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# **Agile Principles and Practices in the Italian Architectural and Engineering Sector**

The Case of ArchLivIng

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# INDEX

- INTRODUCTION..... 1**
- CHAPTER 1. ARCHITECTURE AND ENGINEERING..... 5**
  - 1.1. OVERVIEW ..... 5
  - 1.2. THE CONSTRUCTION VALUE CHAIN ..... 6
    - 1.2.1. *A Supply-Side Perspective* ..... 6
    - 1.2.2. *A Demand-Side Perspective*..... 9
  - 1.3. ARCHITECTURE AND ENGINEERING ..... 10
    - 1.3.1. *Workforce and Activities*..... 10
    - 1.3.2. *Size and Structure* ..... 15
  - 1.4. ATTRACTIVENESS OF THE A&E SECTOR ..... 18
    - 1.4.1. *The General Environment* ..... 18
    - 1.4.2. *The Specific Environment*..... 20
- CHAPTER 2. THE A&E FIRM: ARCHLIVING ..... 23**
  - 2.1. OVERVIEW ..... 23
  - 2.2. COMPANY PROFILE ..... 24
    - 2.2.1. *Overview* ..... 24
    - 2.2.2. *Pillars and Markets* ..... 25
  - 2.3. ARCHLIVING’S ORGANIZATIONAL CULTURE ..... 28
    - 2.3.1. *Organizational Values*..... 28
    - 2.3.2. *Cultural Elements* ..... 29
  - 2.4. A&E COMPANIES AND BUSINESS MODELS ..... 30
  - 2.5. MANAGING A GROWING A&E FIRM ..... 33
    - 2.5.1. *Acknowledging the Tradeoffs* ..... 33
    - 2.5.2. *ArchLiving’s New Challenges* ..... 37
- CHAPTER 3. AGILITY AND AGILE ..... 43**
  - 3.1. OVERVIEW ..... 43
  - 3.2. ORGANIZATIONAL AGILITY ..... 45
    - 3.2.1. *Early Developments*..... 45
    - 3.2.2. *Defining Organizational Agility*..... 46
    - 3.2.3. *Enabling Organizational Agility* ..... 48
  - 3.3. AGILITY IN SOFTWARE DEVELOPMENT ..... 53
    - 3.3.1. *Overview and Antecedents* ..... 53
    - 3.3.2. *The Agile Manifesto. Agile Values, Principles, and Practices*..... 57
    - 3.3.3. *Agile Methodologies and Scrum*..... 62
  - 3.4. AGILITY TODAY: THE AGILE ENTERPRISE ..... 66
    - 3.4.1. *Connecting the Dots*..... 66
    - 3.4.2. *Agility Beyond Software. Values and Areas of Change*..... 68
    - 3.4.3. *Principles, Practices and Frameworks in the Agile Enterprise*..... 72
- CHAPTER 4. WHY DOES A&E NEED AGILITY? ..... 79**
  - 4.1. OVERVIEW ..... 79

4.2.	UNDERSTANDING THE CHALLENGES IN THE A&E SECTOR .....	80
4.2.1.	<i>Professional Service Firms. Professionalism versus Managerialism .....</i>	<i>80</i>
4.2.3.	<i>Managing Knowledge Intensity .....</i>	<i>86</i>
4.2.3.	<i>A Look at the Construction Value Chain. Productivity and Efficiency.....</i>	<i>89</i>
4.3.	THE ROLE OF AGILITY .....	92
4.3.1.	<i>Agile in the A&amp;E Management Transformation .....</i>	<i>92</i>
4.3.2.	<i>Agile to Manage Customers and Workforce.....</i>	<i>96</i>
4.3.3.	<i>Agile to Reach Productivity and Efficiency.....</i>	<i>100</i>
<b>CHAPTER 5. HOW ARE A&amp;E PLAYERS ADOPTING AGILE?.....</b>		<b>103</b>
5.1.	OVERVIEW .....	103
5.2.	A LOOK AT PREVIOUS EXPERIENCES .....	104
5.2.1.	<i>Motivation.....</i>	<i>104</i>
5.2.2.	<i>Solutions.....</i>	<i>109</i>
5.3.	AGILE AT ARCHLIVING.....	117
5.3.1.	<i>Why Agile? .....</i>	<i>117</i>
5.3.2.	<i>Agile in Practice.....</i>	<i>120</i>
5.4.	WHAT COULD BE EXPECTED FROM AGILE IN A&E? .....	130
<b>CONCLUSIONS.....</b>		<b>135</b>
<b>REFERENCES.....</b>		<b>137</b>

*The only way to make sense out of change is  
to plunge into it, move with it, and join the dance.*

— Alan Watts





# INTRODUCTION

In today's volatile, ambiguous and complex business world, the need to devise an organizational strategy and structure that can accommodate change and keep up with rapid developments is becoming increasingly important. Even in sectors like architecture and engineering (A&E) – which have traditionally been shielded from strong market dynamism – new trends like increased competition, higher project sophistication, and diffusion of novel, cutting-edge technologies are forcing players to revolutionize their governance and management. To address this urgency, many companies are seeking insights, guidance, or replicable success stories both inside and outside their industry. Among them is ArchLivIng, a forward-looking, small-sized Italian design firm that provides a stimulating case in point for its business-level choices. The company, departing from the traditional organizational schemes found in its sector, has been experimenting with introducing principles and practices inspired by the growing agile body of knowledge. An innovative approach to conceive the firm and to structure workforce and business processes, agility is found to provide a compelling answer to concerns about A&E's managerial backwardness while being believed as a great way to improve ArchLivIng's performance and to attain a competitive advantage in a progressively more dynamic market.

Central to this work is the A&E sector, which describes the activities performed by a specific segment of the much broader construction value chain. In particular, the industry identifies the occupation of licensed professionals – architects and engineers – who are given the duty to design buildings and infrastructure before project “plans and specifications” proceed to actual construction or execution. In Italy, the sector has historically experienced periods of boom and bust, and it is currently still recovering after the late 2000s financial crisis. Mostly made up of small-sized players, many of which continue to operate as solo practitioners, the Italian A&E industry has evolved over traditional organizational models in a mature and protected business environment which has primarily remained tied to a “professional mentality” at the expense of modern managerial principles such as authority, efficiency, or result-orientation. Nevertheless, as social closure instruments are progressively being dismantled and dynamism and complexity are entering the system, a new phase for the A&E sector is

being inaugurated. As a result of this, players like ArchLivIng are increasingly looking at ways to renovate themselves in an attempt to secure or reinforce their market presence amidst stronger rivalry and higher volatility. It is against this very background that the notion of agility can find its way into the world of architecture and engineering.

An ever more ubiquitous term in high-tech businesses, the quality of being agile can be described as a company's ability to master environmental turbulence by effectively and quickly sensing and responding to change. The concept, first employed in the early 1990s to urge American manufacturers into adopting new organizational arrangements, was popularized only a decade later in the field of software development, where it laid the foundations for the so-called "Manifesto for Agile Software Development". The four values and twelve principles contained in this position paper would later provide a common platform not only for a host of development methodologies surpassing heavy, plan-based software engineering, but also for new lightweight business management tools to cope with complexity and uncertainty.

Currently, despite rising attention in the field, little is known about enterprise agility in the mainstream management literature, let alone its application in architecture and engineering companies. Existing research – mostly coming from consultancy – provides general descriptions of several agile practices, including ways to improve customer involvement, creating autonomous cross-functional teams in lieu of hierarchy, and introducing incremental and iterative processes to improve a company's effectiveness. In the context of construction, a handful of works do attempt to declinate the agile philosophy inside companies operating in the field. These contributions, however, mostly take an engineering point of view, focusing on project management concerns more than organizational matters.

Seeking to fill the existing gap, the present review intends to discuss the potentials for introducing agile principles and practices in the A&E sector in more detail. In doing so, this work will ultimately provide answers to two fundamental questions. First, it will explain *why* architecture and engineering companies should consider enterprise agility as a possible solution to many of the challenges recently surfacing in the industry. Second, it will – most practically – discuss *how* players in the sector can introduce agile values and methods, making reference to ArchLivIng's case study and a few other minor experiences. Incidentally, in shedding more light on organizational agility, this review

also provides a relevant contribution to the management literature debating the agile philosophy.

On the whole, this work is to be interpreted as a preliminary study investigating the room for agility in A&E via a thorough scrutiny of the sector's position in the market, a review of the extant research on organizational agility, and a series of unstructured interviews and "ethnographic evidence" collected by the author at the company in question.

This thesis is structured as follows. Chapter 1 will present the architecture and engineering sector, discussing its stance in the larger construction value chain, presenting the activities and dimensions of the market, and examining its attractiveness. The second chapter will introduce ArchLivIng describing the company, its offerings, and its organizational set-up. This section will also elaborate on the company's business management challenges and the necessity of renovating its processes and structure. Chapter 3 will dive deep into the notion of agility, referring to the different research streams found in the literature. It will first present early research on organizational agility and then move on to agile software development while concluding with a discussion of what the agile enterprise is today. The fourth chapter discusses why the A&E sector needs more agility, and it is divided into two sections. The first part will uncover the significant challenges the industry has been facing, whereas the second part debates the role which the agile philosophy can play in addressing those challenges. Finally, Chapter 5 presents practical implications of agility in architecture and engineering, analyzing a few experiences from the literature and – most of all – how ArchLivIng has been implementing them inside the company. This chapter will be concluded by assessing the case study and discussing potential ways forward.



# CHAPTER 1. Architecture and Engineering

## 1.1. Overview

The construction industry is probably one of the oldest existing industries, yet its role in any society seems to be largely given for granted. In fact, virtually no human endeavor would be possible absent places where to dwell (houses, apartments), places where to work (industrial buildings, facilities), places where to spend some leisure time (theaters, museums), and an overall infrastructure that can connect them and sustain their existence (roads, bridges, energy plants). Over everyone's life as consumers, chances are that they themselves have encountered the need to have a built asset constructed or, increasingly, having an existing one renovated or modernized. If this is the case, they surely experienced the complications of bringing such projects to life, from first idea inception down to construction works being finally over. If this is not the case, most people are very much likely aware of the lengthy and troublesome processes that non-residential buildings or public infrastructure have to go through before users can ultimately benefit from them.

For the sake of this work, the focus is on what happens behind the curtains of such processes. That is, the practices and actors involved in the ultimate delivery of a built asset. More specifically, out of the multitude of activities happening in the *built environment*, this manuscript concentrates on the tasks carried out to *design* these buildings or infrastructure. Put differently, everything that occurs before the actual execution (i.e., construction) of the project occurs.

The duty to design a new building and infrastructure or renovate existing ones is the domain of self-employed professionals or business ventures belonging to the architecture and engineering (A&E) sector. This chapter will introduce the A&E sector, taking a traditional business management perspective. This means that the industry will be investigated as it is currently organized and through the lenses of the conventional business literature. Organizational aspects will be reserved for Chapter 2, while the new challenges for the sector will be introduced in Chapter 4. Unless otherwise specified, the analysis will be centered on the Italian market.

More in detail, the current chapter will first contextualize the sector within the wider built environment value chain. Second, it will dive deep into the sector's characteristics

regarding the people and activities involved. The fourth paragraph will analyze the size and structure of the industry. Finally, the last section will summarize the sector's attractiveness through an analysis of its business environment.

