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How to overcome path dependency through resource reconfiguration

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ABSTRACT

Firms often reconfigure their resources when responding to changes in their external or internal environment, often by incorporating new knowledge and resources in collaboration with external stakeholders. However, the reconfiguration process is challenging, costly, and often fails. The firm's history plays an important role in the resource reconfiguration process being path dependent. Path dependency, debatably, leads to lock-in effects that prevent reconfiguration. However, we argue that this is a very limited viewpoint. In this paper, drawing empirical evidence from the digital games industry, we contend that path dependency constrains the reconfiguration action space and can potentially improve strategic planning by identifying the paths of least resistance. Depending on the extent of the reconfiguration, we identify two alternatives: direct reconfiguration (horizontal reconfiguration) or increasing the complexity by incorporating additional configurations (vertical reconfiguration).

Keywords: strategic planning, path dependency, resource-based view, knowledge-based view, evolutionary economics

1. Introduction

According to the resource-based view (RBV), a firm's survival and growth depends on their configuration of heterogeneous resources. These highly "sticky", difficult to imitate configurations support the firm's competitive advantage, enabling the firm to ask for increased rents (Barney, 1991). However, the heterogeneity of the resources forming the configuration is necessary, but this not sufficient to sustain a competitive position within the market. According to Curado & Bontis (2006), the resources need to be rare and immobile, which means that transferring those resources from one firm to another is costly (Barney, 1991). The term "stickiness" is commonly used to encapsulate the aforementioned conditions of a firm's sustainable competitive advantage according to RBV (Priem & Butler, 2001a). However, even when resources are rare that is still not enough to guarantee above average returns (Priem & Butler, 2001). According to the knowledge-based view of a firm (KBV), a competitive advantage can stem from a configuration of resources, which are not necessarily rare or inimitable by themselves but are combined in unique ways that pose additional challenges to competitors to functionally replicate or substitute them (Barney, 1991; Herden, 2019). Schoemaker (1990) argues that more than one pathway leads to such configurations (equifinality). However, current literature has ignored the antecedents of the emergence of these pathways. Additional research is required that adopts a longitudinal point of view on how resource configurations emerge and evolve over time (Pereira & Bamel, 2021). KBV can improve our understanding of how resources are reconfigured by incorporating internally or externally generated knowledge (Curado & Bontis, 2006) as well as the relationship between resource configurations and competitive advantage, and consequently their operational validity (Thomas & Tymon, 1982).

Resource configurations form and change constantly over time because the environment firms operate in follows the same pattern. Firms respond to those changes to sustain their competitive position (Dierickx & Cool, 1989; Eisenhardt & Martin, 2000). The 'capabilities' the firms develop over time manifest as complex configurations that form connections not only among themselves, but with their environment and often with other firms (Priem & Butler, 2001b). Fiol (1991) argued that when firms need to rearrange their resource configurations, this usually takes place around a "core competency", which is not surprising given the complexity of the configuration and how important it is for the company's competitive position. In highly volatile environments, such as innovative technology sectors, the speed of technological advancements cannot sustain a competitive advantage requiring constant resource reconfiguration (Fiol, 1991, 2001). As a result, the process of changing the resource configuration is path dependent because it relies heavily on the history of the firm's configuration around its core competencies (Dyer & Singh, 1998).

Environmental changes are not solely responsible for resource reconfiguration. As new knowledge becomes available, either internally generated or externally provided through partnerships, firms may identify new pathways to strategically reposition themselves against competition (Pereira & Bamel, 2021). Extending the RBV of the form which advocates direct resource reconfiguration, KBV offers two distinct pathways: i) strategic alliances (Lockett et al., 2009) and ii) mergers and acquisitions (Wernerfelt, 1984, 1995). A key factor in the effectiveness of the process of external knowledge assimilation is resource complementarity (Cohen & Levinthal, 1990; Dyer & Singh, 1998; Teece et al., 1997). Complementarity manifests in dyadic relationships leading to resource co-dependency to improve the value generating potential of their resources (Casciaro & Piskorski, 2016). These processes, in terms of resource reconfiguration, are highly dependent on the ability of the firm engaging in strategic partnerships to identify and develop complementarities (Carmona-Lavado et al., 2021).

Path dependency of the resource reconfiguration space can constrain the action space of the decision makers and managers (Kay, 2005) and consequently the process of developing complementary configurations. Often path dependency, in terms of resource configurations, is considered the source of organisational inertia which prevents a reconfiguration of a firm's resources (Hay & Wincott, 1998; Kay, 2005). On the other hand, path dependency contributes to the inimitability and indivisibility of the configurations supporting the firm's competitive position (Barney et al., 2016). Understanding the impact of path dependency on the reconfiguration action space can improve the efficacy of strategic planning because if a firm is at point A and plans to move to point B, there is a restricted number of pathways. In this paper, we also argue that if moving from A to B requires a finite number of resource reconfigurations, the path that entails the least number of necessary changes, or the path of least resistance, can be identified for resource reconfigurations. Considering the distance between two configurations can then allow decision makers to choose between reconfiguring the current configuration (horizontal reconfiguration) or increasing the complexity of the current configuration by incorporating another configuration via merger, acquisition or organic growth (vertical reconfiguration).

In this paper, we draw from the digital games industry with the aim of developing a method to identify resource configurations in order to investigate their evolutionary pathways and relationships and determine their complementarities. We identify two pathways of reconfiguration: horizontal reconfiguration (changing from one configuration to another) or vertical reconfiguration (identifying complementary configurations within the value chain). To identify such configurations, we will use cladistics classification where classification, or systematics, is the discipline that focuses on the systematic arrangement of subjects/objects into groups according to their similarities (Peneder, 2003), and cladistics is the inductive method of classification which uses the most recent common ancestry to distinguish the decomposable from non-decomposable configurations. Common ancestry implies path dependency between parent and daughter configurations. Via cladistics (or phyletic) taxonomy, we identify and develop a taxonomy of the archetypes (non-decomposable configurations) as the basic building blocks for more complex portfolios (typology: decomposable configurations based on the complementarities among the decomposable configurations). This synthesis allows the development of an empirically observable landscape of resource configurations within the sector to measure their 'strategic distance' which will inform reconfiguration either organically (reconfiguration of archetypes) or inorganically (portfolios of archetypes).

2. Configurations as classification products

Valuable contributions from classification systems usually stem from their effectiveness in identifying and capturing the diversity of particularly heterogeneous phenomena. However, designing and creating a "perfect" classification system is extremely challenging. This is mainly because in heterogeneous environments classifying the entire population of entities in a unique system usually requires extensive resources and effort, and the resulting sophistication may erode both relevance and value of the entire exercise (Eadie, 1953; McKinney, 1966). According to Sanchez (1993), overcoming the abovementioned limitations calls for a new approach in organizational classification that moves away from the 'atheoretical' approaches. However, building on extant theories will facilitate significantly both the choice of classification variables and the prescriptive, descriptive power of the exercise. For clarity and consistency, we will refer to classification objects, subjects, phenomena, or events as *entities* for the remainder of the paper.

The literature related to systematics can be divided in two methodological streams according to whether they are based on deductive or inductive approaches (Figure 1), with their corresponding outcomes called typologies and taxonomies respectively (Bailey, 1994). Both approaches share criticism. On the one hand, typologies are commonly criticised for relying on heuristic processes which generally lead to abstract, albeit theoretically robust, classification systems that do not exceed the two-dimensional space and lack substantial empirical validation (Baden-Fuller & Morgan, 2010; Meyer et al., 1993). Moreover, typologies stem from the "...Weberian logic of ideal types" (Meyer, Tsui and Hinings, 1993, p. 1182), and as such they "... cannot be used for empirical research" (McKelvey, 1975, pp. 510). On the other hand, taxonomies emerge from empirical data. Nonetheless, they frequently lack the necessary theoretical lenses and risk producing potentially disjointed outcomes from a corresponding context (Rich, 1992).

