evolution and strategic renewal.*

2.4 Strategic renewal – Scalability

"*Today, it is no longer a matter of big companies outperforming small start-ups; rather, those firms which grow fast and are responsive to change end up winning the game"* (Stampfl et al., 2013: 229). As such, strategic scalability, being the extent to which a firm achieves its desired value creation and change without adding proportionate extra resources (Zhang et al., 2015), becomes one of the most important predictors of business growth (Gilbert et al., 2006). The results of the study by Zhang et al. (2015) found that high or low scalability of strategies generally depend on the configurations of the three main dimensions of business model design: customer identification, customer engagement, and value chain linkages.

Customer identification and market positioning has a significant effect on scale, mostly through network effects, whereby proper targeting can increase the size of the network related to a new product/service ultimately leading to increasing the product's value. This can also have potential for learning by using benefits from scale. Many successful products build on existing skills within the target group and therefore do not require users to develop new knowledge. As people tend to dislike using complex products or services, business models which are easy to

understand and are built around simple offers are more likely to succeed (Zhang et al., 2015). Business models that generate network effects create the 'lock-in' phenomenon of switching costs preventing migration to competitors (Amit & Zott, 2001). Extant research supports a positive relationship between strategies exploiting network effects and scalability (Stampfl et al., 2013). Similarly, strategic formulation based on proper customer identification can make a product part of a value system and technological infrastructure, creating potential for scale through technological interrelatedness. As a system's technology or platform becomes more adopted, a wider range of sub-technologies become part of its infrastructure, further increasing adoption and scale (Zhang et al., 2015).

The customer engagement element of strategy concerns the value proposition and the degree of customisation the firm offers to its customers. To be scalable, strategy should not be built around 'technology push', but rather should be 'user-driven' and needs-pulled. "*Simple business models that solve a real problem and are built around existing user knowledge will scale more easily*" (Stampfl et al., 2013: 238). With digitalisation, such customization becomes more scalable through co-creation and customer self-customisation. As the customer is required to do some of the production work themselves, the cost of satisfying specific or expensive needs and tastes is minimized (Zhang et al., 2015). Better customer engagement makes a technology better understood, resulting in a larger number of users and a greater scale of operation.

Value chain linkages is the part of a firm's strategy related to information governance systems and to the mechanisms the firm uses to pass on its generated value to its customers. It is found that network governance, such as platforms compatible with value systems, tend to promote scalability (Stampfl et al., 2013). Whereas traditional hierarchical governance models tend to hinder scalability (Zhang et al., 2015), such networked value chains can improve the scalability of production and distribution by enabling large numbers of new customers to be serviced without having to make major investments in enlarging capacity. This implies open

governance models that can reduce the value generation cost by adopting modular design principles that engage a user community and support combinatorial innovation (Yoo et al., 2012).

Therefore, incumbent, and mature firms wanting to meet scale up conditions will first need to renew their strategic trajectory appropriately. This is likely to mean renewing existing strategy by adopting the adequate customer targets and engagement tactics, along with suitable value chain linkages, that will give the firm greater scalability. It is therefore hypothesised that:

H3a*: Strategic renewal positively relates to scale up conditions.*

For incumbent industrial companies, Visnjic et al. (2022) observed how these firm had to "*embed then scale out*". This meant that organisations had to be thoroughly adapted and adequately restructured before embarking on a digitally driven scale-up process. But for such change to consolidate, strategic coherence and a robust sponsorship from top management is essential. The scale-inducing and scale-compatible technologies, cost and revenue structures, internal configurations, as well as the scale-adapted boundary conditions of organisations are unlikely to be effective at stimulating sustained growth if it is not conducted along a clearly attuned strategic path and business model (Stampfl et al., 2013). Not doing so will lead to incoherencies that will generate constant sources of resistance to scale (Visnjic et al., 2022).

A traditional hierarchical company can usually accommodate a small number of minor strategic incoherencies as the autocorrecting effects of established organisational routines and inertia will tend to compensate and rectify (Rigby et al., 2016). However, in the case of incumbent firms that have adapted their organisational structure for the achievement of greater scale in response to the recognition of systemic industry transitions, the mentioned organisational inertia will tend to oppose such change in the absence of a clear strategic steering. As with any change, organisational routines can and will produce all kinds of 'antibodies' that

attack the new scale-up direction that the company wants to take. Thus, a leadership team hoping to scale up needs to instil a compatible strategic path and communicate these renewed values and principles throughout the enterprise (Rigby et al., 2016). It can therefore be assumed that despite organisational adaptations for scale-up, without compatible strategic renewal scalability is unlikely to be reached.

***H3b**: Strategic renewal fully mediates the relationship between organizational adaptability ((i) structure and (ii) architecture) and scale up conditions.*

2.5 Moderation role of Technology and Specialisation

Giustiziero et al. (2022) posit that the greater the level of digitalization of a firm, the more it will tend to have scalable resource bundles due to significant economies in their productive resources, due to markets with low distribution costs, and due to strong network effects. According to these authors, the greater scalability of digital firms' resource bundles affects their opportunity costs of integration, "which requires allocating resources to multiple value-adding activities, rather than using them more intensively to grow within the focal activity" (Giustiziero et al., 2022: 3).