## 1.2. The Construction Value Chain

### 1.2.1. A Supply-Side Perspective

Before uncovering the specifics of the A&E sector, one should take a step back and look at where the activities of A&E companies are embedded. That is, the built environment value chain or – for simplicity – the construction value chain (CVC)<sup>1</sup>. Typifying the CVC is not simple because several elements differentiate it from the more exemplar manufacturing value chain. Vrijhoef & Koskela (2000), for instance, describe the CVC as converging, temporary, and make-to-order. While in a factory – they argue – multiple products are processed and distributed to several customers, the “*construction factory* is set up around a single product” – the project – where all materials are directed to and assembled. Moreover, the construction project is temporary and self-contained in the sense that it is characterized by a one-off nature. This translates into the value chain being an unstable, fragmented, and fluid network of players which can be called upon if and whenever needed. This pattern is exacerbated because each project is a make-to-order proposition and essentially a new product – one may say, a “prototype” – each time. Each project is unique in terms of scale, types of work, and customer expectations. Therefore, it does not come as a surprise that different numbers of players with more or less specific proficiencies are engaged in a project each time. For example, at the construction site, the most significant chunk of the product's value is delivered by sub-contractors and other suppliers (Dubois & Gadde, 2002; Segerstedt & Olofsson, 2010). Needless to say, with such a wide array of actors who inevitably have wide-ranging and, at times, conflicting interests, coordination is seldom easy.

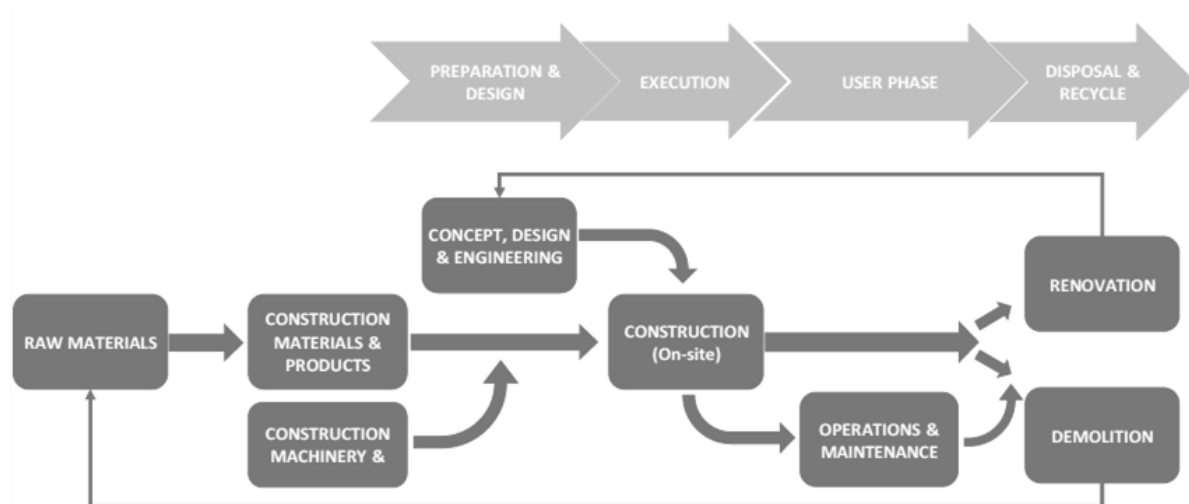
As Figure 1.1 suggests, construction *stricto sensu* is but the most evident stage of a built asset value-creation. Several upstream activities exist – such as raw materials and product manufacturing – which are meant to provide construction materials,

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<sup>1</sup> An industry value chain (or value system) is the set of activities and inter-organizational links within a given industry which, as a whole, are necessary to create a product or a service (Johnson et al., 2014).

prefabricated goods, and equipment to the construction site. Architecture and engineering (or simply, design), in fact, represent only a mid-, knowledge-intensive stage preceding the execution of the project. Frequently overlooked are the activities that occur *after* the built asset is handed over to the project owner. On the one hand, facility management entails all those operations enacted to preserve the asset during its “exploitable life”. On the other hand, the activities of renovation or, more drastically, demolition represent the asset lifecycle ending. As Figure 1.1 shows, however, the process can be cyclical in that renovation re-engages A&E services, and out of a demolished building, several raw materials can re-enter the chain.

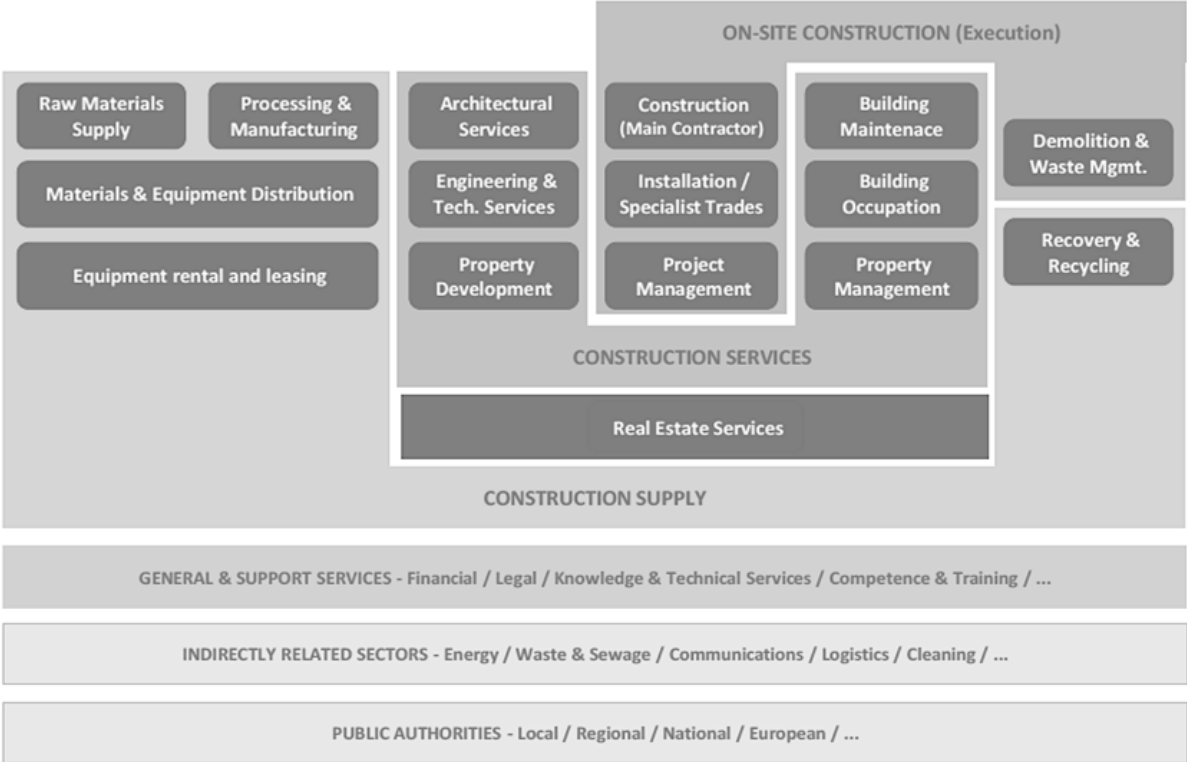
Figure 1.1 The construction value chain. Arrows on the top provide a project lifecycle perspective.



Source: Gloser et al. (2017)

From the supply side, the CVC can be broken down into at least five sets of activities (Gloser et al., 2017; Maarten & Marianne, 2016) (Figure 1.2). First, execution involves all the on-site construction tasks. These activities are formally conducted by contractors and a wide array of sub-contractors that provide many specialized services to complete the building. Over execution, the construction site is prepared, the building activities are performed according to plans and paced by project management requirements within the coordination of the general contractor or a construction manager. It should be noted that execution tasks identify both the erection of new assets and the dismantling or renovation of existing ones.

Figure 1.2 The activities of the construction value chain from a supply-side perspective.



Source: Gloser et al. (2017)

Second, construction services describe the set of activities performed during the design phase that formally precede construction, as well as all knowledge-intensive tasks to manage the built asset once it becomes operational. More specifically, a distinction is made between what are known as “professional construction services” that provide all the architectural, engineering, and surveying chores to design the asset and get it ready for execution, and “building operational services” that are meant for the maintenance and management of the built facility over its use life. Construction services at large represent the focus of this work. More specifically, the A&E activities – typically limited to the professional construction services – are found within this area.

Third, construction supply identifies all activities and actors that provide contractors with the essential materials, products, and equipment to realize the asset and conduct the building activities.

The fourth area of the CVC is occupied by real estate services. In a way, real estate services – acting as a sort of marketplace for the industry's supply and demand sides – keep the construction market running. Their role over a construction project life cycle is manifold. They may provide the initial project ideas and planning, financing or



investment schemes, brokerage and valuation services, facility management, renovation, and so on.

Finally, the CVC is surrounded by a set of non-construction, supporting activities and other players who have some stake in the project. These include general services such as financial institutions, law firms, and agents; indirectly related actors such as energy and ICT providers; and public authorities at different levels, which generally process permissions and sanctions.

### 1.2.2. A Demand-Side Perspective

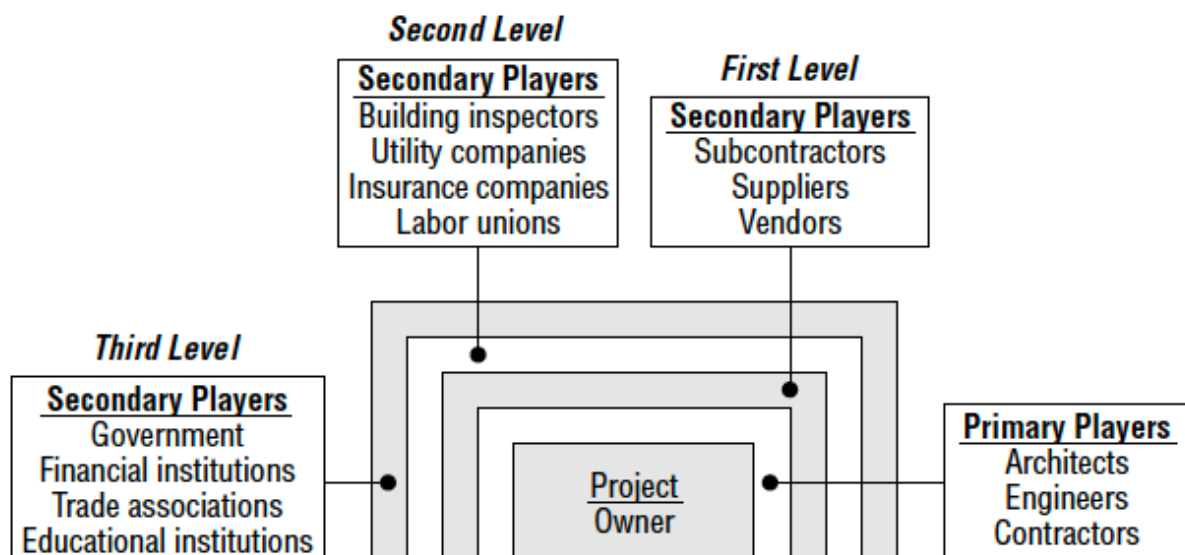
Another way to describe the CVC is to take the users' point of view. At its core, two major sets of distinctions can be made. On the one hand, the kind of work involved, either a renovation or a new building. On the other hand, the type of building being delivered. This reflects the facility needs of a society and can be broadly distinguished in five markets: residential buildings, commercial buildings, heavy civil construction, industrial construction, environmental construction (Jackson, 2010).