According to Rich (1992) and McKelvey (1975), the choice between a typology or a taxonomy represent the starting point of any classification process. This choice is not random and entails precise theoretical and methodological implications because, implicitly or explicitly, it dictates the vector of the classification *characters* (breadth). Characters, or characteristics, are variables whose states provide information regarding the entities (McCarthy et al., 2000). From an organisational systematics point of view, relationships or *configurations* of characters, namely the ways characters are ordered and/or combined in order to define entities, are based on four main *imperatives*: environment, structure, strategy, and leadership (Miller, 1987). Different imperatives suggest different levels of complexity of those relationships (Miller, 1987, 1996). Depending on the level of complexity of the relationships among characters, scholars select between taxonomies or typologies to identify and describe the corresponding contextual 'fit' (Drazin & Van De Ven, 1985; Grandori & Furnari, 2008). Typologies are generally used to capture more complex, non-linear relationships of qualitative characters while taxonomies are based on quantitative empirical evidence (Miller et al., 1984). However, a number of studies (Baden-Fuller & Morgan, 2010; Burns, 1967; Hotho, 2014; Warriner, 1979) highlighted the superficiality of the dichotomy arising from methodological differences between taxonomies and typologies, arguing that scholars should overcome the barrier in this distinction.

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Another important issue for the classification process is how each entity is allotted to a particular category (*type* for typologies, and *taxa* from taxonomies). A category is described by the corresponding configuration of characters (those emerged at the end of the classification process), and it is directly compared to the entity against which is classified (Figure 1). According to similarities among configurations, an entity is assigned to the most appropriate category. There are two types of configurations: *universal configurations*, which describe the entity; and *middle-range configurations*, which describe part of the entity (Miller et al., 1984; Pinder & Moore, 1979). Comparing and developing configurations from different imperatives is a challenging task, particularly in the case of universal configurations. Although attempts to link imperatives have already been made (Miller, 1986), bridging the gap becomes even more challenging when corresponding configurations (middle or universal) are contextualised in the form of *archetypes* (Short et al., 2008). Following Short, Payne and Ketchen (2008: pp. 4), we define archetypes as "...configurations that are context specific and are identified through an array of organizational features".

3. Assumptions, methodology and sample description

The methodology developed in this paper consists of two parts: the first describes the development of phyletic taxonomy of archetypes which represent configuration gestalts (non-decomposable configurations) build around a firm's core competencies (Chesbrough, 2007; Fiol, 2001). The phyletic taxonomy, and in particular cladistics, stems from the biological school of classification and is based on the assumption that the resource reconfiguration process is governed by evolutionary dynamics, namely selection, variation and retention (Fernandez et al., 2001). However, the identified archetypes do not exist in a vacuum as they can cluster to form complex relationships based on their complementarities. To capture that complexity, the second part presents a typology that uses the archetypes as building blocks in the typology of the digital-games industry portfolios according to the industrial value chain integration. To identify the resource configurations, a business model framework was used as the operational taxonomic unit.

3.1. Business model and operational taxonomic unit design

Business models can be regarded as a form of resource configuration, especially within the silo of researchers that argue that business models can act as a source of sustainable competitive advantage (Aversa, Furnari, et al., 2015). Although a universally accepted definition of a business model does not exist, many scholars consider it as an architecture of interrelated elements or subsystems (Foss & Saebi, 2017; Zott & Amit, 2010). As such, business models have been the focal point for a wide variety of both taxonomies and typologies (Lambert & Davidson, 2013). However, most studies used the business model as a theoretical framework for typologies of businesses instead of a typology of business models. The versatility of the concept (business model) is reflected in its dual functionality either as a part of an organisation (middle-range configuration) or as a representation of an organisation (universal configuration), but Massa et al. (2016) argue that the concept suffers from issues related to structural validity that hinders further empirical investigation. To improve the structural validity of the business model, Foss & Saebi (2017), who cite Simon (1991) drawing from complexity theory, argue that the first step is to differentiate decomposable from non-decomposable subsystems of business models.

In this paper, we bridge the gap between taxonomies and typologies by proposing a middle-range resource configuration in the form of *business model archetype*. For clarity and accuracy purposes, we will refer to middle-range resource configurations as *business model archetype*s hereafter. More specifically, we define a business model archetype as the product of a theoretically-grounded, empirically-driven taxonomy which confers an appropriate structural validity to the concept of the business model (Massa et al., 2016). We argue that business model archetypes can be used as building blocks for developing universal configurations in the form of typologies e.g. business model portfolios, (Aversa, Haefliger, et al. 2015; Valerie Sabatier et al. 2010) according to the corresponding theoretical paradigm (Miller, 1986, 1987). For clarity and consistency, we will refer to the complex clusters of resource configurations consisting of archetypes as *business model portfolios*.

Defining 'species' within organizational systematics context is challenging (Sanchez, 1993) and we employ cladistics to iteratively allow this to emerge. Cladistics Systematics consists of five steps (Figure 1): classification theory (evolution, common ancestry), universe of characters determination (business model component analysis), character selection based on theory (mining for characters), placing the taxonomic units into types based on data analysis (rule of parsimony), and creating the phylogenetic groups (cladogram). A schematic description of the process is given in Figure 2. In our case, we employ the business model archetype as the *operational taxonomic unit*. Initially, the business model archetype and the business model portfolio are characterised by a tautological relationship (universal configuration) which is systematically (Subsection 3.2) analysed against its corresponding middle-range configurations (business model archetypes). Business model archetypes emerge from the empirically based taxonomic process of cladistics classification, consistent with the broader inductive driven classification.

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The operational taxonomic unit is defined as "... the unit (resource configuration in our case) that could stand by itself as an autonomous organisation without adding major kinds of activities not now performed by the unit" (Warriner, (1979: pp. 7). There are no specified hard rules for selecting an appropriate operational taxonomic unit. However, regardless of its internal structure, the operational taxonomic has to be an *economically autonomous* unit, even as part of a more complex organisation, implying that an organisation may not always be the best choice as an operational taxonomic unit (Rich, 1992). Consequently, the operational taxonomic unit can be used as a building block to describe a firm's resource configurational structure (Ulrich, 1987). The identification and choice of the operational taxonomic unit is a very important first step in the classification process since it implicitly or explicitly dictates the appropriate vector of the classification variables.

As building blocks of universal configurations, business model archetypes describe various processes of creating and capturing value from different links within an industry value chain (*equifinality* Schoemaker, 1990). As such, they are industry-specified (Short et al., 2008), undifferentiated, elementary business models (archetypes of resource configurations in our case) similar to type I business models as described by Chesbrough (2007). The main difference between an undifferentiated business model (type I) and a business model archetype is that the archetype can focus on either value creation or value capturing process, which are considered interrelated but distinct processes in literature (Lepak et al., 2007; Pitelis, 2009). Consequently, the relationship between two archetypes within a portfolio structure can be used to overcome potential *value slippage* (Lepak et al., 2007). Value slippage is used to describe the asymmetry between value creation and capture processes (Lepak et al., 2007: pp. 181)

3.2. Cladistics classification using crisp set qualitative comparative analysis

Cladistics classification allows business model archetypes to emerge vis-à-vis their corresponding characters that provide evidence of their phylogenetic relationship (common ancestry). These characters are required to construct multiple conceptual trees called cladograms. The array of characters (Table 1) consists of binary (0 or 1) conditions leading to a *crisp set* of variables that may be present (1) or absent (0) within the corresponding archetype. The characters used to define the archetypes were collected via directed content analysis (Bohnsack et al., 2014; Osterwalder & Pigneur, 2005) based on a sample of business model case studies (Subsection 3.3) that covered the entire history of the digital games industry to allow sufficient variation of the population to be captured (Rihoux & Meur, 2008). *Crisp sets* are ideal because they account for both quantitative and qualitative characteristics (Rihoux & Meur, 2008), and multiple case study design is encouraged by Barratt et al. (2011) for comparative analysis and theory building. On the other hand, Eisenhardt (1989) argues that more than ten case studies hinder comparability which, in turn, clouds the complexity of a particular phenomenon. However, the construction of a classification framework aims to overcome exactly this challenge through constant updating of the system as new evidence becomes available.