Prior research compiled by Stampfl et al. (2013) have identified that technological intensity is a key factor of scalability and of its internal and strategic preconditions. New technologies have reduced the cost of communication (Rappa, 2004), it has introduced new ways of interaction between different parties (Bouwman & MacInnes, 2006), it has enabled innovative transaction and exchange mechanisms (Amit & Zott, 2001), and has generated greater speed of change within the business environment (Stampfl et al., 2013). As such, instituting organisational adaptations and strategic renewal becomes much more responsive and apt for scaling. The digital intensity of the incumbent firm will greatly influence the agility with

which it can conduct its transition and implement the necessary scale up conditions (Rigby et al., 2016).

The supply-side scale advantages due to the adoption of digital resources are enhanced by the simultaneous effect that digitalization has had on reducing demand constraints, which may induce digital firms to remain specialized even as they significantly expand their output (Giustiziero et al., 2022). The resulting trend has been a shift from vertical integration towards vertical specialization.

With digital transition, value systems have seen the emergence of specialist providers at all the stages in their business systems (Jacobides et al., 2018). More engaged firms are often characterized by narrow vertical scope as they focus on their core activity. Such vertical specialization facilitates organizational and strategic adaptations and enables scale through very broad horizontal scope in terms of the products, markets, and countries that are reached through their value system (Menz et al., 2021).

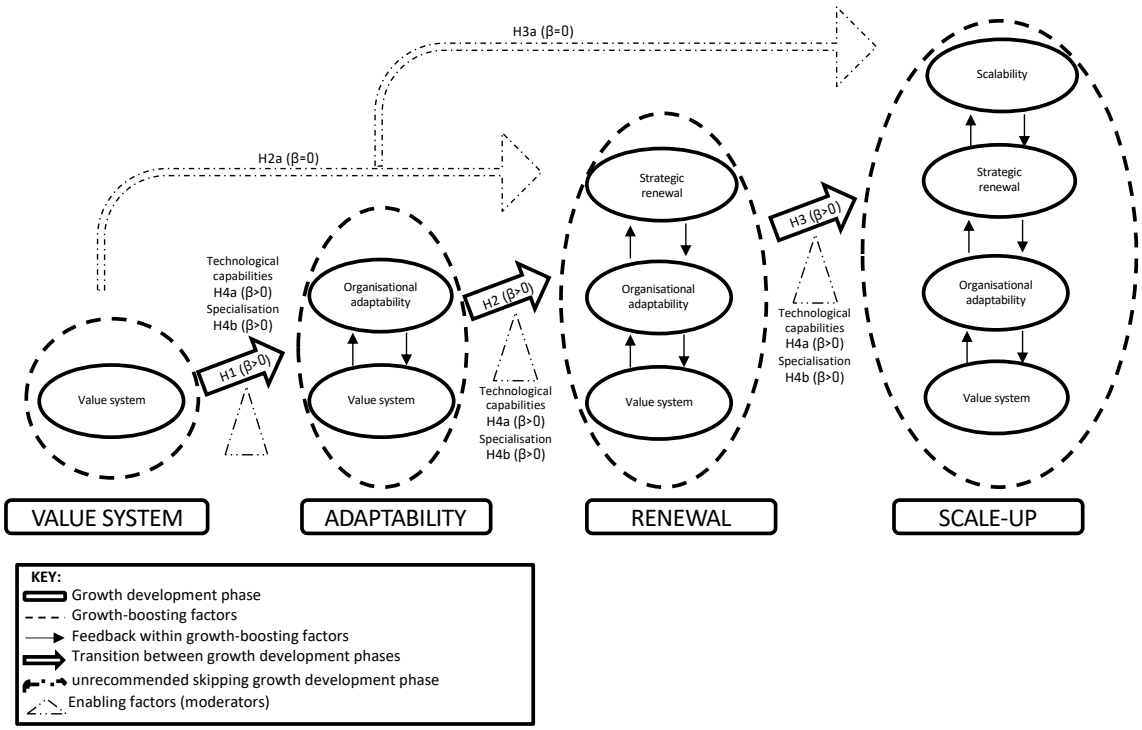
To capture the influence of the technological intensity and specialisation of firms over the different stages of the scale up process, the following hypotheses are presented:

***H4a**: Technological capabilities enhance all the relationships specified in H1-H3.*

***H4b**: Specialisation enhances all the relationships specified in H1-H3.*

The hypotheses proposed and the model of relations between variables is shown in Figure 1.

Figure 1. Developmental stages towards Scale Up



3. METHODOLOGY

3.1. Sample

This study seeks to uncover developmental stages towards firms' scale up using a sample population of Spanish manufacturers. Taking ORBIS database –a service of Bureau Van Dijk (BvD) (http://sabi.bvdep.com) that provides financial information– as reference, we selected firms with more than 50 employees that present high sales growth, non-increasing marginal costs, and increased customer base: theoretical conditions of scale up. On this basis, we identify a population of 2,394 firms. To achieve a statistically representative survey that respects composition of size and activity sector, we took a Gaussian distribution with a confidence level of 99% that suggested a minimum target sample size of 521firms. A pilot survey was presented to three managers to assure that the questions were clear and suitable for the study's proposed objectives. A specialized survey collection firm, with extensive experience in market research, contacted firms via Computer-Aided Telephone Interviewing. This method is an established procedure that is supported by the literature (Opazo-Basáez et al., 2022), cost effective, and

useful for measuring the behaviors of interest (Couper, 2000). This firm also collaborated to restructure the questionnaire as to increase response rate. From September to October 2021 companies were contacted by phone, having an average time spent of 20 minutes each, and reaching 532 valid questionnaires (above the minimum sample size needed).