An alternative way to look at the CVC from the demand side is to take the project owner's point of view and consider all the parties they have to directly or indirectly interface with. Jackson (2010) provides a convenient representation by distinguishing between primary and secondary players and categorizing the latter into three levels of influence (Figure 1.3). The project owner clearly represents the person who initiates the construction demand. They can be either a private party or a public body, and their duty is essentially that of communicating the scope, needs, and requirements of the project and, obviously, providing the needed capital investment over the venture life cycle.

Among the primary players are designers – i.e., architects and engineers – and construction professionals. As for the former, more details will be provided in the following sections. Construction professionals, instead, include a variety of workers such as project managers, superintendents, construction managers, and operation officials who are collectively known as *contractors*. Contractors prepare cost estimates and time schedules based on A&E plans and project owner's requirements, implement the construction practices, and oversee construction site operations. Contractors are seldom an integrated company, but they are increasingly a network of second-order traders

coordinated by a so-called “general contractor”. From the project owner’s point of view, these subcontractors are a set of first-level secondary players with which they have, just like material suppliers and equipment vendors, no direct agreement. Second-level secondary players are also indirect stakeholders to the project owner. They include several parties with no formal contractual obligation to other players but who can significantly influence the project's success (e.g., public officials and inspectors, and utility companies). Similarly, third-level secondary players can provide indirect effects on the construction project advancement (e.g., governments, banks, trade associations, and so on). On the whole, the latter two categories of players correspond to the non-construction support activities presented in the previous subsection (Gloser et al., 2017).

Figure 1.3 Actors involved in a construction project.



Source: Jackson (2010)

### 1.3. Architecture and Engineering

#### 1.3.1. Workforce and Activities

As anticipated, the Architecture and Engineering (A&E) sector is that segment of the CVC that revolves around professional construction services for the project which anticipate – or follow – the actual execution phase. These services are provided by independent, self-

employed professionals or, collectively, by business endeavors known as A&E companies<sup>2</sup>. In both cases, the key people involved are licensed professionals known as architects and engineers – or, in short, *designers*.

Architects are professionals in the field of building design who provide the functional and aesthetic aspects of the built asset according to the client’s requirements and needs, as well as according to normative restrictions and constraints (e.g., building codes, health and safety regulations, etc.). Architects create design concepts through sketches and translate them into formal drawings, plans, and written specifications. Engineers are also regulated professionals and their job – at first sight – is not very dissimilar from that of architects. They also ultimately provide drawings and specifications. Engineers, however, are specifically trained in the physical and mathematical aspects of buildings, and their areas of expertise may even be narrower. For example, they may be proficient in structural, mechanical, electrical, or civil engineering. As a consequence, the role of engineers is usually more critical in heavy civil and industrial construction. In reality, though, on an average construction project at a typical A&E company, architects and engineers' tasks frequently overlap, and either of them may take the lead depending on the type of facility being designed (Jackson, 2010).

Regardless of their qualification, on the whole, designers are responsible for assisting the project owner in defining needs and requirements, specifying the materials to be used, and the qualitative level of the outcome. They also advise clients about the facility's characteristics, and they can assist in configuring the budget for the overall project. Ultimately, designers have the duty of developing the blueprints and building plans to be handed over to contractors which, in turn, execute the project.

To understand the underlying operations involved in designing a built asset, first, it is important to discuss how the work of the A&E company relates to the overall construction project, as this may ultimately influence how designers operate and interface with other stakeholders in a construction project.

The term “project delivery” identifies the formal agreement among the project owner and the other primary players in a project (see Subsection 1.2.2). It describes how the

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<sup>2</sup> There is little agreement on how to call the companies performing architectural and engineering works, and the taxonomy used is frequently subject to a country’s regulations and traditions. This work will use the term “architecture and engineering” (A&E) companies to identify these types of business endeavors as an equivalent to the Italian “*Servizi di Ingegneria, Architettura e Rilevamento*” (Engineering, Architectural and Surveying Services) – that is, NACE Rev. 2 “Architectural and engineering activities; technical testing and analysis”.

project's construction services and execution components should be coordinated, organized, and programmed. Several delivery methods exist, the choice of which is ultimately a project owner's sole responsibility. Overall, the differences among them typically depend on the number of contracts to be executed, the role of each party with respect to the agreement, the point in time when the contractors get appointed and involved in the project, and – significantly – whether design and construction phases can overlap (Jackson, 2010).

For simplicity, here only two extreme cases of project delivery methods are discussed. On the one hand, “Design-Bid-Build” (DBB) is the most common and traditional project delivery method. As the name suggests, the owner has the responsibility to stipulate *two separate contracts* at two distinct points in time: one for the design and the other for the project's construction phase. In practice, the owner initially hires the designers, and only later – once A&E tasks are completed and plans are executable – does he or she hire a contractor to realize the project. This latter phase, known as “procurement”, is generally the result of a tender. The DBB project delivery method is very linear and straightforward, but it has some drawbacks. Because the owner acts as the sole interface between the A&E company and the contractor, once construction begins, they are fully responsible for any design mistake, request fulfillments, or corrections which can potentially increase risks and costs.

On the other hand, “Design-Build” (DB) is an alternative delivery method gaining ground in recent decades. Under DB, the owner lays down a *single contract* with a unique design-build entity that will perform both the project's design and construction phases. DB is a convenient way to fast-track the project as it allows overlapped designing and construction as well as reduced risks for the owner who is no longer responsible for misunderstandings between designers and contractors. The design-build entity results from a temporary or permanent vertical integration between an A&E company and one or more contractors. This may be enforced via a partnership, a joint venture, or an integrated company. In general, all types of project delivery methods that resemble a DB method – that is, where design and construction may overlap, and a tight, ongoing interface between owners, designers, and contractors are involved – are known as *Integrated Project Delivery* (IPD) methods.

Expectedly, the chosen delivery method ends up influencing the operational aspects of designing a building in an A&E firm. Here, as an example, an overview of a typical DBB

design phase is presented following Allodi (2008). The design phase begins after a private or public client wants a construction need to be satisfied. Provided they have a clear solution and a somewhat formalized brief in mind, activities commence by conducting a preliminary feasibility study. This report examines the project's economic viability in terms of budget, costs, and benefits with respect to the customers' means and expectations. Moreover, an initial technical and legal assessment of the undertaking is conducted to determine whether the built asset can, in fact, be erected and under what conditions. If the project is deemed feasible, the client and the A&E company will move on to reaching an agreement on some objectives and delivery requirements that will provide designers with a set of specifications and constraints on what the built asset should "look and feel" like – both aesthetically and functionally. This phase is known as pre-designing or conceptual designing. After that, the core activities of designers commence. This stage, sometimes labeled "scheduling" (*programmazione*), is organized into three main steps: schematic designing (also known as concept phase, *progetto preliminare*), design development (scheme phase, *progetto definitivo*), and contracting documents (detail design phase, *progetto esecutivo*). The schematic design essentially studies the asset's technical feasibility, and it provides some initial account of the aesthetic quality of the building, volumes, and estimated costs. The design development represents the official plans of the built asset. This report documents the work to be done in more detail; it includes a number of surveying accounts, several types of estimations, and, of course, all the blueprints and specifications of the building. The design development file receives formal sanctions from public authorities. Finally, the contract documents thoroughly describe all the design details to be eventually executed by contractors. During this final phase of scheduling, a safety and coordination plan is elaborated for the construction site, and all the previously mentioned artifacts are delivered. The client can now tender out the construction project to a contractor to begin the execution phase. A graphical representation of the overall process is rendered in Figure 1.4.

Besides the type of delivery method, techniques and frameworks to fulfill the aforementioned designing steps may differ across companies. In general, they are more or less informed by project management guidelines and standards. Thus, the ultimate approach to conducting the design process depends on the "maturity" of the A&E company and, increasingly, on the size, importance, and complexity of the design. To be

sure, it should also be clear that much of the underlying processes and phases are in fact dictated or paced by a series of normative and legal requirements which provide stage-gates to the system. It is not the purpose of this review, however, to investigate these regulatory aspects any further.

Figure 1.4 Typical phases in a DBB project.



Source: author's elaboration on Allodi (2008).

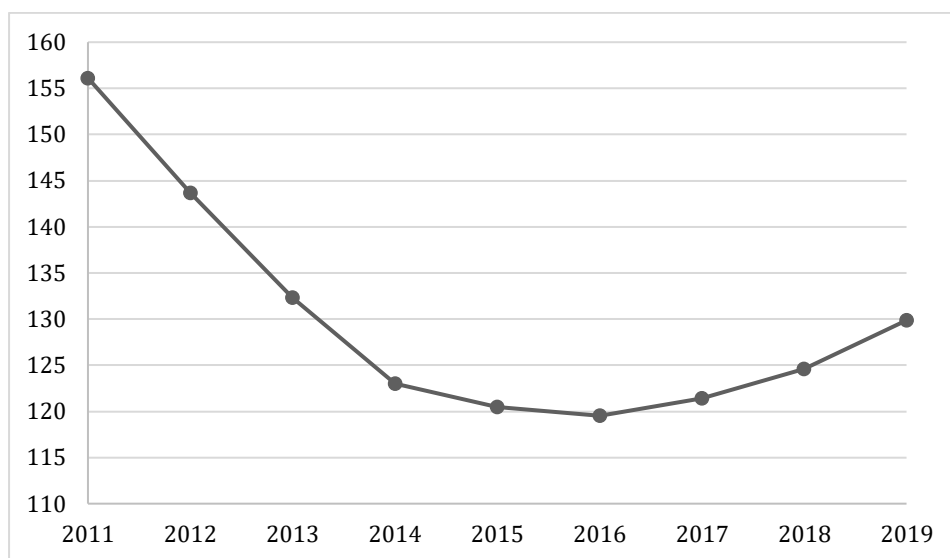
Although this paragraph might have given the impression that the A&E companies and designers' activities are limited to the creation of plans and specifications for new buildings or existing ones needing renovation, in reality, design services include a more comprehensive array of additional offerings. For starters, larger companies are frequently vertically integrated either to tap into DB delivery projects or so that they can be both the providers of A&E activities upstream and act as coordinators during the execution phase of the project. In these cases, while not being involved in the asset's actual construction (i.e., they are not contractors), once the design phase is concluded, they may be given first-order responsibility to coordinate activities at the construction site. Even smaller A&E companies frequently act as external construction supervisors without being the project's contractors.

More generally, regardless of their size, several A&E companies differentiated their offerings, providing ancillary activities. For example, their propositions may include project management services with no actual designing being performed, or they may operate as consulting companies to provide design-related process optimization for businesses, auditing, due diligence, and so on. For example, several A&E firms offer to survey companies' industrial premises to redesign spaces and work areas to improve operational efficiency. Similarly, A&E firms frequently engage in one-off services such as building or infrastructure health and safety inspections, construction site analysis, and structural studies.

### 1.3.2 Size and Structure

The underlying value chain heavily influences the size, structure, and dynamics of the A&E sector. To put it into perspective, the A&E sector produces but a small fraction (4.7 percent) of the overall value chain turnover and, on the whole, construction services at large account for about one quarter of the total production. While construction suppliers (inclusive of materials and machinery producers) account for just above 25 percent, the construction value chain is, indeed, led by the execution segment, which controls above 50 percent of the total turnover (Federcostruzioni, 2016)<sup>3</sup>.