The directed qualitative content analysis (Ragin, 2007) is based on business model component analysis (Bohnsack et al., 2014; Osterwalder & Pigneur, 2005) to identify the array of classification characteristics. We define a business model as a first order construct of value proposition, creation, and capture (Bohnsack et al., 2014) , based on second order constructs borrowed from the Business Model Canvas (Osterwalder & Pigneur, 2005): key resources, key partners, key activities, cost structure (value creation), value proposition, and customer relations, channels, customer segments and revenue structure (value capture). We added a tenth dimension, *tactics*, to examine the contingent relationship between business model and strategy by providing a directional dimension to the corresponding business model archetype. Tactics are used to describe the behaviour of organisations at a local level with limited capabilities of enactment (Emery & Trist, 1965). As a result, tactics can provide contingency evidence of a business model portfolio. Table 1 shows the set of classification characteristics used to describe and identify the business model archetypes.

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Our methodology is an extension of the crisp-set qualitative comparative analysis used to identify configurations but not to classify them. To achieve that, we assigned a specific business model described by a vector of characters. Compared to traditional crisp-set qualitative comparative analysis, we resolved character conflicts through historical analysis: it is now possible to identify which of the characters belong to an ancestor, and which are *derived*, or have evolved (character polarity). There are cases, however, where two business models share the same character. If the two entities inherit the character from a different ancestor, the event is called *homoplasy* and the character is called *analogous* (Lipscomb, 1998). Analogies erode the objectivity of the classification system because they challenge the criteria for determining membership assignment for the entities. To circumvent this, we perform an *internal decomposition* of the character (McCarthy et al., 2000). Character decomposition examines whether the specific character describes the same attribute (activity, resource, etc.) for both entities. When the character is used to describe two different attributes, it is adjusted accordingly (splitting it into two or more different characters) to reflect that difference. Alternatively, if character decomposition is not feasible, then the business model is divided into its component archetypes that in turn are classified according to their corresponding, closest-related, ancestor. Business model decomposition emerges after the rearrangement of characters, following the character decomposition, into new vectors of characters (Figure 2). Consequently, through the process of character conflict resolution we can circumvent the N*(N-1)/2 comparisons among all possible (2^k, where k is the number of all characters) configurations that are required by crisp-set comparative analysis (Fiss et al., 2013). Through the gradual decomposition of the business models, archetypes emerge as autonomous operational taxonomic units classified in a hierarchical form called the *cladogram* (Figure 4).

The construction of the cladogram to represent the hierarchical classification schema of the business model archetype depicts all the classification characters (coded), the classified archetypes, and their corresponding relationship. In other words, it is a more informative version of the “truth table” of crisp-set qualitative comparative analysis (Fiss et al., 2013) because not only does it contain the identified archetypes but also their corresponding relationship. The construction of the cladogram is based on *outgroup comparison* and tested against the *rule of parsimony* which states that the evolution follows the shortest path. Outgroup comparison helps determine which characters are primitive (inherited by an ancestor) or derived through the evolutionary process (Lipscomb, 1998). In some cases, a business model archetype may lose a character (i.e., *apomorphic* event) and this is displayed on the cladogram as a negative character code. Ultimately, the most parsimonious tree is chosen.

The second step (Figure 3) of the suggested classification framework uses the output of the taxonomy to build a theoretically driven typology of the industry business models. The business model archetypes identified from the first step are used as the components of business models (Massa & Tucci, 2013). Figure 3 presents a schematic description of the typological process of the classification framework. Business model archetypes are initially grouped together according to the value chain link that describes their economic activity. The economic activity of the business model archetype is identified based on their unique value proposition, and then portfolios of business model archetypes are created that describe a company's business model.

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3.3. Sample Description

We collected data from primary and secondary sources. Primary sources include three interviews with the chief executive officers of a UK-based development studio i.e., Enigma Interactive, and two non-profit trade associations representing the UK games industry i.e., United Kingdom Interactive Entertainment, and TIGA. This was to validate the relevance of the classification system (cladogram and business model portfolio framework) and the nomenclature as well as evaluate its ability to reflect reality as suggested in the systematics literature (Peneder, 2003). Secondary sources include books, journal articles, press releases and corporate reports, databases (Euromonitor Passport, Fame, and Moby Games), and publicly available online interviews. Data comprise information on 32 different company types including console manufacturers (Sony, Microsoft, Nintendo, Ouya, 3DO, Fairchild Semiconductor etc. Atari (1972 - 1980), Gaikai, OnLive, Nvidia), arcade games manufacturers (Nutting Associates, Syzygy, Atari (1980 - 1996), Capcom), publishers (Activision-Blizzard, Electronic Arts, Ubisoft, Atari (2000 - 2009), Sega, Konami, Capcom) and development studios (inXile, Revolution, Riot Games, PlayGen, BioWare, Activision, Cloud Imperium, Obsidian, Eidos, Hyde). The case of Atari was of particular interest because the company has existed throughout the entire history of the industry, and changes in its business model can be linked directly to the corresponding industrial changes. Multiple cases were selected to provide illustrative examples of various types of companies (size, age, type, location) to allow triangulation of the empirical evidence (Eisenhardt, 1989). Furthermore, since each business model archetype attribute works as an autonomous building block, the internal decomposition of the case study business models resulted in a sample of 67 business model archetypes.

The data was further organised into a two-dimensional matrix (truth table). The first dimension relates to the identified business model archetypes (13), and the second relates to the identified characteristics (63). The binary value of each entry indicates the existence (1) or not (0) of a specific business model character given the corresponding business model archetype. For the computational aspects of the classification, we used *Phylip* that allows the automatic production of cladograms.

We took steps to minimise the risk of selection bias, associated with the choice of the characteristics used to compare entities, and from sampling bias. For instance, we used event analysis to minimise the impact of sampling bias. Major organisational events (entry, exit) were considered to track and record organisational change that is reflected in the company's business model (i.e. Atari, Activision Blizzard, BioWare). Moreover, to increase inclusiveness of representative cases, we examined the technological trajectory that acts as an evolutionary trigger for business model innovation by exploring the effect of technological advances on business models of the sample together with potential new ones.

In addition, to limit and minimise selection bias, we performed a robustness test to examine the effect of the business model component analysis (business model canvas). We also used component analysis introduced by Bohnsack et al., (2014) which did not suggest extensive changes to the array of classification characteristics. To eliminate potential selection bias related to the choice of the cladogram in Figure 4, we performed several iterations targeting character conflicts through repeated content analysis until only one cladogram emerged from our data. We validated this cladogram via interviews with industry experts. Finally, we acknowledge that a new species of business model archetypes may exist, and certainly will appear in the future. However, these new units can be incorporated into the cladogram without challenging the current suggested phylogenetic relationship.

4. Results

The cladogram is shown in Figure 4 and depicts the evolutionary trajectories of the characters coded as reported in Table 1. The robustness and consistency of the cladogram are evaluated using two key indices (consistency and retention indices) in the appendix (A and B). The apomorphic events in the digital games industry lead to character reversals, which are attributed to technological advances that challenged (via disintegration) the industrial value chain (Schweizer, 2005) leading to new archetypes. The results present a trace of the evolutionary trajectory of the video game industry on the axis of the historical analysis of our research, thus providing the content of the suggested classification framework.

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The cladogram identifies thirteen business model archetypes that map the evolutionary trajectory in the digital games industry. All archetypes share a common ancestor and evolve from the electronic manufacturing industry, namely the cladogram outgroup. These archetypes can be phylogenetically grouped together into four homogeneous classes which serve different links in the industry value chain and that identify archetype changes in a taxonomy over time (Figure 5). Figure 5 corresponds to the second step of the typology-construction process as described in Figure 3.