We compared early and late respondents (first and last quartile) to assess non-response bias for size and industry (Armstrong & Overton, 1977). The t-tests showed a lack of difference between groups that is statistically significant at 99%. Common method bias (CMB) may arise when a single source of information is used. The merging of survey data and ORBIS financial information –that included the measures selected for classifying firms as scale up– allowed us to control CMB. The use of industry characteristics as moderating variables was beyond respondent's cognitive map and also is a useful instrument to control CMB (Chang et al., 2010).

3.2. Measures and Justification

Value system characteristics (Billinger, 2007; Jacobides et al., 2018): This variable captures those representative characteristics of the value system where firms operate, such as separability of processes and products that allow organizational unbundling and disintegration within the value system. It also incorporates measures of firms' efforts towards benchmarking of in-house operations, that facilitates the recognition of systemic shifts on the industry. The construct measure is composed of four items (see Appendix) measured by a 7-point Likert, from 1= Total disagreement, 7 = Total agreement. The exploratory analysis through principal components analysis with varimax rotation showed that items loaded on a single component, with rotated factor loadings higher than 0.4. Kaiser-Meyer-Olkin and Barlett's test of sphericity report measures of sampling adequacy –KMO=0.825, higher than the threshold level 0.8, Barlett's test $\chi 2$=837.38 (p=0.000), no significative– being total variance extracted (TVE=68.11%) higher than 50%. As to Cronbach's alpha, value was α=0.839 while Confirmatory Factor

Analysis (CFA) showed that all factor loadings where higher than the threshold level 0.700 (see Table X). Average Variance Extracted and Composite Reliability are as well upper the threshold level 0.700 (AVE=0.591, CR=0.852).

Organisational adaptability (Vertically permeable structure, firm boundary architecture), and strategic renewal: These variable constructs are taken from Jacobides & Billinger (2006) that analysed how firms adapt their organisation by implementing a vertically permeable structure and an appropriate firm boundary design. These authors suggested that vertically permeable structures arise from implementing adequate internal adjustments, establishing mechanisms for future process redesign, implementing pertinent IT structure, and developing a structure for promoting modularity in products, process, and technological modules (see appendix 1). As to construct validation, this variable is composed of six items measuring the mentioned organisational adaptability (Appendix 1). Following the same analysis of the previous variable, items loaded on a single component, being the measures for the factorial analysis above the threshold levels (KMO=0.874, Barlett's test $\chi 2$=1744.37 (p=0.000), no significative) and TVE=59.03%. Reliability of the composite is measured through Cronbach's alpha (α=0.855), CFA showed satisfactory factor loadings (Table 1), being AVE=0.537, CR=0.862).

On the other hand, firm boundary architecture demonstrating adaptability comes in the form of how firms' modular process redesign, architectural technology, and re-configurability of modular structures allow boundary interactions while creating barriers that protect distinct capability bundles. This composite variable is composed of four items (Appendix 1) that load on a single component (KMO=852, Barlett's test $\chi 2$=2228.38 (p=0.000), and TVE=67.28%). Factor loadings and the other measures for CFA was satisfactory (Cronbach's alpha (α=0.851), AVE=0.632, CR=0.867) as it can be seen in Table 1.

Table 1 Factor loadings and reliability analysis

VALUE SYSTEM RECOGNITION, ADAPTABILITY, STRATEGIC RENEWAL, & SCALE-UP					
Construct / items	Mean (S.D.)	Factor Loading (t-values)	R^2	Composite Reliability	Variance extracted
				0.852	0.591
VEC1	3.931 (2.362)	0.732 (23.06)	0.536		
VEC2	4.672 (2.227)	0.805 (26.49)	0.648		
VEC3	4.596 (2.218)	0.794 (26.39)	0.630		.
VEC4	4.256 (2.115)	0.779 (28.70)	0.607		
				0.862	0.537
ADS1	5.239 (1.841)	0.716 (30.92)	0.513		
ADS2	4.920 (2.010)	0.805 (30.68)	0.648		
ADS3	5.290 (1.829)	0.749 (31.12)	0.561		
ADS4	4.840 (2.121)	0.769 (30.42)	0.591		
ADS5	4.878 (2.143)	0.751 (28.69)	0.564		
ADS6	4.789 (2.196)	0.707 (30.23)	0.500		.
				0.867	0.632
ADA1	4.417 (2.071)	0.830 (26.63)	0.689		
ADA2	4.369 (2.140)	0.822 (26.26)	0.676		
ADA3	4.542 (2.059)	0.864 (26.89)	0.746		.
ADA4	4.548 (2.020)	0.827 (27.22)	0.684		
				0.800	0.598
STR1	4.583 (2.551)	0.843 (29.20)	0.711		
STR2	4.862 (2.345)	0.819 (29.93)	0.671		
STR3	4.580 (2.224)	0.804 (30.04)	0.646		
STR4	4.807 (2.117)	0.747 (30.19)	0.558		
STR5	4.385 (2.219)	0.745 (30.06)	0.555		
				0.850	0.588
SCA1	4.598 (2.363)	0.764 (29.45)	0.584		
SCA2	4.039 (2.354)	0.787 (28.97)	0.619		
SCA3	4.573 (2.305)	0.730 (29.58)	0.533		.
SCA4	4.041 (2.488)	0.782 (28.55)	0.616		