Figure 1.5 Investments in construction in Italy 2011-19 (current EUR bln).



Source: author's elaboration on ANCE (2020) data.

Turning specifically to the A&E segment, the latest publicly available statistics (CNI, 2017a) showed that players in this sector reported revenues totaling just below €26 billion – that is, about 1.5 percent of the Italian GDP. Although consistent information about the sector's performance over the latest years is lacking, the market can be proxied by looking at the overall investments in construction projects and the size of A&E services tender offers. As for investments in construction, in its latest report, ANCE (2020) premised that activities continued to be severely affected by the downturn following the aftermath of the 2008 global financial crisis. For instance, over the period 2011-19, investments showed an average 1.8 percent decline in investment.

<sup>3</sup> Figures exclude the real estate segment.

Simultaneously, data also exhibit a non-negligible change in trends in the most recent years (Figure 1.5). The report mentioned above also provides an interesting further breakdown of the end-use of investments in the industry (Table 1.1).

*Table 1.1 Investments in construction in Italy in 2019 (EUR bln).*

<b>Segment</b>	<b>Value</b>
Residential	64.940
<i>New buildings</i>	17.545
<i>Maintenance</i>	47.395
Non-residential	64.914
<i>Private</i>	41.831
<i>Public</i>	23.083
<b>Total</b>	<b>129.853</b>

*Source: author’s elaboration on ANCE (2020) data.*

Investments show that expended sums were almost equally distributed between the residential and non-residential sector. Within the former segment, however, only about 27 percent of investments went into new buildings. As for the non-residential segment, instead, ANCE records that it was the private sector that led activities (64.4 percent) compared to the public sector (35.6 percent). In both cases, these trends are suggestive of a bearish market. That is because the most prominent projects – those that engage larger players and involve larges investments – usually come from new residential buildings and public infrastructures.

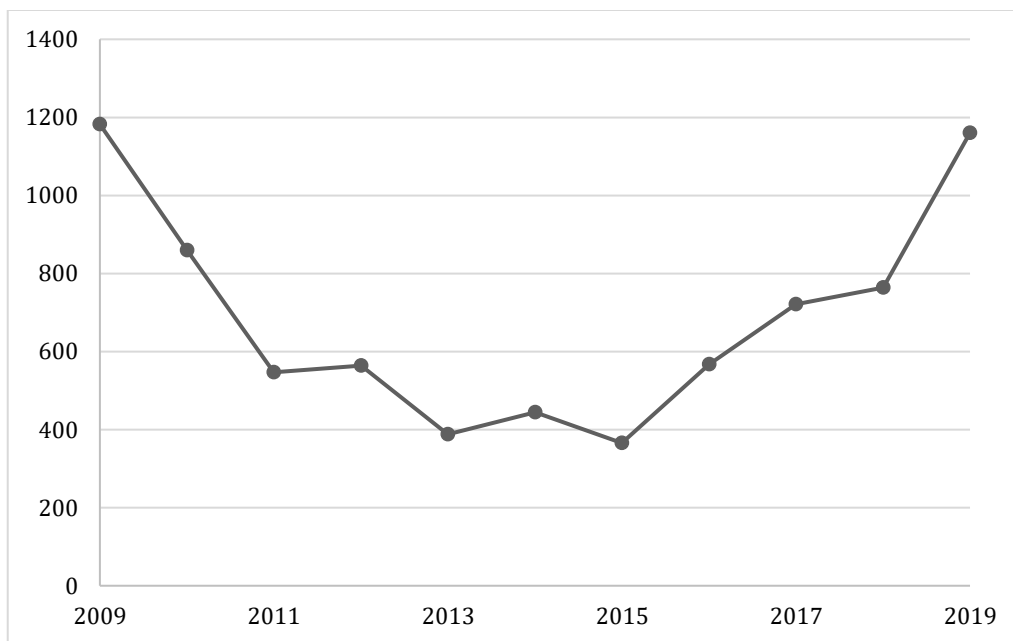
Similar conclusions can be reached by looking at the size of the A&E services tender offers over 2009-19. Figures confirm the negative effect of the 2008 financial crisis and the positive trends that began in 2016 (Figure 1.6). Therefore, based on the proxies presented above, it can be concluded that the well-being of the A&E sector – after some troubled years – has been showing moderate signs of growth which, however, are partially moderated by the underlying quality of projects being relatively mundane.

Another report by CNI (2017b) also points out that further growth in A&E is inhibited by the sector’s structure and its poor aggregation. It is no big news that the architecture and engineering profession – and, in truth, the whole construction industry – is plagued by its players’ very small dimensions. According to Confprofessioni (2019), about 255,000 people operated as independent professionals in the A&E field during 2018. On the other hand, in the same year ISTAT (2020) recorded around 208,000 A&E



companies employing approximately 297,000 people. That is, on average, a company in the architecture and engineering sector employs 1.43 people. More strikingly, less than 1 percent of the companies in the segment employed more than nine people (*Ibid.*). In financial terms, almost one third of the sector’s revenue came from self-employed A&E professionals, while 62 percent of the market’s revenue came from business endeavors (CNI, 2017b)<sup>4</sup>.

Figure 1.6 A&E services tender offers in Italy 2009-19 (EUR mln).



Source: author’s elaboration on CNI (2020) data.

A survey provided by OICE (2020) sheds additional light on the A&E companies<sup>5</sup>. Data show that, expectedly, companies’ 2019 revenues were mainly driven by the sole designing of a project (about 56 percent), while integrated project offerings generated around 34 percent of their turnover. The remaining 10 percent was attributed to project management services. In terms of markets, above 80 percent of the 2019 production was coming from either the energy (49.2 percent), transportation (23.2 percent), or the residential segments (11.5 percent). As for clients, around 61 percent of revenues came from the private sector, while the remainder was turned over from the public sector, represented mainly by public authorities (17.3 percent) and public administration offices (11.6 percent).

<sup>4</sup> The remainder 8 percent include foreign operators.

<sup>5</sup> The reader should be advised that this survey provides insights on a selected population of A&E companies, but its results are nonetheless fairly generalizable.

## 1.4. Attractiveness of the A&E sector

### 1.4.1. The General Environment

Based on the information given in the previous paragraphs, the chapter is concluded by an investigation of the architecture and engineering sector environment from a business management perspective. To provide a meaningful overview, first, the macro- or general environment is presented via the popular PESTEL framework<sup>6</sup>. The macro- or general environment describes the forces that can potentially impact any organization in a given market in such ways that their ability to obtain resources to trade is favored or foreclosed. In the following lines, this framework is used to delineate how several macro-environment forces can affect the A&E sector.

Politics is a substantial factor in the A&E sector. That is because construction companies' activities both result in high political exposure and because the governments themselves – or other public authorities – are directly involved as customers in these types of projects. Political agenda can thus influence the size of the market by financing new projects. These endeavors are primarily in the non-residential segment or public infrastructures, which, incidentally, are also the most profitable segments. Alternatively, politicians can indirectly push the market by providing several forms of subsidies and other incentives to increase the demand in the private sector (Italian governments appear to have a consolidated track record in this matter). To be sure, the opposite is also true. A political agenda may be against financing new infrastructure, it may curb the breath of public subsidies, or, more plainly, a government may not have the financial latitude to invest. Besides these generalized direct or indirect interventions, politics typically has the effect of swinging market demand toward specific segments of the sector. This happens because governments may decide to, say, finance reconstruction activities or requalifying cultural heritages hence revamping A&E companies who operate in this segment and inducing other external players to follow through. Alternatively, governments may benefit a limited number of players who attain specific environmental and social sustainability standards. Thus, on the whole, the role of politics is mixed. It is often the result of short-term, electoral-cycle-induced interest, and – as a consequence – it frequently results in swings in market demand and supply.

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<sup>6</sup> PESTEL stands for Political, Economic, Social, Technological, Environmental, and Legal.

Economic forces also heavily influence the A&E sector. For starters, construction projects are profoundly pro-cyclical. Thus, the size of the market increases as the overall economy grows. This is relatively self-evident: consumers will increasingly invest in projects as their salaries become more secure, rise, or if they expect the economy to flourish in the coming years. A related and equivalently important macro-economic factor is interest rates. Since construction projects are frequently costly, consumers will seek credit and pursue them as long as payback schemes are convenient. Likewise, actors in the construction value chain may need loans to smooth their cash flows. Again, this will be economically viable if the credit system is sustainable.

Social factors have affected the A&E sector a lot, and they are expected to condition it even more in the coming decades. Cultural aspects such as consumer tastes and needs can result in reduced demand for new housing as youngsters prefer shared accommodation or may be more interested in requalifying existing dwellings. Likewise, demographic trends such as the aging population affect a society's residential and infrastructural needs in several ways. For example, as the share of young people in a population diminishes, so does the demand for new housing. Thus, a company in the A&E sector that wishes to remain competitive should be cognizant of these trends and reconfigure itself to the new types of demand.

Technological trends have a twofold effect on the A&E sector – operational and demand-wise. On the one hand, new technologies and ongoing research can provide new project designing techniques, new information-processing tools, new types of design solutions, or change the company's organizational structure. A typical example here is the increasing use of Building Information Modelling in the construction value chain. These types of advancement may determine if a company remains productive and competitive and, ultimately, if it is fit to stay in business. On the other hand, a society's technological needs – both on the part of consumers and business entities – condition the type of residential and infrastructural needs demanded to an A&E company. For instance, the internet and smart appliances require both a networking infrastructure in place and accommodations to be designed to embed these systems. In sum, technological advancements and new devices require designers to be continuously up to date with the most recent trends to accommodate unique needs and remain competitive (see also Chapter 4 and 5).

Environmental forces may also have a non-negligible role in shaping the A&E sector. On the one hand, the results of extreme weather events or natural calamities (e.g., earthquakes) can drive demand in the industry in the aftermath. On the other hand, measures to prevent these disruptions from happening and a movement to introduce environmentally sustainable building in the face of climate change affect the type of offerings that the market requests.

Finally, legal factors provide the bureaucratic and normative requirements surrounding the working of the A&E sector. The process of designing buildings and infrastructure is highly regulated; thus, the introduction of new laws or legal requirements may affect the outcome of a project. In a cumbersome legislative system such as the Italian one, A&E companies should be constantly updated on their job's regulatory aspects. Mistakes in this area can result in fines, and lengthy, expensive trials, which may push a company out of business or that may forever invalidate their activities in the eyes of the public (additional information will be given in Chapter 4).

#### 1.4.2. The Specific Environment

The analysis just presented is suggestive of a general environment that is quite dynamic, and that should be carefully monitored to stay in business. Nonetheless, this review – as much as insightful – was too broad to inform the attractiveness of the A&E sector. A more definitive assessment can be provided by looking at the sector's micro- or specific environment. These are the forces that are specific to an industry or a market and that affect its competitive level and short- to long-term profitability. The ubiquitous Porter's Five Forces framework (Porter, 2008) is employed to investigate the A&E specific environment.