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According to the business model archetype core value proposition, each archetype can be regarded as a set of activities that operate within a particular link of the industrial value chain. In some cases, more than one archetype evolved to serve that purpose. As many companies progressed to operate in multiple links of the industrial value chain, and frequently in other industrial chains, we constructed a typology of business model archetype portfolio (Konde, 2009; Sabatier et al., 2010) according to value chain integration (Rysman, 2009). This exercise enabled us to describe the company's corresponding business models. In addition, the timeline next to the hierarchy in Figure 4 shows the time-points when a given business model archetype emerges as a company or as part of a company. The identified archetype portfolios are shown in Table 5. The results are organised into four major business model archetype groups: arcade manufacturing, console manufacturing, publishing, and video game development. These categories correspond to the core links of the digital games industry value chain and reflect the evolution process of each archetype group. The presence of parallel evolutionary patterns for some of the identified archetypes, particularly after the advent of consoles (Atari 2600) in 1976, prevented us from applying a time-linear narration of the digital games industry evolutionary trajectory.

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4.1. Arcade platform manufacturing business models

This category includes a single business model archetype characterised by complete value chain integration (1.1, 1.2, and 1.3) and is mainly based on manufacturing and distribution platforms delivering a single digital game (1.4). It was one of the first archetypes and its origins can be tracked back to the early 1970s when semiconductor companies such as Fairchild and National Semiconductor established the very first germinal link between the electronic manufacturing industry and the digital games industry (Aoyama & Izushi, 2003; Johns, 2006; Readman & Grantham, 2006). Initially, high production costs (5.1, 10.1) and technological limitations (e.g., the inability of a given platform to support more than a single digital game) prevented companies operating in the industry adopting a more customer-oriented approach. As a result, many companies in this group focused their offer on leisure hubs and amusement parks (6.1, 6.2) (Kent, 2001; Newman, 2013).

The first company that successfully commercialised digital games (5.3, 9.3) was Atari. The company's value chain structure comprised platform manufacturing (1.1), digital games development (1.2, 2.1) and publishing (1.3). The high level of integration of this archetype can be attributed to the strong interrelationship between the software and hardware components of the manufacturing process. The established value network of the electronics manufacturing industry was used by the newly founded industry to serve its customers mainly by distributing mechanical coin-operated games, such as flippers and slot machines (Aoyama & Izushi, 2003; Johns, 2006; Readman & Grantham, 2006). Coin-operated arcade games, or coin-ops, were the first digital game platforms (1.4) (Kent, 2001; Newman, 2013).

4.2. Platform manufacturing

Hardware producers encompass a great variety of digital game platforms such as personal computers (PCs), consoles and portable playing devices. The advent and significant diffusion of mobile phones and tablets, associated with a progressive increase in their average processing power, further enlarged the variety of gaming platforms. At present, consoles operating as media and entertainment hubs dominate 43% of the games market: the Microsoft Xbox, Sony PlayStation and Nintendo Wii U dominate the console market. PCs serve 30% of the market, mainly due to massively multiplayer online games (MMOs) accessible via internet browsing. Phones and tablets have a combined market share of only 18% even if these devices represent the most dynamic segment of the market in terms of potential growth rates (Newzoo, 2014). Table 2 shows the major companies operating in the industry in terms of annual sales.

The disintegration of the value chain (1.2) associated with coin-ops triggered the development of new business model archetypes that focused on creating and capturing value by serving different links of the corresponding chain. Console manufacturing (1.5) started producing the console platforms (standardised computers) which supported different digital games, thus allowing third-party companies to publish digital games (4.4, 9.6). In this context, platforms functioned as the intermediary between publishers on the one hand and a platform's corresponding playerbase on the other, thus establishing the necessary conditions for a two-sided market. For some time, console manufacturers, such as 3DO and Turbo Tech Duo, competed on console prices and availability (Aoyama & Izushi, 2003) because of a lack of strong incumbents between publishers and developers. In 1993, Sega and Nintendo exploited the opportunities associated with an increased value chain integration in a two-sided market: these two companies established a premium relationship with publishers and developers that allowed them to offer exclusive content (Schilling, 2003).

This two-sided strategy (10.6), followed by the majority of console manufacturers at that time (e.g., Sony and Microsoft), can be identified as a predominant driver within this group of archetypes. By pricing console platforms close to break-even point or even below cost, manufacturers aimed to enlarge their playerbase as much as possible. Moreover, an increasing playerbase and advantageous contracts in terms of costs and royalties attracted more digital games publishers and developers. In addition, technical barriers, such as a lack of backward or horizontal compatibility between different consoles, prevented customers moving to competitors within a given generation of consoles (9.1).

As a result, console manufacturers succeeded in integrating the manufacturing, publishing, developing and distribution links of the value chain into their own business model (*Staging Two-sided Platforms*, 2007). Following a two-sided strategy, console manufacturers maximise their profitability by extracting value from the established customer base via a series of contracts (exclusive or not) with other publishers and developers, and by incorporating developing and publishing activities within their business model. This strategy enabled console manufacturers to sustain and progressively increase their customer base, using it to establish revenue streams for products and services that are internally developed. However, given the short life cycle of digital games, as creative products, generating and sustaining a healthy IP portfolio is crucial for console manufacturers. The more exclusive this portfolio, the more attractive the console is to the players (Lee, 2012; Marchand & Hennig-Thurau, 2013; Schilling, 2003).

Nowadays, strategic differences remain among the dominant console manufacturers, namely Sony, Microsoft and Nintendo (Lee, 2012). Nintendo sells its consoles at a profit by maintaining tight relationships with second-party developers by means of exclusive publishing and developing contracts. Most of the digital games are generated in-house, with just 20% of production being outsourced to second or third-party developing studios (Storz, 2008).

The advent of new technologies such as cloud computing may challenge the current industrial value chain and its corresponding business model archetypes and portfolios. The combination between cloud computing and digital games, or cloud gaming, enables customers to play on servers (1.6, 9.3) and in livestreaming (1.7) regardless of the device if they have access to a high-speed internet connection. This technology is currently supported via two archetypes: the Ad Network, which streams demos (9.7) of digital games and is embedded in industry related sites (4.6, 5.2) such as OnLive and Gaikai and Open Platform, which provide digital games on a platform and stream them onto another such as OnLive and NVidia Shield service (9.10). In particular, Open Platform is used to increase the value and services offered by Sony and Nvidia respectively.

4.3. Publishing

Publishing business model archetypes comprises mass production and distribution (6.4) of digital games (1.2). Business model archetypes in this category offer publishing services to developers (1.1) such as marketing, design (5.1), and localisation (3.3, 3.4) (Marchand & Hennig-Thurau, 2013). Revenue streams (9.2, 9.4, 9.8, and 9.9) from digital games are important for this group of publishing business model archetypes. However, publishing is characterised by increased risk in terms of profitability with 70% of revenues generated by only 14% of titles (Aoyama & Izushi, 2003). To offset the increased risk and production cost (10.1), publishers follow a hit-driven strategy (10.2) by investing considerable funds in marketing (5.1) original titles or by creating spinoffs of already successful games in their IP portfolio (3.5) in order to attain a reasonable normalisation of the revenue streams (3.7) (Cadin & Guérin, 2006; De Vaan et al., 2013; Storz, 2008). Publishers develop and sustain IP via three main paths (Lee, 2012): through in-house development (2.1), by signing exclusive publishing contracts with developing studios (8.2), or by acquiring externally developed IP (3.5). As a result, publishers now represent the key source of funding (4.5) for digital games development.

A significant proportion of revenues still comes from the game sales (9.2) of physical products such as DVDs etc. (6.1, 6.2, and 4.1) even though video distribution channels (6.3, 6.4, and 4.2) are increasing in terms of importance. A new archetype has been developed to include new monetisation strategies, Freemium publishing being one (Marchand & Hennig-Thurau, 2013). Freemium publishing, as a business model, offers the game free of charge while generating profits through in-game stores (micro transactions (9.4)) or by offering premium downloadable content (namely DLC). Freemium presents many advantages against digital games piracy and it is highly suitable for social games such as massively multiplayer online role-playing games, known as MMORPGs. There are several examples within the industry of transitions from one monetisation model (such as Pay-to-Play) to a freemium model: for example, Turbine, acquired by Times Warner, with Lord of the Rings online (game) and Electronic Arts for Knights of the Old Republic (game) (Moritz et al., 2020). The largest games software publishers tend also to be the most successful digital games platform manufacturers and operate on more links within the industrial value chain. As a result, these companies are characterised by a portfolio of business model archetypes (Table 2).