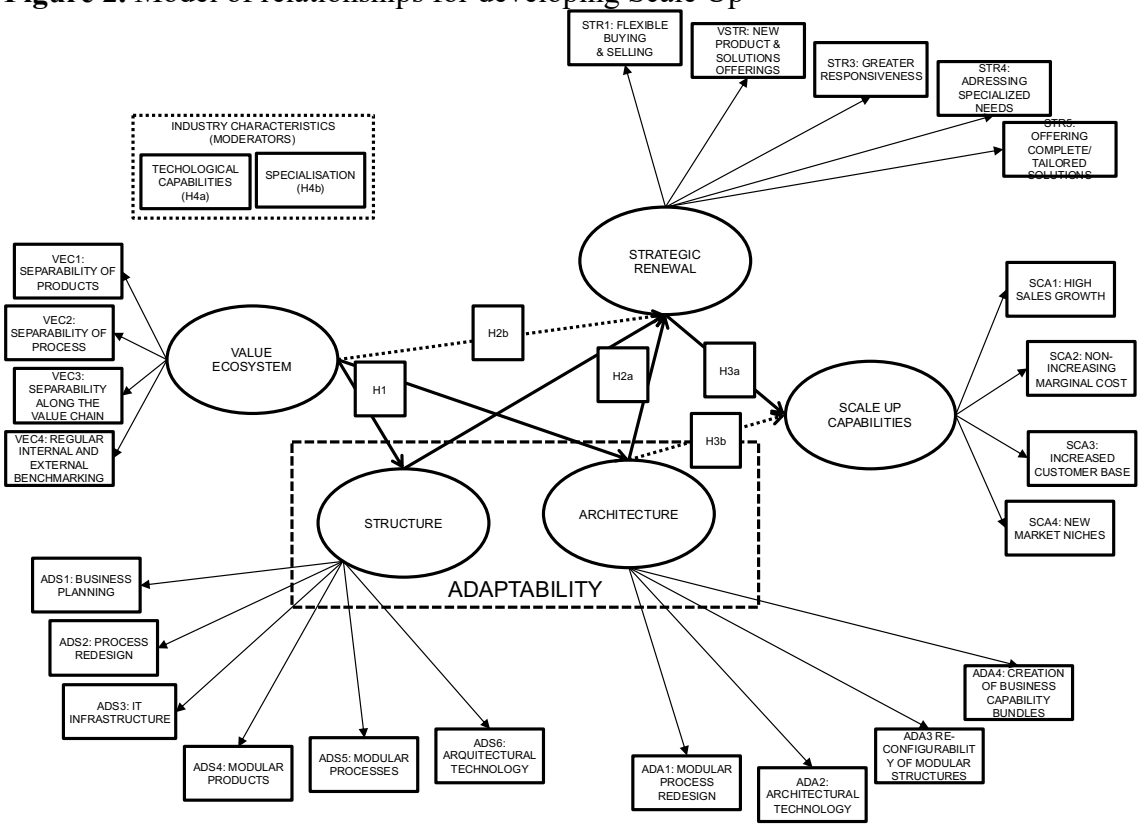
All the factor loadings are significant for a level of $p<0.01$

Finally, for strategic renewal, a concept that incorporates indicators that measure the degree of flexibility in buying and selling within the value system, the capacity for offering new product & solutions, greater responsiveness, if a firm is addressing specialized needs, and if it is offering tailored solutions. The construct measuring strategic renewal is made up of 5 items (Appendix 1), that as with the previous constructs, loaded on a single component (KMO=812, Barlett's test $\chi 2$=1287.37.38 (p=0.000), being TVE=66.56%). Factor loadings and the rest of measures for CFA (Table 1) were equally satisfactory (Cronbach's alpha (α=0.795), AVE=0.598, CR=0.800).

Scale-up capabilities (Eurostat-OCD; Sleuwaegen & Ramboer, 2020): This variable is also a composite measure based on a 7-point Likert, from 1= Total disagreement, 7 = Total agreement, encompassing indicators measuring high sales growth, non-increasing marginal costs, increased customer base, and reaching new market niches (Appendix 1). Items loaded on a single component (KMO=811, Barlett's test $\chi 2$=854.93 (p=0.000), being TVE=68.97%) and, for analysing the construct's internal consistency, the Cronbach's alpha value is calculated (α=0.789). Factor loadings (Table 1) as well of the reliability measures showed satisfactory levels (AVE=0.588, CR=0.850).

Figure 2 shows a summary of the different variables, indicators and relationships stated.