In terms of rivalry, as described in the previous paragraph, the Italian A&E sector is particularly fragmented with a large number of small players and very few companies which can boast significantly larger sizes. In a report by Norsa (2019) – which distinguishes between companies in the engineering sector and companies in the architectural design field – only five engineering companies turned over more than €100 million in 2018, and only four architecture companies had revenues exceeding €10 million. This is indicative of a relatively unbalanced market. On the one hand, more prominent players occupy the high-end segment of the market, forming a virtual cartel

on the larger and more profitable projects, which, overall, results in little rivalry. On the other hand, the very much larger number of smaller players (see Subsection 1.3.2), which are inevitably foreclosed access to the most extensive endeavors, are left in a highly competitive, low-end market segment. Here, rivalry is also exacerbated by the legacy of years of stagnation which shows only moderate signs of growth primarily around ordinary and undifferentiated projects. This encourages price competition, and leads to low profitability. On the plus side, the extent of competition is diminished by the sector's low fixed costs (incumbents will not try to spread overhead costs by increasing their volumes) and low exit barriers (players are unlikely to fight to maintain their market share to avoid the costs of exiting the market). Therefore, on the whole, rivalry is judged to be moderate to high.

An assessment of the threat of new entrants in the A&E sector reveals this force to be moderate. Although access to the market is formally regulated by designers being graduates and registered to official boards, it has been shown that the Italian A&E workforce is in a state of oversupply (Federcostruzioni, 2016). Because – once licensed – a player in the field finds relatively low barriers to enter the market in terms of economies of scale and access to distribution channels, threat of entry is high. This force, however, is fairly moderated by market power of incumbents. More specifically, existing players are more experienced and renowned. Thus, they are likely to have built a reputation and loyalty among customers and sufficient market knowledge to undercut new entrants or threaten to retaliate (see Subsection 4.2.3).

Power of buyers in A&E is reasonably high. That is because, as seen, customers are concentrated, and switching costs are low. In other words, the number of A&E companies is large, clients are limited, and offerings are poorly differentiated. Thus, there is a high incentive for consumers to “shop around” for the best offer. This is all the more so considering that the type of services potential clients seek represents a significant expenditure for them. However, on the plus side, buyer power is limited by non-negligible informational asymmetries, which play in the A&E company's favor (again, refer to 4.2.3. for more on this topic).

Finally, power of suppliers and threat of substitutes can be confidently judged to be low. As for the former, most of the required supply (e.g., design software) can be conveniently purchased at competitive prices. As for the latter, consumers are unlikely to find an alternative to A&E services. Even when renovation or employment of

prefabrication is concerned, there is a high chance that A&E services are called upon – if anything, for consulting.

In summary, from a *traditional* business management perspective, the attractiveness of the A&E sector appears to be weak, it is a consolidated and reasonably stable market, competition is high, and margins are low. However, consolidated players – especially the largest ones – can benefit from its limited uncertainty and comparatively higher bargaining power.

## **CHAPTER 2. The A&E Firm: ArchLivIng**

### 2.1. Overview

This chapter presents a case study of a firm that distinguished itself from the average architecture and engineering company. The company – ArchLivIng – is a small-sized A&E business located in Northern Italy which provides an interesting case in point not only because it decided to adopt Agile principles and practices, but also because it represents a departure from the traditional ways of managing – or, one could say, “non-managing” – A&E organizations. As a matter of fact, even when A&E companies overcome their modest dimensional threshold, competitiveness may still be foreclosed by a possibly deeper concern: their lack of a managerial set-up. That is, although these firms might have taken a corporate structure, they frequently lack a business management perspective to function efficiently (more on that will be covered in Chapter 4). On the contrary, over the last decade, ArchLivIng has been consolidating primarily thanks to a renewed consideration of governance and coordination aspects that are somewhat more typical of A&E companies in the English-speaking business world. With the company’s growth, however, new organizational issues emerged, and the most compelling question has become how to maintain its nimble, startup-like layout in a structure that would demand some bureaucratic or more mature arrangement.

This chapter will begin by presenting an overview of ArchLivIng, discussing the firm's size, its historical evolution, and presenting its current offerings. Section 2.3 will complement the examination by displaying the company’s organizational values and culture. The review will then move on to discussing the type of managerial approach required to conduct A&E companies and the business models which are most commonly found in the sector. It will mostly build on the experiences and literature on A&E companies in the international landscape, and it will present ArchLivIng’s stance in the described framework. Section 2.5 will introduce the organizational change that the company went through, illustrating initial results in terms of structure and performance. The last section will further elaborate on the challenges that the company still needs to address, and it will build the case for the adoption of Agile (Chapter 5).

## 2.2. Company Profile

### 2.2.1. Overview

*ArchLiving S.r.L.* (Figure 2.1) is a small-sized Italian company active in the architecture and engineering business arena where it offers design services for the construction industry as well as other engineering tasks.

Figure 2.1 *ArchLiving*



Source: *archliving.it*

The company as it is currently known was established in Ferrara, Italy in 2011. Back then, the founder, architect Gianluca Loffredo, gathered nine colleagues and turned the business from a partnership into a corporation<sup>7</sup>. Despite its relatively small dimensions, the company ranked among the 2018 top-100 highest-grossing design companies in Italy (Norsa, 2019). Table 2.1 summarizes selected accounting information and indexes that the company recorded over the latest decade.

Initially primarily engaged in designing “A-labelled” energy-efficient buildings and renewable energy plants, ArchLiving offerings expanded as the company grew larger over the period 2013-14 (Table 2.1). This was in conjunction with high post-seismic reconstruction demand in the aftermath of the 2012 Northern Italy earthquakes. Table

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<sup>7</sup>As per Italian law, the business – formerly a partnership (*Studio Associato*) – was incorporated as a company (*Società di Ingegneria*).



2.1 also hints at a second wave of development that came over the years 2016-17. This further expansion was attributed to the introduction of new offerings in the product line and a larger workforce that could be leveraged over new projects. Despite a slight slump recorded in 2019, as of late 2020, the company is expecting to consolidate as witnessed by an even larger workforce totaling thirty-five people – between employees, associates, interns, and partners. The company also operates three additional branches, which are scattered across Italy. The decision to open supplementary offices in Avellino, Macerata, and Verona was dictated by the necessity to cater to local needs and attract neighboring clients. Additionally, local branches could more carefully uphold relations with regional public authorities, which are responsible for public tendering, financing, regulating some A&E activities (including subsidies), and sanctioning new construction plans.

*Table 2.1 ArchLiving. Selected accounting data and indexes.*

	2011	2012	2013	2014	2015	2016	2017	2018	2019
<b>Revenues</b>	187,081	245,687	547,608	815,463	1,057,293	1,098,179	1,420,725	1,296,042	1,073,333
<b>EBITDA</b>	31,898	9,205	18,382	(2,447)	33,729	37,349	72,265	40,999	62,845
<b>Net Income</b>	23,571	(6,655)	399	(13,838)	20,251	10,974	27,812	5,393	17,295
<b>Partners</b>	5	5	5	5	6	6	6	6	6
<b>Non-partners<sup>a</sup></b>	2	3	4	9	13	10	9	7	11
<b>ROS (%)</b>	15.90	1.58	1.64	(2.02)	1.42	1.54	3.05	1.08	2.99
<b>Revenues per professional<sup>b</sup></b>	26,726	30,711	60,845	58,247	55,647	68,636	94,715	99,696	63,137
<b>Leverage<sup>c</sup></b>	1.40	1.60	1.80	2.80	3.17	2.67	2.50	2.17	2.83

*Source: author's elaboration on data retrieved from aida-BvD (2020). (a) Figures may undercount associates and interns discontinued before accounting year-end. (b) Professionals are the sum of partners and non-partners; revenues per professional is a widely used measure of profitability in professional service firms (Greenwood et al., 2005). (c) In this context, leverage refers to the ratio of professionals (partners and non-partners) to the number of partners (Ibid.).*

### 2.2.2. Pillars and Markets

Since its inception, the company's mission has pivoted around three pillars. First, providing integrated A&E services (see Section 1.3). While also engaging in DBB propositions, the company is committed to delivering turn-key solutions covering all knowledge-intensive and technical or managerial aspects of a construction project, from

inception and design down to construction oversight and facility management. Second, ArchLivIng intends to maintain an active role in the experimentation and testing of innovative R&D-related applications, which it has been achieving through extensive collaborations with some Italian universities. Such types of projects include applied computational engineering, material, and structural stress testing, and devices to monitor infrastructural health. Third, ArchLivIng aims to capitalize on cross-functional, team-based effort. Over the years, the company has come to realize that higher value can be generated by assigning projects to teams whose members can contribute different hard skills to the job. Although transitioning to teams has not been easy (see below and Chapter 5), the company has been able to boast a considerable competitive edge, being among the few comparable firms arranged in this way. This structure, indeed, corroborates the company's capabilities in delivering integrated offerings while translating in faster and more flexible marketing of its services.

As for ArchLivIng's typical customers and the types of projects, the company can now leverage its multidisciplinary arrangement providing services and engaging in projects that range from hardcore engineering studies to more lightweight architectural solutions. To get to this point, the company developed over essentially three "waves". As anticipated, at its inception, ArchLivIng focused on small projects in the residential construction fields and in the energy plants and infrastructure segment. Soon, however, it moved to the B2B industrial construction segment. It was here that the firm found a viable opportunity to grow. In the years 2013-14, indeed, several businesses were demanding A&E and construction services to rehabilitate their plants and working premises shattered by a series of earthquakes that hit Northern Italy in 2012. These types of propositions required strong A&E proficiency, which ArchLivIng has attained by embedding several professional disciplines in its workforce. These include but are not limited to architecture, structural engineering, electrical engineering, mechanical engineering, health and safety engineering, acoustical engineering, and environmental and energetic sustainability designing.

Thanks to these experiences and its multidisciplinary personnel, the company has been experimenting in new fields. Since 2017, further expansion was attained by shifting to projects in the public sector. Here, ArchLivIng has been piloting in new segments, including transportation (e.g., bridges, viaducts, tunnels, and railway), energy and environmental infrastructures, urban development, and cultural heritage restoration.

Today, with the residential segment being but a residual occupation, ArchLivIng handles mostly mid-sized projects (ranging 5-10 million euros), but it also engages in smaller commissions – such as the restoration of old churches in Central Italy – as well as much more extensive projects, for example, an urban development program in Bologna worth over 20 million euros.

ArchLivIng can thus claim a very differentiated experience which also translates into the capacity to offer ancillary services besides the core designing and planning functions. To begin with, architects and specialized engineers collaborate with contractors in the definition of technical analyses (e.g., feasibility studies, and economic, normative, and environmental assessments). Moreover, thanks to integrated projects, designers matured managerial skills and functions, such as construction oversight and facility management over the project lifecycle.

Second, ArchLivIng has been extending the use of Building Information Modelling (BIM) in the design process. BIM-based designing represents the latest advancement in the digitalization of the construction industry. Put simply, BIM is the “natural evolution” of Computer-Aided Design (CAD) for the built environment. Complementing 3D designing with a digitized construction environment and a repository of design and construction information, BIM can be leveraged starting from project inception down to facility management and ultimate dismantling of the built asset. Alongside the tridimensional rendering of the asset, BIM allows scheduling and planning (4D), estimating and cost control (5D), and much more. As this technology is spreading fast among digitized international players, ArchLivIng recognized the potential of BIM and started experimenting with its use. Since this digital design method will become a mandatory requirement to participate in public tenders in the near future, the company will take advantage of its matured experience while also gaining a non-negligible competitive advantage vis-à-vis other players in the Italian sector (mostly still far behind).