4.4. Digital games developing

Business model archetypes operating in this category include the design, programming (1.4), and financing aspects (2.7, 4.5) of the digital games production process (3.6). Originally, independent developers were individual computer and software engineers (2.4) working freelance for publishers mainly on contract-based projects (Kent, 2001; Newman, 2013) with publishers financing (4.4) and distributing the games (6.4, 6.2) (Johns, 2006). The rise of mobile phones and tablets as gaming platforms and the creation of video distribution channels has lowered market entry barriers and increased the number of independent developers (Crogan, 2018; Marchand & Hennig-Thurau, 2013; Readman & Grantham, 2006).

However, some entry barriers do remain and affect developers' success, profitability, and survivability. For instance, due to the significantly increased influx of independently developed titles in traditional digital distribution channels (4.1,4.2) such as the App Store, Google Play, Windows Store and Steam, the discoverability and observability of new titles (Broekhuizen et al., 2013; Crogan, 2018; Landoni et al., n.d.; Mayo, 2009) is significantly limited. As a result, the expected revenue of independent developers varies significantly (10.5) and developers do now compete on price and availability (Readman & Grantham, 2006).

The link between development studios and publishers remains strong in the current digital games industry. This is mainly due to the positive externalities derived from complementary assets (2.6, 2.2) which support the development of multiple IP while minimising production costs (10.5). This situation generates a favourable funding environment for those in partnership with publishing companies. It also provides opportunities for mergers and acquisitions between development studios and publishing companies in the industry (10.4) particularly when creative independence (10.3) is not of strategic importance.

By establishing partnerships (9.5) with publishers (8.3), developers can access the publishers' established distribution channels and customer segments while not having to rely on multiple online markets to support their growth (2.5, 8.3, 2.3, -2.4) (Feijoo et al., 2012). Relationships between developers and publishers are formed to facilitate access to funding and to stabilise revenue streams even if they have a negative impact on developer creative independence (10.3), and on potentially abnormal future cash flows stemming from privately owned new IPs. The product of the close relationship between developing studios and publishers is that discoverability and observability of the games increase dramatically albeit in exchange for limited creative independence (Broekhuizen et al., 2013).

At opposite ends of the spectrum of developer creative independence, two business model archetypes can be identified: *second party* development and *white label* development. The corresponding business model archetypes are shaped by how exclusive the relationship between the studio and the third-party publisher is. Second party developers strategically favour a close relationship with a third-party publisher (or console manufacturer), developing exclusive content (8.2) for that partner. HAL Laboratory and Game Freak are two case studies of studios that operate as second party developers. Engaging in exclusive contracts with third-party publishers does not prohibit those studios from developing and sustaining an originally developed IP portfolio. At the other end of the creative independence spectrum, white label developers are uncredited developers (8.4) of IPs contracted via third-party publishers. As a result, this type of business model archetype focuses on production and financial risk minimisation by sacrificing creative independence. To circumvent third-party publishers as a funding source, some studios (e.g., Revolution, inXile, and Obsidian) attempted and succeeded in attracting funding directly from customers via crowdfunding online platforms, such as Kickstarter (3.9). The advantages of crowdfunding vary from co-development and co-creation (8.1) of the final product to establishing a playerbase without investing heavily in marketing (Planells, 2017).

5. Discussion

5.1. Implications for theory

According to RBV, a competitive position within markets often stems from rare, inimitable, and non-transferable resources (Barney, 1991). RBV is often criticised for its static approach to the causal relationship between the resources on the one hand and their ability to generate superior rents on behalf of the firm on the other (Priem & Butler, 2001b). Researchers aimed to expand RBV by arguing that in many cases it is a configuration of resources that are the source of competitive advantage (Black & Boal, 1994; Schoemaker, 1990). The strategic value of those configurations stems from their complex relationship among their constituent elements and those of the external environment (Barney, 1991). The KBV of the firm, however, moved a step forward and argued that these complex configurations encapsulate the knowledge within the organisation, and as a result they are harder to replicate or functionally be substituted by competitors (Schoemaker, 1990). KBV scholars moved further forward and argued that as new knowledge emerges, either internally within the organisation or externally from the environment, those research configurations can, and should, change for a firm to defend or support its competitive position and continue gaining superior rents from those resources (Darroch, 2005).

However, this process is not seamless. The resource reconfiguration is highly path dependent and resource configurations develop into core competencies (Eisenhardt & Martin, 2000). Reconfiguring core competencies may have a negative impact on the sustainability and survivability of the firm (Scarbrough, 1998). As a result, the history of a firm's resource configuration is important because path dependency often poses challenges for firms that are required to reposition strategically. In this paper, however, we extended the RBV of the firm by arguing that path dependency can have a positive impact by constraining the action space available and consequently informing strategic planning. As a result, we need to map the complex relationship between those resource configurations and operationalise their relationship. Mapping that relationship can potentially allow direct comparison between initial configuration and target configuration informing the decision process of reconfiguration. Consequently, this allowed us to identify two potential paths of reconfiguration, the first being direct, or horizontal, reconfiguration between two configurations (stemming from RBV), namely the target and the initial configuration. The second pathway of reconfiguration occurs through increasing complexity vertically by combining configurations together. The choice between these pathways is the distance between two configurations. Drawing from a KBV, if reconfiguration entails complex and costly changes that threaten the core competencies of the firm, then the firm can consider increasing complexity through mergers, acquisitions or through organic growth. The key factor of the aforementioned approach is resource complementarity: in our case, how firms, based on their configurations, create and deliver value within the value chain. An example that illustrates this from the games industry is the two-sided markets of console manufacturers. To maximise the rents received from the configurations, the firms need to combine two or more resource configurations.

5.2. Implications for managers

Path dependency of resource configurations can have significant impact on management. Until recently, path dependency has been examined as a factor to be overcome or managed in order to allow innovation to happen because it leads to lock-in effects (Lehtimäki et al., 2020; Morgan & Kubo, 2005; Pylak, 2015). However, studies have also emerged that investigate the positive impact of path dependency on building necessary capabilities (Augsdorfer, 2005; R. Bohnsack et al., 2019), and we argue that path dependency can potentially have a positive impact on innovation. Resource configurations as non-decomposable configurations are much more "stable" configurations: they require intensive effort to rearrange the complexity of their structure because of the tight links between the characteristics required to articulate the mechanism a business creates to deliver value (Saebi et al., 2017). As a result, managers that attempt such a change need to take into consideration the industry's historical evolution, position, and identify pathways of reconfiguration. By positioning a firm's configurations against competition, managers can identify target reconfigurations and create pathways accordingly, those which are tractable and measurable in terms of the extent of reconfiguration. If the 'distance' between two configurations (initial and target) is 'reasonable', then horizontal (direct) reconfiguration can make sense. However, as the distance increases, increasing the complexity of the current configuration may be a less costly alternative, especially when reconfiguration targets a firm's core competency.

In the second case, combining configurations (through mergers, acquisitions or organically grown) may be a better alternative (Table 2). At this level, the agency of management increases in scope and scale as managers can create novel combinations of archetype portfolios, or even examine and justify innovation on a more fundamental level given that they can more accurately articulate their strategy. For example, following a top-down approach, managers can identify parts of their business model that may require development on an archetype level. Based on the above, we can position the business model archetypes and business model portfolios within the typology of business model innovation developed by Foss & Saebi (2017).

6. Research Limitations

The historical analysis of the evolution of the industry, even for a young industry like video/digital games, is not exhaustive; thus in our case, neither is the heterogeneity of the configurations. It is indeed possible that some business model archetypes or portfolios are missing from our analysis. Moreover, the identified archetypes act as evolutionary gestalts of an entire spectrum of different configurations and the cladogram reflects a set of local optima in terms of business model archetypes. However, this does not imply that local optima cannot arise from emergent variants of the existing business model archetypes: local optima can be captured via the internal decomposition of the predetermined characters or with the addition of new ones. Furthermore, our analysis is myopic by shifting its focus onto the history of the evolution of the industry's extant configurations and it does not take into consideration future development of novel configurations that have yet to exist. As a result, one of the most interesting implications of our research is its impact on innovation management.