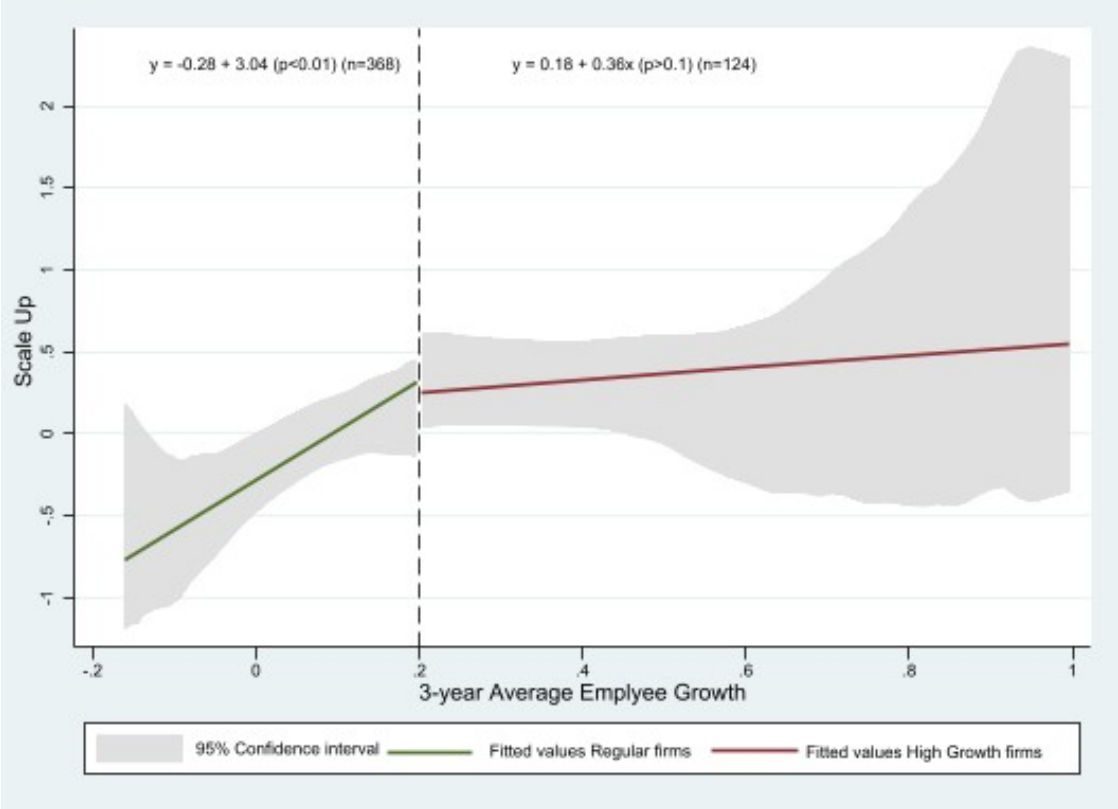
Figure 2. Model of relationships for developing Scale Up



If our scale-up construct is well-designed it should be more sensitive to changes in growth rate for regular firms (<20% average employee growth rate) than to high growth firms (>20% average employee growth rate). To make this argument clearer, we would expect that scale-up

construct would change more for a firm moving from 5% to 10% growth rate than to a firm moving from 25% to 30% growth rate. Or in other words, scale-up potential should be similar for all high growth firms. We test this possibility by correlating the linear prediction of our scale-up construct with the average employee growth for the previous three years obtained from BvD records. As can be observed in Figure 3, the relationship between employee growth and scale-up is non-linear. Specifically, it follows a kink relationship, moving from a positive to a zero-slope relationship (Arin et al., 2021). Therefore, as expected, employee growth and scale-up are positively correlated for regular firms ($p<0.01$) but uncorrelated for high-growth firms ($p>0.1$).

Figure 3. Employee growth and scale up capability



4. FINDINGS

Our model proposes different mediation and moderation relationships that are tested using Stata 17. There are two mediation analysis: a) organisational adaptability, measured by vertically permeable structure and firm boundary architecture, mediates the relationship between the value systems recognition and strategic renewal, and b) strategic renewal mediates the relationship between organisational adaptability and scale up capabilities. As for the moderation analysis, our model proposes that c) technological capabilities and d) specialisation moderates the entire set of relationships.

Table 2: Mean and standard deviation for relevant variables

	Variable	Full sample	Tech capability	Tech incapability	With Specialization	Without Specialization
	Observations	508	191	317	232	276
Firm Size	# Employees	114.98 (336.02)	114.94 (154.94)	115.01 (408.65)	92.07 (95.86)	134.33 (447.21)
Dependent Variables	Employee's growth	0.186 (0.364)	0.241 (0.452)	0.152 (0.364)	0.180 (0.323)	0.190 (0.396)
	Scale up capabilities	0.749 (0.237)	0.795 (0.204)	0.721 (0.251)	0.780 (0.205)	0.724 (0.259)
Independent variables	Opp. Recognition	0.600 (0.296)	0.669 (0.270)	0.560 (0.305)	0.692 (0.248)	0.523 (0.311)
	Structure Adapt.	0.835 (0.160)	0.833 (0.164)	0.836 (0.157)	0.847 (0.133)	0.825 (0.178)
	Architecture Adapt.	0.583 (0.322)	0.679 (0.273)	0.524 (0.336)	0.646 (0.282)	0.529 (0.344)
	Org. Renewal	0.785 (0.222)	0.812 (0.200)	0.769 (0.785)	0.824 (0.173)	0.752 (0.252)

Table reports mean values for relevant variables in the study and their standard deviation in parenthesis. Employee's growth calculates the average growth in employment for the last three years. The other dependent and independent variables are obtained from principal component analysis (PCA). For easier interpretation, the linear predictions of PCA are standardized, getting values between 0 and 1 using the formula *(x-min)/(max-min)*.