A third type of services ArchLivIng provides is auditing, consulting, and due diligence on behalf of corporate partners. These involve clerical, knowledge-intensive tasks concerning economic and technical feasibility studies, normative and project compliance certifications, market research, advisory activities for private-public partnerships (PPP), and sustainability surveying and studies.

Finally, the company offers professional services within the industrial engineering segment. These involve counseling services – such as integrated logistics, industry 4.0,

and business analytics – that are meant for supporting industrial clients in implementing lean principles and technological advancements to their processes (e.g., operational streamlining, digital solution integration) with a look at the architectural and structural aspects of facilities and workplaces.

## 2.3. ArchLivIng's Organizational Culture

### 2.3.1. Organizational Values

A company's organizational values define what principles and ethical concerns it abides by, as well as what its aspirations are. When a firm clearly defines its values upfront, they act as a guide to personnel's behavior towards organizational goals and strategy. Communicating corporate values externally proves that the company is committed to a specific code of conduct and, in turn, it acts as an incentive to attract conscientious potential customers (see Chapter 4).

ArchLivIng's organizational values revolve around four core principles. First, the company values dynamism. This means that it actively welcomes change and innovation, and it strives to have an active role in it. This is witnessed by the ongoing collaborations the company established with universities, as well as the pioneering introduction of Building Information Modelling (BIM) in the design process and in engineering services. Second, ArchLivIng encourages its designers to be curious. People who work at ArchLivIng should always be enthusiastic and creative and seek improvement and growth. Curiosity means being receptive to change that happens outside the firm's boundaries as well as experimenting with new ideas and ways of working. A third organizational value is engagement. This suggests that ongoing dialogue and ideas cross-fertilization are believed to be key to the company's success. Moreover, engagement is related to the idea of teamwork as a way to improve organizational processes and output. Finally, ArchLivIng stresses the importance of ethics and professional honesty. Trust, precision and the right amount of pragmatism are thought to be central to conduct business.

### 2.3.2. Cultural Elements

Organizational values are a fundamental component of a company's culture. That is, the basic assumptions, beliefs, and "ways of doing things" that are given for granted in a given organization. At first glance, an evident cultural aspect is that, at ArchLivIng, the working environment is fairly informal. Although an explicit chain of command exists, this is not rigidly enforced. From conversations at the company, employees confirm that there is no strict authority-based approach to hierarchy. For instance, junior designers know that they can rely on seniors and executives' higher standing or experience. Simultaneously, they have a significant latitude to make decisions, and autonomy makes up an essential part of the company's working approach. Autonomy, however, does not necessarily mean "going solo". In fact, junior designers frequently lean on their peers for help and consultation. This is crucial in an A&E company as project plans and specifications are the results of the joint effort of people with different technical skills. On the other hand, the only possible exception to ArchLivIng's non-hierarchy concerns strategic decisions. These usually come from the executives at the top. Nonetheless, long-term planning often results from a dialectical questioning and discussion that encompass senior designers too.

Another vital component of ArchLivIng's culture is a relatively high risk tolerance. This is especially true the higher in the organizational charter. Senior designers manifest their risk-loving attitude by their willingness to experiment with new ways of working and piloting in new A&E fields, segments, and clients. It was undoubtedly thanks to this cultural element and inclination that the company expanded its product line over the years and found new profitable segments to invest in (e.g., energy infrastructure, structural reconstruction, environmental design). Furthermore, this cultural mindset does not limit to venturing into uncharted territories. Risk-loving also affects willingness to innovate and invest in R&D. More interestingly, this cultural propensity also influences the workforce structure both in terms of retention and recruitment. New hires are selected based on whether they show this kind of risk propensity besides, of course, their talent. On top of that, this mindset is strengthened by a process of self-selection among personnel as, naturally, only workers who can embody this attitude will stay in the company.

High risk tolerance also suggests that the company moves fast as environmental change happens and adapts to it flexibly. Although this work purposefully ignored the 2020s COVID-19 pandemic preferring to give a wider-encompassing picture, it seems convenient to cite how this occurrence proved ArchLivIng's flexible nature. During the early months of 2020, when the Italian government enforced a rigid lockdown, and virtually all economic activities were blocked, the company did not "lose heart". While most of the projects got suspended and all personnel had to work from home, CEO Mr. Loffredo decided to embark on public A&E tender offers, encouraging everyone to join in and pitch their ideas. The result was unprecedented as ArchLivIng was awarded more than 30 percent of the bids it participated in.

#### 2.4. A&E Companies and Business Models

Section 2.2 described ArchLivIng's activities, exhibiting how the company provides a rather wide-ranging set of ventures. Engaging in various projects with no specific specialization is a common characteristic of Italian A&E firms (Manzoni et al., 2014). This is probably a consequence of small dimensions, years of market downturn, and the highly swinging nature of the sector's type of demand. For instance, during some years, heavy public intervention (typically in the form of subsidies) to specific segments of the private market determined contingent segment-specific spikes in demand. On a closer account, however, the observation that ArchLivIng is a pure generalist – just like most other A&E businesses – would lead to a rather superficial assessment. In fact, ArchLivIng's business model<sup>8</sup> differentiates itself from most competitors. To understand how, a short digression on the business models of A&E companies with an international perspective is presented in the following lines.

Building on a seminal work by Maister (2003), Klein (2010) presents four types of business models applicable to A&E companies. First, an efficiency-based A&E firm is one that derives its income from fast, low-scale, less risky projects for clients seeking standardized and quick solutions. These companies benefit from economies of specialization which they mature from extensive experience over a limited range of project types such as small residential projects, remodeling, or light commercial designs.

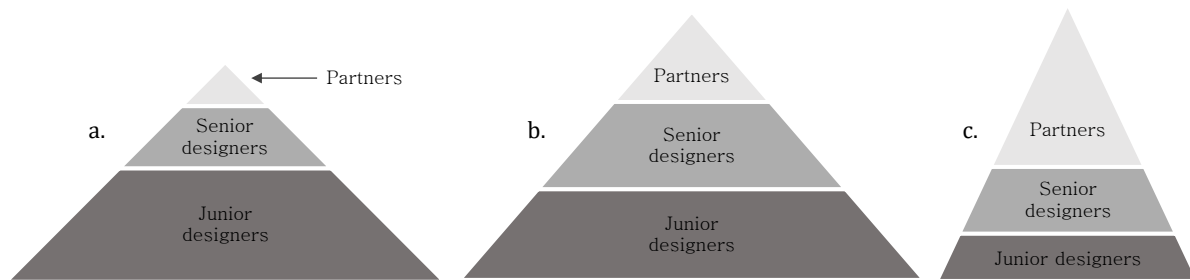
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<sup>8</sup> In short, a business model describes how a firm's activities are arranged and how it will profit from them (Johnson et al., 2014).

These types of A&E companies strive for large volumes and higher productivity. Thus, their managerial style seeks efficiency via control. In terms of workforce, efficiency-based A&E firms employ a relatively larger number of junior designers to be leveraged over routinized project activities. Junior designers are those people who have less experience in the field (many of them may actually be interns or apprentices) who, consequently, are delegated operational and practical matters. Just above junior designers are senior designers. These workers are more experienced and provide a liaison with the company's partners. Senior designers are frequently entitled the role of project managers. In an efficiency-based firm, there are relatively fewer senior designers. They engage with operations only when non-routine interventions are required. Finally, in these types of firms, partners are even scarcer, and they are usually occupied with business-level activities (e.g., project or new client scouting). Partners are those who founded or own the company and are generally responsible for finding new business opportunities, handling relationships with customers, and strategizing (Manzoni et al., 2014). As this suggests – and Chapter 4 will show – rarely do A&E companies separate ownership from management. Figure 2.2 (a) provides a visual representation of the staffing triangle in a typical efficiency-based A&E company.

Second, experience-based A&E firms are accustomed to satisfying requests for non-standard and more complex designs (e.g., schools, museums, airports, etc.). Although some players may specialize in specific types of buildings or infrastructures, these kinds of projects remain quite complicated to require special skills and knowledge due to idiosyncrasies and contingencies that may arise. Staffing is critical in these companies. Executives need to hire talented senior and junior designers because much of the company's competitiveness is derived from their skills. Compared to efficiency-based, experience-based firms employ a more balanced workforce (Figure 2.2 [b]). Senior designers devote much of their time to highly sophisticated tasks while also reserving occasions to train, mentor, and transfer knowledge to junior designers. This way, junior architects and engineers can perform more ordinary tasks which – in an experience-based firm – still require higher-level skills. Alongside talent, these types of A&E companies rely on welcoming innovations in design trends and engineering techniques or materials to remain profitable.

Figure 2.2 Representation of efficiency-based (a), experience-based (b), and expertise-based (c) A&E firms staffing triangle.



Source: author's elaboration on Klein (2010).

Third, expertise-based firms describe those types of A&E companies whose business model is driven by profoundly knowledgeable and talented designers. Sometimes these businesses even pivot around just one individual – what is commonly known as the “starchitect”. These firms are frequently specialists in a limited set of product segments where they provide non-routine, highly knowledge-intensive, and innovative services. In these businesses, the staffing triangle is steep as their workforce involves a disproportionate number of partners or key senior designers (Figure 2.2 [c]). Junior designers are scarce because, in general, expertise-based firms are not very large.

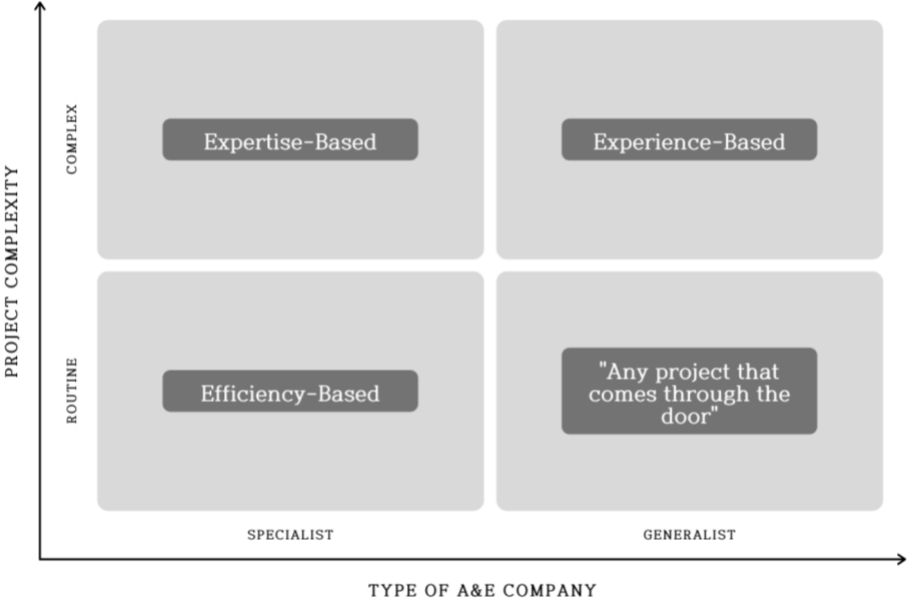
Finally, a fourth type of business model exists. Klein (2010) labels it “any project that comes through the door”. These types of firms engage with several different types of projects, but none of them is significantly complex. From a business management perspective, this model does not appear to be sustainable because designers do not mature any specific skill or knowledge to gain an advantage in the market and because these projects remain relatively small in scale (Manzoni et al., 2014). Such a business model might make sense in a nascent organization, but it can quickly turn uncompetitive as the firm grows. As anticipated, however, this is the type of approach that most Italian A&E companies follow. To escape the “any-project-that-comes-through-the-door” trap, the firm should move to one of the three business models described above or – provided it created a name in the market and an extensive network of buyers, suppliers, and other stakeholders – it can move to a consultancy value proposition and turn itself into a “network broker” (*Ibid.*).