7. Future Research

Future research can extend to two, non-mutually exclusive pathways. First, the application of the methodology of cladistics classification in other industries can help refine the process of identifying the resource configurations promoting and supporting empirical research on RBV, equifinality and the sustainability of competitive advantage. Second, our method is the first that aims to bridge the gap between taxonomies and typologies because previous studies had considered those two approaches as being mutually exclusive. Bridging that gap has a significant impact on innovation studies. By using the product of cladistics (resource configurations according to RBV) as further classification units, researchers can attempt different theoretically constructed typologies (portfolios I in our case) according to different theoretical perspectives (the value chain in this paper), thus facilitating the discourse between RBV and KBV in a firm. As new knowledge emerges, either internally or externally through strategic relationships, data can manifest as novel reconfigurations that are empirically tractable and theoretically grounded.

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Appendix

A. Cladogram Evaluation Indices

A set of evaluation indicators developed by researchers to assess the outputs gathered from classification. The length of the cladogram measures the changes in character state required to support the relationship of the *taxa* (archetypes) in the tree that are then compared to the actual number of characters. A higher number of characters indicate that some change more than once during the evolutionary process and may not be parsimonious. In our case, the length of the cladogram is estimated to be 55, while the total number of characters is 63. The increased length is attributed to 8 character-reversals associated with the historical disintegration of the digital-games industry value chain.

The Consistency Index (CI) provided in Eq. A.1 measures the relative number of analogies in each cladogram compared to the expected character changes, and the actual changes reported in the factual cladogram. In our case, the CI estimation is 84%, meaning that 84% of the expected character changes based on the table of characters captured in the cladogram.

$$CI = \frac{total\ character\ changes\ expected\ given\ the\ data\ set}{actual\ number\ of\ steps\ in\ the\ tree} * 100 \qquad (A.1)$$

Consistency Index compared to the Retention Index (RI) given by Eq. A.2. The Retention Index is also a measure of the amount of homoplasy. The difference between CI and RI is that the latter takes into consideration reverse evolution (character reversals, or apomorphic events). In our case, RI estimated to be 90% implying that the dataset sufficiently supports the classification as depicted by the cladogram. The descriptive statistics, such as Length, RI, and CI, show a sufficiently good fit of the cladogram against the data structure.

$$RI = \frac{\max \# \; of \; steps \; on \; a \; tree - \# \; of \; state \; changes \; on \; the \; tree}{\max \# \; of \; steps \; on \; a \; tree - \min \# \; of \; state \; changes \; in \; the \; dataset} \qquad (A.2)$$

B. Classification Algorithm

This section provides an *ex post* algorithmic representation of the business model classification framework discussed in the paper. For a more detailed description of the phylogenetic methodology please refer to McCarthy *et al.* (2000).

1. Select sector and timeframe (right censored timeframe is preferable)
    a. Identify the sector value chain.
    b. Identify the industrial major technological innovations through time.
    c. Identify companies (regardless of size or type) active during the technological advances.
    d. Identify major companies active during the entire period.
2. Define characters
    a. Apply business model component analysis to the selected sample of companies.
    b. Based on the business model component analysis collect the initial list of classification characteristics.
    c. Perform content comparison with the characteristics; eliminate double entries.
    d. Resolve conflicts between characters e.g., characteristics with different content per business model (split characteristics if necessary).
    e. Generate an array of classification characteristics.
3. Organise and codify characters.
4. Detect character polarity: determine if the characteristics were inherited by an ancestor or newly acquired. Only necessary for manual construction of the cladogram.
5. Define the business model archetypes
    a. For each value proposition that serves a particular value chain link:
        i. using business model component analysis, identify all the characteristics that support via value creation or deliver that value proposition
6. Create the business model archetypes.

7. Construct a two-dimensional matrix: the first dimension is the business model archetypes (or species); the second dimension is the list of classification characteristics.
8. Construct conceptual cladograms by using a phylogenetic classification software (i.e., Phylip).
9. Validate conceptual cladograms.
10. If necessary, repeat steps 2.a to 5.b
11. Choose factual cladogram.
12. Taxa nomenclature.
13. For each company, use taxa to construct the business model portfolio based on the vertical diversification of the company's business model.

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Figure 1: **Map of the two main methodological streams of systematics**: Taxonomies, typologies, and the corresponding sub-streams (adapted from Rich (1992)). Adaptations are in italics. The dashed line shows the transition from the taxonomy of business model archetypes to a typology of business model portfolios according to value chain integration. The imperatives that influence the configurations (environment and structure) are also included.

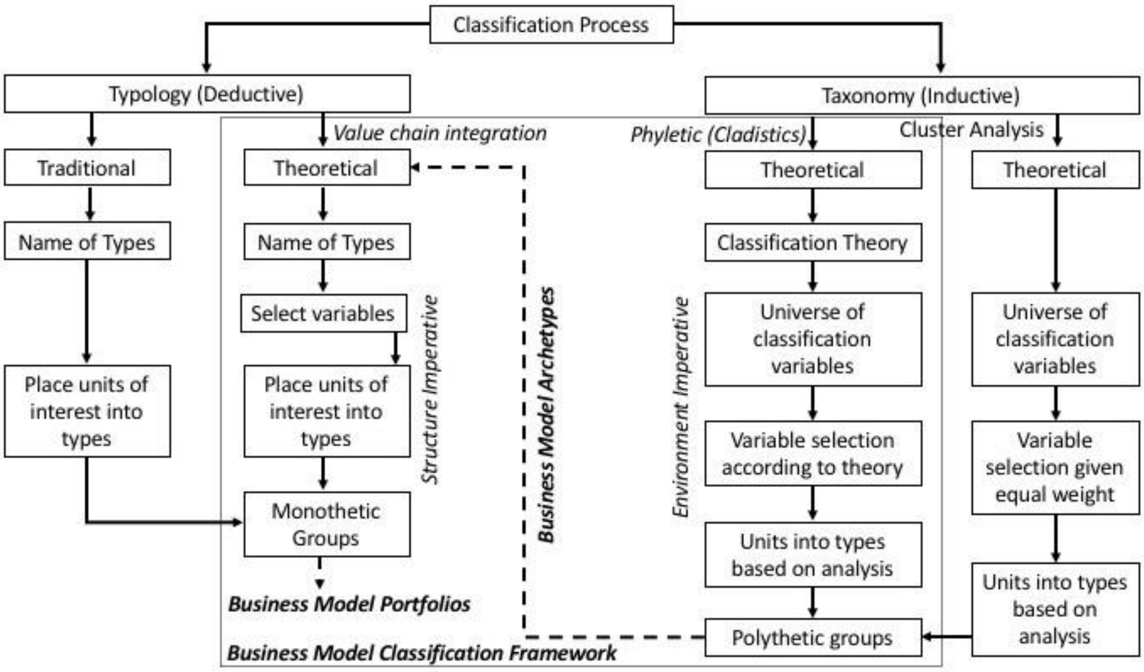

Figure 2: Step 1 Taxonomy. According to cladistics classification, business model archetypes classified according to how recently they shared a common ancestor (rule of phylogeny). The product of cladistics classification is a hierarchical tree, namely the cladogram illustrating the evolutionary paths. When data (characters) suggest multiple evolutionary paths (of species), the shortest path is chosen (rule of parsimony). The processes of mining for species and mining for characters is iterative, continuing until all character conflicts are resolved. The business model archetypes emerge from the data analysis and classification and are not constructed in advance (taxonomy).