a) For testing mediation relationship, we followed the bootstrapping nonparametric approach (Hayes & Scharkow, 2013). Firstly, we examine the extent to which organisational adaptability mediates the relationship between the recognition of value system shift and strategic renewal. As for the influence of such value system recognition on vertically permeable structure and firm boundary architecture, results show positive coefficients (β=0.292, $p<0.001$ and β=0.385, $p<0.001$ respectively), supporting Hypothesis 1. Following with the analysis of the influence of organisational adaptability through vertically permeable structure and firm

boundary architecture on strategic renewal, results also show positive and significant coefficients for both cases (β=0.446, p<0.001 and β=0.391, p<0.001) thus supporting Hypothesis 2a. Finally, on analysing the mediation role of organisational adaptability, the relationship between value system recognition and strategic renewal shows a total effect that is positive and significant (β=0.250, p<0.001), being the direct effect almost zero and non-significant (β=0.016, p=0.690) and the indirect effect (β=0.234, p<0.001) representing most of the effect (0.234/0.250=93.6%). For testing mediation through the bootstrapping approach, 5,000 repetitions were performed over the indirect relationship and a percentile-based 95% Confidence Interval (CI) was constructed. As the bootstrap standard error for the indirect effects did not cross zero at the 95% CI (s.e.=0.012, [0.007:0.035] and s.e.=0.016, [0.009:0.068]), we can affirm that organisational adaptability fully mediates the relationship between value system recognition and strategic renewal. This result supports H2b.

b) On the relationship between strategic renewal and scale-up capabilities, results show a positive and significant coefficient (β=0.299, p<0.001), supporting H3a. The mediation analysis gives a total effect that is positive and significant for organisational adaptability through vertically permeable structure (β=0.424, p<0.001) and firm boundary architecture (β=0.192, p<0.001), being the direct effect significant in both cases (β=0.187, p<0.05 and β=0.095, p<0.05) and the indirect effect (β=0.237, p<0.05 and β=0.097, p<0.05) representing half of the effect (0.237/0.424=55.90% for vertically permeable structure and 0.097/0.192=50.52%). As shown by these results, strategic renewal partially mediates the relationship between organisational adaptability and scale up capabilities, partially supporting H3b.

The entire model analysis offers appropriate indicators of goodness of fit (absolute, and incremental), all of them on satisfactory levels (Hair et al., 2010). For measuring absolute goodness of fit measures, we report Chi-square likelihood ($\chi 2$=622.433, p=0.054), Goodness-of-fit index (GFI=0.921>0.900), Root mean square error (RMSA=0.059, between 0.050 and

0.080), and Root mean residual (RMR=0.038<0.050). Finally, the comparison of the fit index (CFI=0.948>0.900) and Tucker–Lewis index (TLI=0.941>0.900) showed satisfactory incremental goodness of fit measures.

Table 3: Linear, Logistic and Quantile Regressions

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)
	OLS	Logit	Quantile regression (Firm growth)				
	Firm growth	High growth	Q10	Q25	Q50	Q75	Q90
Scale-Up Cap.	0.0216**	0.1883***	0.0168***	0.0111***	0.0098**	0.0090	0.0362
	(0.0088)	(0.0688)	(0.0061)	(0.0036)	(0.0042)	(0.0103)	(0.0250)
	0.0141	*0.0062*	*0.0060*	*0.0020*	*0.0183*	*0.3814*	*0.1489*
# Employees	-0.0000**	-0.0009**	0.0000	-0.0000	-0.0000	-0.0000	-0.0001
	(0.0000)	(0.0005)	(0.0000)	(0.0000)	(0.0000)	(0.0001)	(0.0001)
	0.0339	*0.0488*	*0.8396*	*0.7263*	*0.5889*	*0.4860*	*0.3947*
Tech capability	0.0879**	0.5796**	0.0143	0.0108	0.0331**	0.0700*	0.2301***
	(0.0403)	(0.2361)	(0.0213)	(0.0125)	(0.0145)	(0.0360)	(0.0875)
	0.0298	*0.0141*	*0.5013*	*0.3882*	*0.0234*	*0.0524*	*0.0088*
Specialization	-0.0241	0.1444	-0.0052	0.0125	0.0152	-0.0020	-0.1411*
	(0.0358)	(0.2222)	(0.0205)	(0.0121)	(0.0140)	(0.0347)	(0.0843)
	0.5014	*0.5159*	*0.7987*	*0.3004*	*0.2781*	*0.9535*	*0.0949*
Constant	0.1150**	-0.6667	-0.1019	0.0255	0.1325***	0.1924	0.2837
	(0.0557)	(0.6343)	(0.0710)	(0.0419)	(0.0485)	(0.1202)	(0.2920)
	0.0395	*0.2933*	*0.1518*	*0.5421*	*0.0066*	*0.1102*	*0.3318*
Observations	508	508	508	508	508	508	508
R^2/Pseudo R^2	0.064	0.109	0.100	0.073	0.071	0.077	0.116
Industry FE	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses. P-values in *italics* *** p<0.01, ** p<0.05, * p<0.1. Dependent variable is average employee growth for a three-year period. In the logistic model the cut off is 20%, representing the probability of being high growth firm. Scale Up is the unstandardized linear prediction of the PCA. Industry Fixed Effects (FE) are at two-digit NAICS level.