Figure 2.3 maps the four types of business models described above into a matrix distinguishing between specialist and generalist players, and between the level of project complexity the firm is accustomed to taking on.



The analysis which was just given provides a convenient way to describe ArchLivIng’s business model, too. An assessment of the type of projects the company has been working on suggests that ArchLivIng engages in relatively complex projects. As for its approach, the company is best described somewhat between a specialist and a generalist player – although probably lingering more towards a wider encompassing offering. Therefore, different from most competitors, which end up in the much less compelling position of being generalists providing routine projects (i.e., residing in the “any project that comes through the door” quadrant), ArchLivIng can be located somewhat between an expertise- and experience-based company. However, as the type of staffing triangle found in the firm seems to suggest a relatively balanced distribution among partners, senior, and junior designers (Table 2.1), ArchLivIng’s business model is best located in the experience-based segment.

Figure 2.3 A&E firms business model matrix.



Source: author’s elaboration on Klein (2010).

2.5. Managing a Growing A&E Firm

2.5.1. Acknowledging the Tradeoffs

When looking at the Italian architecture and engineering companies, managerial considerations appear to be mostly neglected. On the one hand, this could be linked to

the limited dimensions of the firms. Small businesses naturally do not require the kind of formal control and governance that larger ventures live on. Thus, Italian A&E companies – being mostly small-sized – are accustomed to handling employees, projects, and customers in a relatively informal or “craftmanship-like” way. On the other hand, some scholars discuss how lack of management in this sector may be due to some kind of stigma towards administering the firm as if it was an actual company (Manzoni et al., 2014). A&E companies are reluctant to address management concerns because they claim that their job's creative aspects would be stifled as a consequence. More generally, there is a contention that architects and engineers' tasks are too professionalized or technical to require management as that would not provide any help. While more on this conflict will be reserved for Chapter 4, the purpose of this section is to outline how managerial concerns play out in a growing reality like ArchLivIng.

Managing a small firm is anything but easy, both when the business is doing good and when it is not. Management can become unrelentless, demanding, and heavily influenced by uncertainties, the working pace is frequently incessant, and new challenges emerge on a daily basis. People who work in small firms often do not have work hours, and working late at night is fairly common. Likely, the reason keeping them in office for long is fighting against an emergent issue or rushing to tackle a new opportunity which has just emerged in the market. While, arguably, there are some elements of enjoyment in working in this way (e.g., autonomy, little formal control, and room for creativity), it can be contended that in a rushing market, small firms can be knock down by pressure to deal with day-to-day operations and stakeholder requests while overlooking important business or strategical matters.

If the market remains profitable and demand expands, a small firm can withstand the complications of its size by enlarging its workforce and delegating to new hires some of the activities. However, managing a bigger company as if it were still small can lead to chaos. Processes, roles, and responsibilities become confused while the company's efficiency and effectiveness quickly decline. Moreover, working in these firms leaves their people unsatisfied and stressed out. Soon enough, the company will be pushed out of business.

Therefore, as a firm enlarges, new structural, governance, and managerial requirements emerge. In short, more formality and a coherent, common-knowledge structure needs to be introduced for the venture to function efficiently. The organizational design re-routes

towards a more mechanistic structure that grants control and productivity. In professional service firms like A&E companies, however, an organizational design which is too bureaucratic can potentially impair the need to maintain flexibility and creativity, which used to be virtually self-realizing when the business was small (for the very reason that it lacked structure!). This is one of the biggest concerns for an evolving organization in the A&E sector.

This “quick-and-dirty” account perfectly describes the issues that are frequently found when companies develop, and similar concerns have emerged at ArchLiving over the years. As the company went through its “first wave” of expansion, some of the complications described above quickly emerged that bogged down business efficiency and effectiveness. Countervailing measures needed to be taken, and the company began undergoing some organizational transformation. The following lines provide a more in-depth account of how the company evolved to counter administrative hurdles. The next subsection, instead, will present what the challenges are that remained to be solved

As seen, during the mid-2010s, ArchLiving significantly expanded in terms of turnover (Table 2.1), driven by a larger number of projects and new clients. Initially, however, this transition was not paralleled by an organizational transformation. New projects and new clients translated into devoting much more time to networking with stakeholders, but, at the same time, of course, working on the designing and planning aspects of the job. Partners, associates, and senior designers were quickly overwhelmed by day-to-day operations, requirements, and new tasks while being left with no time to dedicate to “the company’s big picture”. An immediate response was to expand the company’s workforce. This made sense. Delegating some jobs to newcomers eased pressure on senior designers. Nonetheless, because managerial and structural aspects were not addressed, chaos soon emerged. With no one given a clear duty or responsibility, everyone was consulted on different matters and engaged in several aspects of various projects resulting in little to no capitalizing on economies of specialization or experience. On top of that, time management did not benefit from new hires, and the company lived on a constant state of emergency, rushing to complete assignments just before their deadlines. An associate – now a senior designer in the company – typified this situation by describing how, when she first joined the company, phones were ringing all the time:

When anyone called – be it an existing or a new customer, a supplier or a contractor, a co-worker, etc. – no one was responsible for picking up or redirecting calls. Phones were ringing altogether in each and every office of the facility, much like in a 1990s Wall Street stockbrokerage company!

Fortunately, the company’s directors quickly realized the problem. While the business had turned from a partnership to a company, they still handled operations “like the old days”. Another senior collaborator described it somewhat like this:

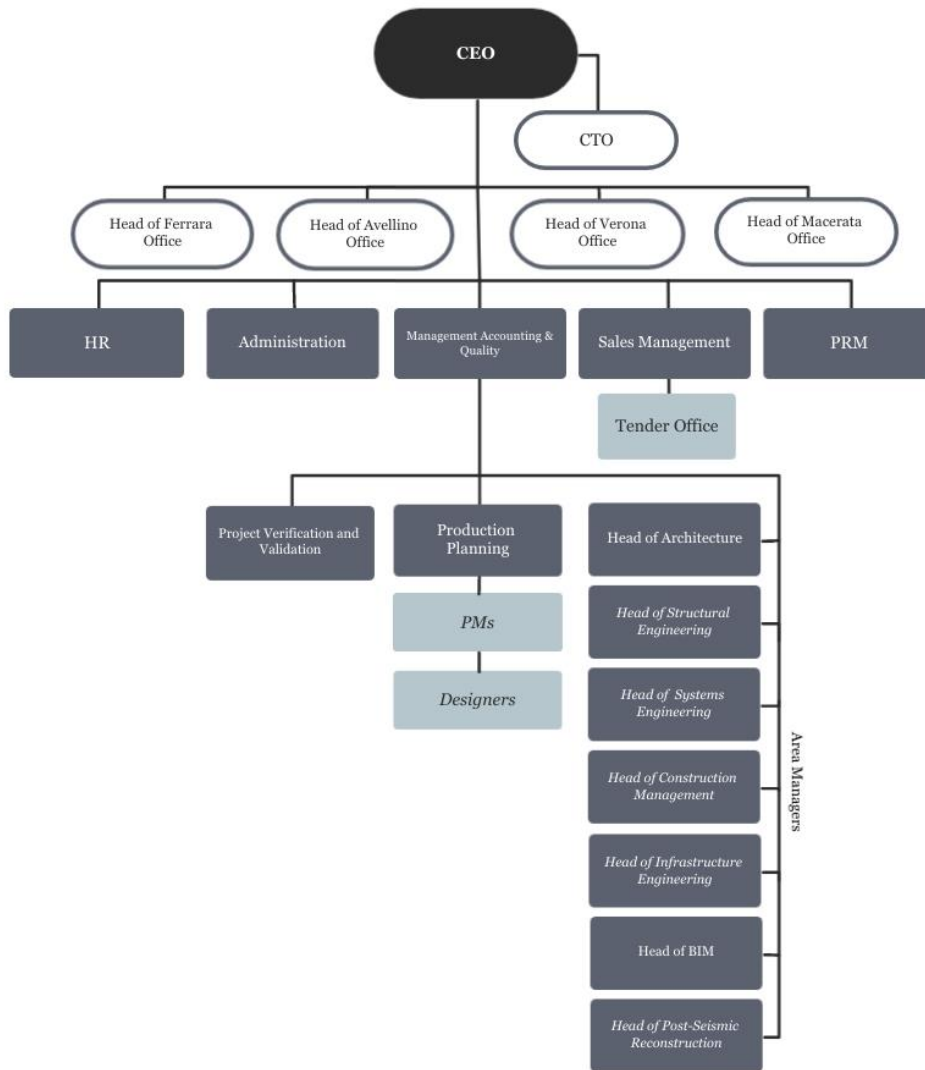
We moved from being an A&E studio to having an actual firm. We all need to realize it and start acting like one.

Consequently, since about 2017, ArchLivIng has committed to giving itself governance and a structure. For starters, it began to structure operations in teams. Each team was assigned new projects as they came in, and a project manager (PM) was appointed to lead members. The PM – usually a senior designer – was given a coordination responsibility. He or she acted as an internal liaison and the first and foremost interface with external stakeholders.

Ultimately, the company agreed on an organizational charter (Figure 2.4). Interestingly, the charter combined some elements of a functional organizational design with a matrix-like structure. This was because architects and engineers – besides being headed by PMs – were also represented by area managers. Area managers were appointed to lead designers who shared a common professional specialization (e.g., structural engineering, system engineering, BIM, etc.).

These decisions surely marked a fundamental step forward for the company. They also represent essential hallmarks with respect to competitors. While still not a large business, ArchLivIng’s managerial approach makes it stand out relatively to comparable incumbents – for example, the employment of PMs is an element that is more commonly found in large A&E companies. Nonetheless, completely effecting the organizational changes that had been introduced did not prove easy as some new complications surfaced which required further attention.

Figure 2.4 Synthetic representation of ArchLiving's organizational charter.



Source: author's elaboration on information retrieved from the company's internal documents.

## 2.5.2. ArchLiving's New Challenges

The path to ArchLiving's new organizational layout was not complete. Agreeing on a new arrangement is but the first step. Next comes testing the effectiveness and benefits of these approaches (one may argue that this second step is even more complicated!). As a matter of fact, the company has to realize what new elements do work and what do not. If something turns out to play out *against* expectations, decisions must be taken about whether to fine-tune and optimize it or to drop some practice altogether.

Therefore, while ArchLiving improved its processes and structure, it had to address challenges regarding optimizing the organizational and managerial innovations it

introduced. This section intends to lay down these challenges as these are the main reasons that brought the company to consider the adoption of Agile. Thus, the aim here is to build the case to introduce agility principles and practices, which will be then resolved in Chapter 5.

When the company's executives created an organizational charter and arranged project work in teams, they knew that roles and responsibilities were not set on stone. Senior designers, PMs, and area managers had to get accustomed to their positions, understand their new duties, digest them, and finally completely enforce them. Therefore, initially, these roles were more fluid and dynamic in an attempt to crystallize best practices, define what benefits can be attained, and make up for errors or misinterpretations. Besides structural or organizational design concerns, the company had to address cultural and communication issues.