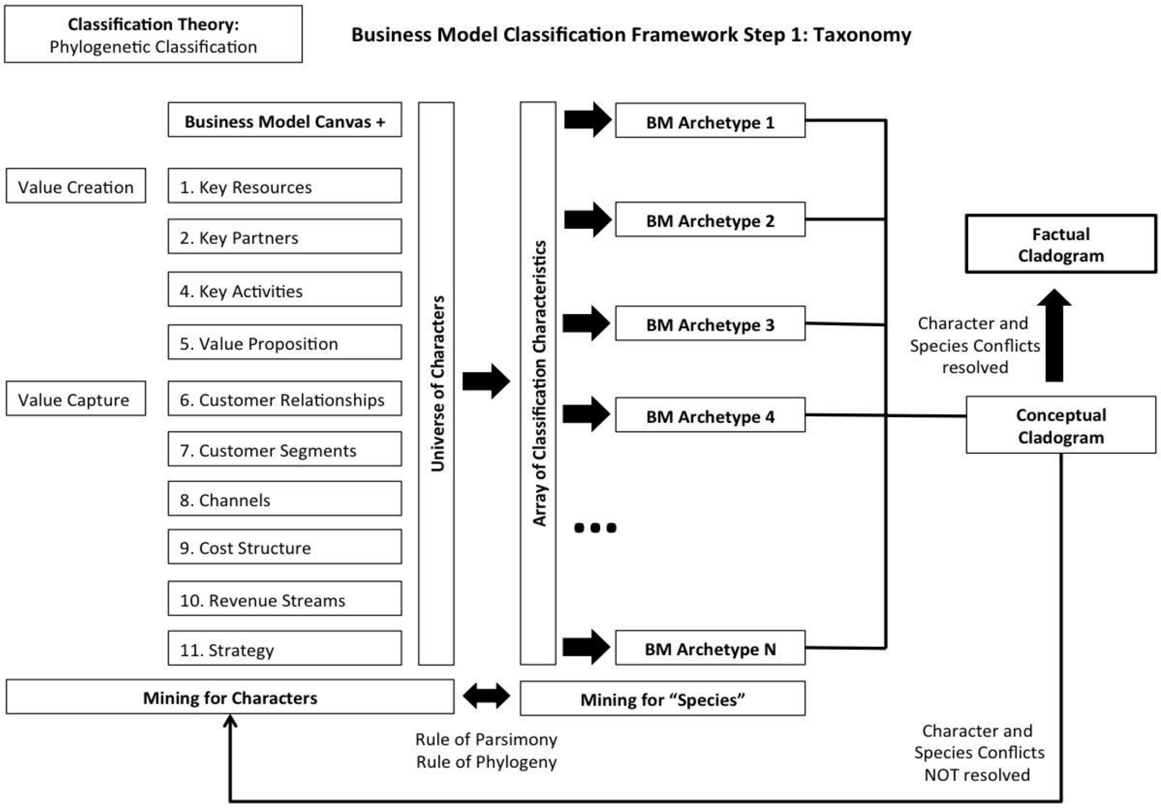

Figure 3: Step 2 Typology. Business model archetypes evolved to create and/or capture value within the context of a link of the corresponding industrial value chain. Consequently, they can be grouped together as portfolios of archetypes to describe the diversity of the approaches of value chain integration within the industry. The archetype is assigned a link in the industrial value chain according to its core value proposition.

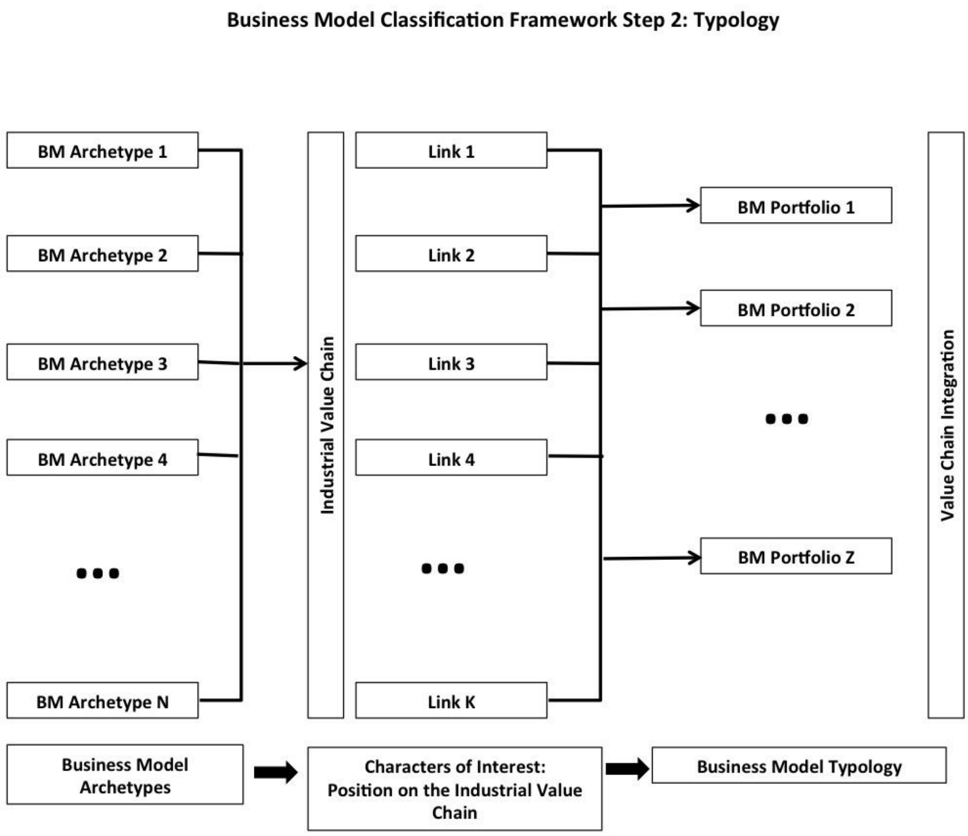

Figure 4: Video game industry: business model archetypes cladogram. The cladogram is the hierarchical depiction of the classification of the games industry business model archetypes. It depicts the archetypes and the coded characters that describe them (Table 1). Negative codes represent apomorphic events: the loss of a character. The cladogram depicts the horizontal diversity of the digital games industry, and the vertical historical evolution.

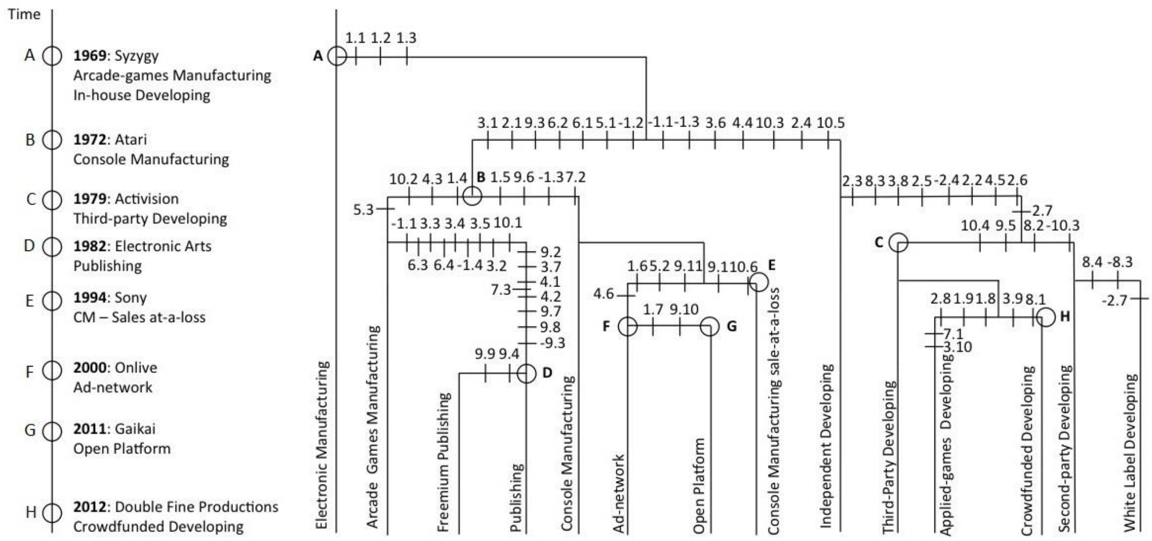

Figure 5: Business model archetypes and the digital games industry value chain. Business model archetypes assigned a link in the industrial value chain according to their value proposition. The figure displays the nested, hierarchical relationship between the archetypes within a particular link.