Finally, we performed a moderation analysis where the moderators are tested as homologizers; that is, they do not interact with predictor variables nor have relation to criterion variables (Sharma et al., 1981). This type of moderator variables operates by modifying the strength of the relationships in the model. Moderation analysis divides the sample through median multi-group. After that, paths are restricted to equality and the solution compared to that of the unconstrained model by a $\chi 2$ difference test (Byrne, 2013). As we found significant increases in $\chi 2$ when analysing the restricted model for technological capabilities ($\chi 2$=876.679 vs $\chi 2$=622.433) and specialisation ($\chi 2$=930.925 vs $\chi 2$=622.433), we classified those variables as moderators of the model. When we freely estimated the parameters for the subsamples, we

found increases in all the parameters in the subsample of those firms that develop technological capabilities, whereas we found increases in the parameters for H1 and H3a and decreases for H2a in the subsamples of firms that specialise. These results support H4a but only partially support H4b as specialisation did not have an enhancement effect on the relationship between organisational adaptability and strategic renewal (H2a).

5. CONCLUSIONS

This paper set-out to answer the question of whether established organizations can develop scale up capabilities, but most importantly it sought to understand how this can be achieved. From the combined literatures into value systems, organisational design, and firm growth we developed a novel four-phase model of individually exclusive and progressive steps that incumbent firms must take to reach scale-up conditions: value system recognition; organisational adaptability; strategic renewal; and scale up. The proposed model was verified and validated by the study's results. These results were obtained by testing the theoretical predictions with a covariance-based Structural Equation Model (CB-SEM) applied to a primary sample of more than 500 Spanish manufacturing companies.

Apart from validating the hypothesised model of how incumbent firms can reach scale up conditions, the study also found that organisational adaptability partially mediates the relation between systemic change and strategic renewal, and that strategic renewal fully mediates between organisational adaptability and scale up. This implies that value cannot be obtained by skipping an intermediate step. Furthermore, technological capacity is found to positively moderate the entire process, while the level of vertical specialisation of the firm positively moderates the relation between strategic renewal and scale up.

5.1 Theoretical contribution

The study presented in this paper contributes to academia by delivering research that improves the understanding of how scale is achieved. McKelvie & Wiklund (2010) made a call for such research in their seminal paper. And although this call was made over a decade ago, Shepherd & Patzelt (2020) recently repeated a similar call by indicating that the 'how' question related to firm growth was still poorly understood. Ongoing factors such as the digitally transition affecting all aspects of the economy, seem to highlight the importance of focussing research on breaking down the mechanisms by which a firm, especially existing incumbent companies, can scale up and attain/maintain competitiveness in such a context. As such, the findings of our study serves to shed light on the scale up process and in this way answer the calls by Stampfl et al. (2013) for further research into the environmental conditions for strategic scalability resulting from the digital transition of the economy, of Shepherd & Patzelt (2020) for more research into organisational scaling and how management can facilitate scaling, and by Piaskowska et al. (2021) for research into the scale up conditions of mature and incumbent firms.

The article extends research into the scale up phenomenon, largely discussed in entrepreneurship (Shepherd & Patzelt, 2020), to the field of established organizations. This change of context is important because it allows both a generalization of the concept and a detailed analysis of the organizational changes required. The disruptive nature of the changes imposing scalability requirements on companies often means that it becomes easier to start up from scratch than to attempt to transition towards scale up conditions. Whereas entrepreneurial scalability is directly linked to opportunity discovery and value generation capacity, the path for incumbent firms is not so direct. The results of this study contribute to setting an understanding of the steps needed and process that incumbent firms must follow in order to adapt, organisationally and strategically, to such disruption.

The study also makes a theoretical contribution since it combines three apparently unconnected literature streams in order to propose a novel conceptual framework that is empirically validated. By doing so, the presented research was able to connect previously unconnected dots and adopt a perspective that allowed it to make an important stride in an area that saw "notably slow" development of new research (McKelvie & Wiklund, 2010: 261).

Finally, the article offers formulas to operationalize all the relevant constructs robustly, which allows not only to validate the model, but also to open up new research opportunities to further develop this incipient but growing area of study.

5.2 Managerial implications

The results of this study make important contributions to management. Its findings contribute to setting an understanding of the steps needed and process that incumbent firms must follow in order to adapt, organisationally and strategically, to the important systemic and technologically provoked disruptions affecting most areas of the economy. The proposed and empirically validated model for incumbents to reach effective scalability conditions not only gives the phases that incumbents must address in order to scale up, but it also establishes this process as a progression where scale cannot be obtained by skipping any intermediate step. Each phase is a mutually dependent stage towards reaching scalability. An incumbent firm cannot scale up if it does not first renew its strategy, it will not be able to implement its renewed strategy if it does not first adapt its organisational structure and boundary architecture, and such internal adaptation will be inconsequent if it is not preceded by the recognition of the systemic evolution of the firm's external value chain.

Managers of incumbent firms can also find hints as to the appropriate policy to implement to activate each stage of the proposed process. To better prepare for scale up, managers of incumbent firms, by looking more closely at the items that compose each of the models stages

up to scalability attainment, can have a better idea of the necessary conditions at each stage of the process. The results of the model's moderation variables, technological capabilities and vertical specialisation, also have important managerial implications as they confirm the importance of both of these factors in facilitating the development of the scale up process for established firms. Overall, the findings of the study have great potential to influence thinking and practice in organizational regeneration and technological adoption.

This is of special importance at a time of digital transformation of industry and society affecting all aspects of production and business (Menz et al., 2021). Digitalisation is no longer a niche characteristic exploited in only certain sectors and industries, but rather has become, or is destined to become mainstream. Digitalisation is increasingly playing a part in most business value propositions. As such, firms must reconsider the manner in which they are generating value and rethink their corporate and business strategies: where and how they compete.