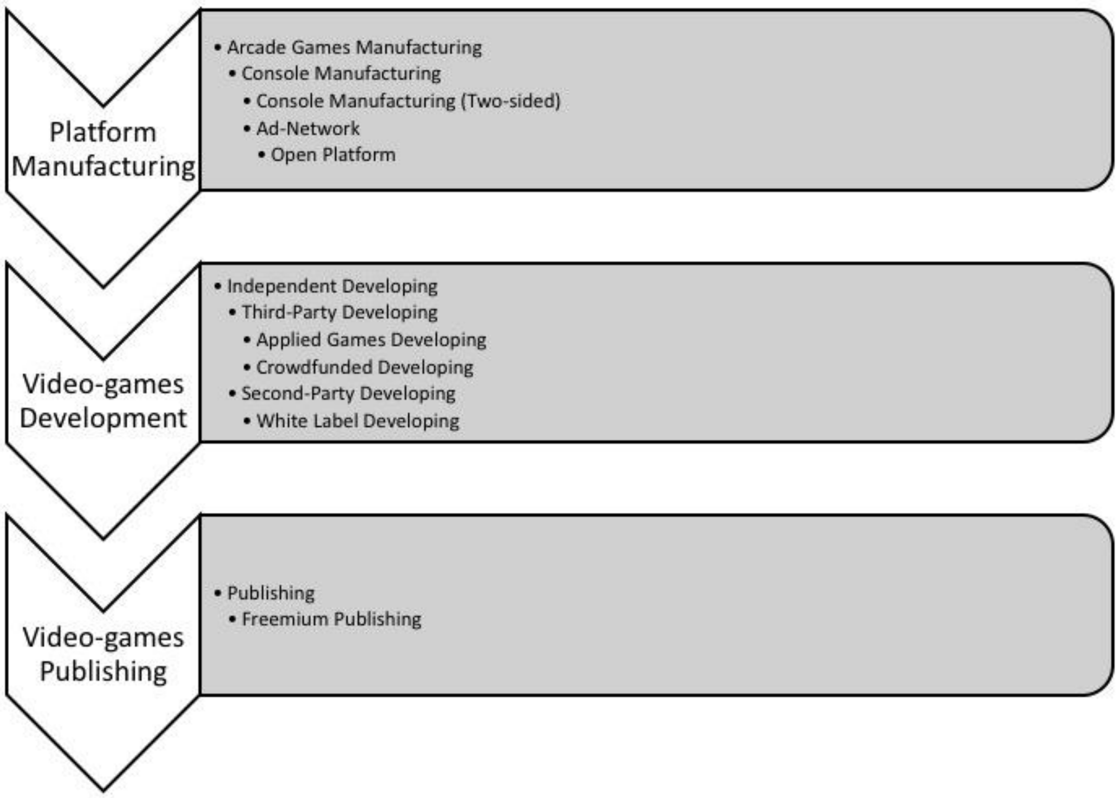

Figure 6: **The business model innovation process** adapted from Foss & Saebi (2017). The process describes the formation of new business models as a modular process using business model archetypes as modules vis-à-vis complexity and path dependency at each level of innovation.

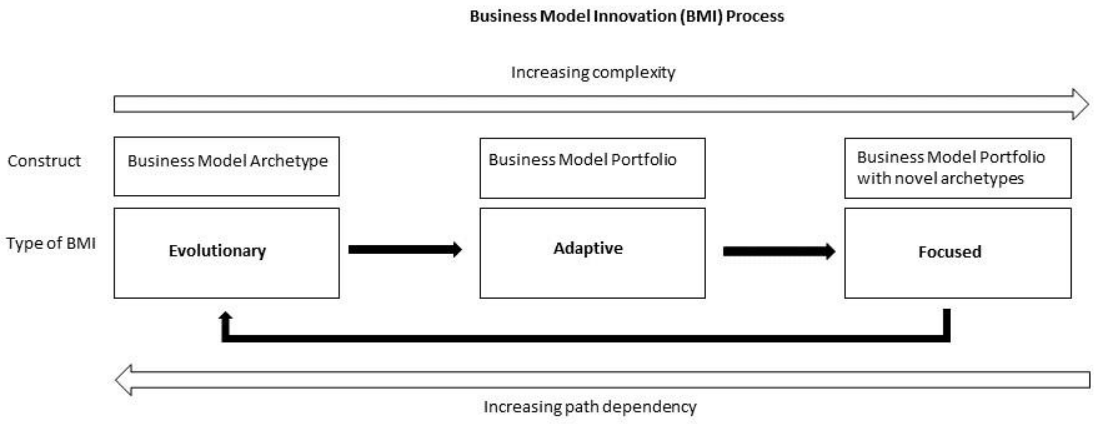

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Table 1: The list of characters and their corresponding codes. The character states are in binary form [0; 1], stating either the lack or the existence of the corresponding character in each business model archetype. The coding facilitates the depiction of the character evolution in the factual cladogram.

List of classification characters			
1. Value proposition		6. Channels	
1.1	Platform manufacturing	6.1	In-house physical distribution
1.2	Digital-games development	6.2	3rd-party physical distribution
1.3	Digital-games publishing	6.3	In-house digital distribution
1.4	Arcade-games manufacturing	6.4	3rd-party digital distribution
1.5	Console manufacturing		
1.6	Online server platforms		
1.7	Digital-games streaming		
1.8	Applied-games development		
1.9	Gamified applications		
2. Key Resources		7. Customer Segments	
2.1	In-house development assets (Physical / digital capital)	7.1	Business-to-Business
2.2	Complementary assets (Physical / digital capital)	7.2	Publishers / Developers
2.3	Multidisciplinary development team (Human capital)	7.3	Advertisers
2.4	Small, *close-knit*, team (Human capital)		
2.5	Big production studio (Physical capital)		
2.6	Middleware (Digital capital)		
2.7	In-house financial capital		
2.8	Reusability and interoperability of final product		
3. Key activities		8. Customer relations	
3.1	In-house physical distribution	8.1	Co-creation and development
3.2	In-house digital distribution	8.2	Exclusive publishing agreements
3.3	Localisation services	8.3	Multiple publishing agreements

3.4	Layout design and printing	8.4	Complete dependence on a publisher
3.5	Intellectual property acquisition		
3.6	Intellectual property creation		
3.7	In-game advertising		
3.8	Open-source software development		
3.9	Crowdfunding		
3.10	Project-based production process		
4. Key partners		9. Revenue streams	
4.1	3rd-party physical distributors	9.1	*Razor-blade* model
4.2	3rd-party digital distributors	9.2	Direct sales (game)
4.3	3rd-party developers (outsourcing)	9.3	Direct sales (platform)
4.4	3rd-party publishers (outsourcing)	9.4	Microtransactions
4.5	3rd-party publishers (funding)	9.5	Royalties receivable (Intellectual property license)
4.6	Online serve providers	9.6	Royalties receivable (Platform publishing agreements)
		9.7	Royalties receivable (advertisements)
		9.8	Subscriptions
		9.9	*Freemium* revenue models
		9.10	Servitization
5. Cost structure		10. Tactics	
5.1	Marketing costs	10.1	Production-risk minimisation
5.2	Royalties payable to online server providers	10.2	Hit-driven blockbuster production
5.3	Royalties payable to intellectual property holders	10.3	Creativity independence
		10.4	Exit strategy
		10.5	Cost minimisation
		10.6	Two-sided tactic

Table 2: A typology of business model portfolios. Business model portfolios consist of business model archetypes and capture the diversity of the value-chain integration strategies within the industry.

	Value chain													
Type	**Manufacturing**						**Publishing**		**Development**					
	Electronic	Arcade	Console	Sale at a loss	Ad-Network	Open Platform	Publishing	Freemium	Independent	3rd party	2nd party	1st party	Crowdfund	Applied
1							■	■						
2							■			■				
3										■			■	
4										■		■		
5										■	■			
6											■			
7										■				■
8			■				■	■						
9				■										
10				■			■	■				■		
11				■		■	■	■				■		
12					■	■								
13	■	■												
14									■					
15								■	■					