One way in which digitalisation is deeply transforming business and industry is by making scalability accessible to many industries and business models that were previously considered unsuitable for scale up (Stampfl et al., 2013). Digital scalability not only enables the potential benefits from data analytics that are difficult with smaller scale operations and sales, but also scale gives access to the value generated from network externalities, where the greater the number of users of a product or service, the more value each individual user will extract. Similarly, scalability from technology allows firms to take advantage of greater user familiarity and value-added from the experiential learning benefits for customers resulting from 'learning by using'.

More importantly, digital scalability allows greater customer engagement and self-customisation without the usual diseconomies (Zhang et al., 2015). Digitally enabled analytics and servitized production is allowing scale and customisation (which were previously thought to be antonyms) to become simultaneously achievable (Shleha et al., 2023). Through

digitalisation, it becomes possible for firms to implement higher value-added solution business models whilst gaining scale. By eliminating the need to choose between customisation and scale, market niche strategies become less attractive strategically. With digitalisation, scalability is no longer just a source of competitive advantage; it is a strategic necessity.

As a result, strategies are bond to evolve from niche markets to niche functions within complex value generating systems (Zott & Amit, 2010; 2013). Together with the accrued customer focus and shorter development cycles brought on by digitalisation, firms are facing greater inclusion and interdependence within broader connected value systems. The basis of competition and value creation in these value systems shift from the functionality of any single product or service to systems consisting of interrelated goods and services, and further beyond product systems to wider system-of-systems (see Porter & Heppelmann (2014) for several examples withing the agricultural and mining sectors).

Within such system-of-systems, greater scalability affects the firm's opportunity cost of productive scope, where resource allocation is better oriented to a focal activity than multiple value-adding activities at once (Giustiziero et al., 2022). According to these authors, in such system-based economic reorganisation, firms are much more likely to be driven towards 'hyperspecialisation' to reach needed scalability conditions.

5.3. Limitations and Future Research

As with any study offering theoretical models, replication studies are warranted to further validate and contextualise. For reasons of rigor and theoretical consistency, the model constructs in this study and the items used to compose them replicated those tried and accepted within the relevant literature. Seeing that these have given expected results, future research could potentially fine-tune and disaggregate the factored constructs in order to test specific items and micro-processes behind each stage of the scale up model.

Because the main research question addressed in the study is a 'how' interrogation, future process oriented qualitative research could offer valuable corresponding results to those already obtained. It is not that the study's variance approach was inadequate as it served to validate the antecedents and/or consequences of the different stages of the proposed scale up model. Working upon the now corroborated theoretical model, new process research can pin-point the underlying generative mechanisms and contingencies at play when incumbent firms attempt to scale up. Through similar qualitative research, future studies can extend the process further and look into the post scale up phases of incumbent firms: their performance, their persistence, as well as their continued agility to follow the dynamic changes occurring within their value system.

The cross-sectional nature of the data used in the study does not allow for longitudinal heterogeneity analyses. As a result, future work based on longitudinal data seems decisive to better understand the temporal evolution of incumbent firms along the modelled scale up process. Likewise, the conclusions generated in this study are the result of the analysis of medium to large manufacturing firms. We believe that our findings and recommendations can be extended to organisations within different industries and value propositions, but future research may want to distinguish between different sectors of activity, geographic settings, and possibly between firms whose customers are end users and firms that sell their products/services to other organisations (BtoB). We therefore encourage researchers to engage in studies dealing with the wide spectrum of scenarios and business types that can come to influence the path that firms adopt on their way to becoming scale up compatible.

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7. APPENDIX

Items measuring permeability and renewal (Billinger, 2007; Jacobides & Billinger, 2006)

VALUE SYSTEM RECOGNITION

Please indicate to which extend (1= Total disagreement, 5 = Total agreement) you consider that allows permeable organizational structures to emerge is:

VCC1: Separability of products along the value chain.

VCC2: Separability of processes (organizational unbundling).

VCC3: Separability along the value chain (organizational disintegration).

VCC4: Regular internal and external benchmarking of in-house operations.

ORGANISATIONAL ADAPTABILITY

Vertically permeable structures

Please indicate to which extend (1= Total disagreement, 5 = Total agreement) you consider that firms implement a vertically permeable structure through:

VCS1: Business planning.

VCS2: Process redesign.

VCS3: IT structure.

VCS4: Modular products.

VCS5: Modular processes.

VCS6: Technological components.

Firm boundary architecture

Please indicate to which extend (1= Total disagreement, 5 = Total agreement) you consider firms improve its strategic prospects, and reduce the pressures of a price-driven commodity market by:

FBD1: Modular process redesign.

FBS2: Architectural technology.

FBD3: Re-configurability of modular structures.

FBD4: Creation of distinct capability bundles.

STRATEGIC RENEWAL

Please indicate to which extend (1= Total disagreement, 5 = Total agreement) you consider that the main means of strategic renewal are:

STR1: Flexible buying & selling along the value chain.

STR2: New product & solution offerings

STR3: Greater responsiveness.

STR4: Addressing specialized needs.

STR5: Offering complete/tailored solutions.

SCALE UP

SCA1: High sales growth.

SCA2: Non-increasing marginal costs.

SCA3: Increased customer base.

SCA4: Reaching blue ocean niches.