During discussions with the company's representatives, at least five areas emerged that were requiring further attention. First, there was a communication and coordination problem. When the company was small, data and information used to flow freely. As a consequence, virtually everyone was on the same page very soon. Today, with a larger workforce, personnel reported how they lacked information to make decisions and had to look for people or teams who had that information or who could direct them to the primary source. This is a classical issue of siloed knowledge. Solutions call for informational redundancy and demand that the company finds a way to make its people actively share information and spread it across the firm's boundary.

Furthermore, absent coordination, processes can become inefficient and negative consequences can also be reflected externally. With a comprehensive product line, the company has to deal with diversified public and private stakeholders and accommodate idiosyncratic needs and requirements. This requires strong networking abilities, such as having an ongoing dialogue among clients, authorities, and other stakeholders. While these elements can significantly contribute to jobs' efficiency and effectiveness, an uncoordinated firm whose people lack consistent information about clients and other stakeholders can end up disappointing or, worse, scare them away because value creation is inhibited and reduced.

Second, the company attempted to make up for communicational issues by creating a quasi-matrix organizational design. As explained above, team members are headed both by a PM and an area manager. This arrangement is an excellent approach to address

communicational silos because it promotes knowledge-sharing across functions and teams. However, matrix organizations are known to create authority tension. While it is not right to claim that ArchLivIng's PMs and area managers have the same degree of hierarchical power (area managers are rather *primus inter pares*), conflict and decision-making delays can still occur. In particular, this is evidenced by effectiveness and time management in meetings. From discussions at the company, these meetings were described as mostly useless. On the one hand, this was because employees were unsure about the purpose and content of these gatherings, which resulted in "chit-chatting" without a purpose. On the other hand, they uncovered an issue that is generally common in most meetings held at the company. That is, there is a tendency to divert from the agreed agenda which results in these gatherings lasting well beyond schedule and ending up in discussions about matters that were outside the originally programmed scope. Resolving these questions entails a disciplined approach to meetings and more accurate time management.

Third, the company has undergone several attempts to institutionalize teamwork. However, it found obstacles in enforcing a solid team mentality. Processes lacked appropriate approaches and "rituals" for team members to work and stick together. Moreover, teamwork effectiveness was weighed down by poor workload management and an extensive amount of work in progress. Although teams were designed with high hopes, the result was that they quickly split apart due to pressure on assignments and deadlines. Moreover, because some teams lacked expertise, it was common to ask other group members to contribute their knowledge. This might have worked if one-off in nature, but it leads to chaos in the long run. Soon teams got dismantled, and the company wound up operating as a unique big crew. Roles and responsibilities fell apart as a consequence. Ultimately, the benefits of teamwork were not accrued. Solutions to this problem require a deeper analysis of roles, skills, tasks, and projects so that the team is genuinely cross-functional, fully proficient, and self-contained.

Fourth, as in most A&E business, ArchLivIng realized that there was an issue with focusing too much on the project's technicalities and aesthetics while overlooking the necessities and requirements of the clients who commission the projects in the first place. A senior designer in the company recounted that:

Like most designers, we have a tendency to fall in love with our job, with our projects. Instead, we should focus on what customers really want or, else, we end up delivering something that does not live up to expectations and needs to go over hours of rework.

Addressing this concern, however, requires more than a cultural shift. The reason why A&E companies find it difficult to meet customers' requirements and needs is also tied to project management approaches. As described in the previous chapter, the design process is frequently entangled with normative constraints and traditional project management approaches. Under these frameworks, clients are asked to comprehensively spell out design specifications and requirements upfront at project inception. Then – much like in a waterfall-like project management model – designer-client interactions are limited or suspended until the very end of the processes. In reality, this approach is hazardous because seldom do customers have a clear and definitive idea about what they want when they first commission the project. Instead, if an ongoing interface between the A&E company and its clients is established, the project would be co-created and adjusted as the customer learns more about their needs. Consequently, he or she can define requirements more accurately. Simultaneously, this open-ended dialogue would limit designers' blindness and the risk of "falling in love". Finally, an area that needs more consideration is the company's high employee turnover. While – as emerged from discussions – there surely is an exogenous component beyond the company's control<sup>9</sup>, considerations offer an interesting discussion in terms of links to the concept of job satisfaction. Managing high turnover is not easy. For example, it can result in significant rehiring expenses, higher training costs, delays in working pace, and additional pressure on existing staff. On the contrary, it can be contended that a more appropriately structured and managed workplace can increase employees' job satisfaction and result in longer retention. Higher retention promotes talent management and results in more invested and engaged staff.

In conclusion, the points which have just been made suggest how ArchLiving needed to make some further steps to complete its transform. From about a couple of years, the company approached Agile principles and practices, realizing how it could learn a lot from this business management trend. Agile was believed to be an appropriate answer

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<sup>9</sup> Typically, the youngest designers are very mobile. This is usually because they are "freshmen" in the business or because they are interns whose intentions are to be exposed to different experiences in different organizational settings. Older junior designers are also very frequently more mobile, although in this case, the reason is often linked to family matters.



for an A&E company that intends to grow in size, abandoning a small-firm structure but keeping the flexibility and dynamicity of a startup. The next chapter will introduce the concepts underlying Agile and agility, while Chapter 5 will adopt its methods at the company.



## CHAPTER 3. Agility and Agile

### 3.1. Overview

Wandering around the corridors of many of today's most forward-looking businesses, chances are that statements like "our company has adopted an *agile* approach" or "we handle projects with *agility*" can frequently be picked up. As a matter of fact, being "agile" is praised as the new and better way of managing a firm in a business world that is continually shaken by hyper-competition, short product lifecycles, advancements in technologies, and, more generally, environmental dynamism and turbulence. Thus, as the notion of agility is increasingly entering the "management lingo" and its prominence as a desirable business-level quality appears a central issue to the modern firm, the arduous task becomes to describe what being agile truly means and what its underlying concepts and methods are.

When asked to define agility in an organizational setting, experienced managers would probably resort to illustrating it as a valuable business-level competence to fend off market volatility by being alert to opportunities and threats and quickly adapt as a consequence. Others would likely relate agility to a project management scheme describing a series of guidelines for structuring people and scheduling tasks. Many others, on the contrary, would probably dismiss the concept arguing that it more appropriately pertains to practices from the IT department. Finally, some executives may get away with defining agility as the attitude of "embracing change". None of these interpretations is wrong *per se*. In fact, they are all capturing different facets of the same notion. Arguably, though, their mixed standpoints and domains indicate a lack of clarity surrounding the concept of agility.

Turning to a semantic consideration, Merriam-Webster Dictionary (2020) describes agility as the quality of being "marked by ready ability to move with quick easy grace". This definition uses a verb ("move") denoting a purposeful action effecting change and two adverbs ("quick", "easy") specifying that such action is rapid, efficient, and harmonic. Unlike other definitions<sup>10</sup>, Merriam-Webster also adds that agility is not just about the exercise itself but the condition of being *ready* to act in the first place. Simply

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<sup>10</sup> Oxford Dictionary (2020), for instance, limits to define the word "agile" as the characteristic of being "able to move quickly and easily".

by looking at this dictionary lemma, an informed reader can surely spot connections between agility and many business management philosophies. Wanting a company to be agile, after all, can be linked to the aspiration of remaining competitive and keeping pace with innovations in the market.

The advent of agility as an explicit business management concept can be traced back to the early 1990s. At that time, an “agile manufacturer” was described as an innovative company that possessed specific organizational capabilities to understand and anticipate the evolution of its environment and to devise the most appropriate responses to it. More generally, the notion of “organizational agility” was conceived to refer to a set of business-level characteristics that equipped companies to face new drivers of international competition and, more broadly, a fast-paced digitized business world.

Somewhat inspired by these ideas, a decade later, the word “agile” came to be popularized in a different setting, that of software development. Coalescing around the experiences of several software engineers, at the turn of the millennium, a movement was born that intended to spread an innovative, “lightweight” approach to develop software. Agile software development – as it came to be known – represented a reaction to the traditional, “heavyweight” project management methods, which were quickly becoming clumsy and obsolete under the pressure of rapidly-changing technologies, fast-moving consumer needs, and fierce competition. Agile software development focused on prioritizing user satisfaction, putting people and teams at the center, encouraging ongoing informal communication, and iteratively and incrementally delivering output. Very pragmatically, agile software development could be implemented by following a collection of principles and practices within broader frameworks known as agile methodologies.

As agile development was rapidly gaining ground as an innovative project management approach to build software, the effectiveness of the underlying techniques and astonishing productivity results led to the adoption of agile principles and practices, first, in IT departments at large, and, later, in organizations as a whole. Moreover, infused by the earlier experiences with organizational agility, “agile enterprise” came to identify a company that scaled agile methods to the whole firm and adopted an agile mentality to design its processes and structure.

If this brief recount sounds somewhat confusing, it is no surprise. The story of agile is not well-organized, and the underlying literature is only nascent. This is all the more so today, as research in enterprise agility is primarily the domain of business consultants and practitioners. Hence, this chapter's very purpose will be to shed light on “the ins and outs” of agility. This is achieved by reviewing scholarly research and integrating the most prominent contributions from outside academia. Ultimately, this chapter should provide a description of what an agile enterprise is, eliminating concerns of many who wonder whether agility is but another management buzzword. Thus, this review will be essential for describing how agile principles and practices apply in the architecture and engineering sector and in the case study presented in this work.

The chapter is structured as follows. Sections 3.2 and 3.3 will review the extant literature. The former will focus on organizational agility, presenting and defining the concept and its development as well as what elements in a business enable the realization of agility. The latter introduces agile software development as an innovative approach to managing software projects. Section 3.3. will also discuss values, principles, and practices found in agile developers, and it will present an exemplar agile methodology. Finally, Section 3.4. will debate the latest development in agility, showcasing what an agile enterprise is and how it is managed and structured.

## 3.2. Organizational Agility

### 3.2.1. Early Developments

In 1991, at the Iacocca Institute (Lehigh University) in Bethlehem, Pennsylvania (USA), several industry leaders and scholars gathered to discuss the international manufacturing landscape and the place occupied by American firms. The conference – motivated by the realization that US manufacturers were giving in to the rise of the Far East and the imminent formation of the European Union – terminated with the elaboration of a two-volume report titled “21<sup>st</sup> Century Manufacturing Enterprise Strategy” (Nagel et al., 1991). Pointing out that the business environment was continually evolving and becoming more competitive and volatile, the report called modern firms to change and adapt to a new era, that of “*agile* manufacturing”.

The report cited several transformations encouraging the adoption of agile. Information technology, in the form of computer-controlled machinery, processes, and new communication systems, was revolutionizing operations and opening up new value propositions and offerings. Mass production was declining and being substituted by manufacturing of higher-quality, highly customizable products embedding a higher informational content and an extended value proposition (cf. servitization). Even popular management philosophies such as Just-In-Time and Lean were reported as no longer enough to remain competitive. Not anymore could companies assume isolation and internal development, focusing on cost-effectiveness, and achieving perfection because the market, more than anything, demanded speed and effectiveness.

Agile manufacturing advanced new concepts like modularity, cooperativeness, flexibility, and responsiveness. While mass manufacturers seek stability and predictability, agile manufacturers would have striven in constant change, capitalizing on their flexible technologies, structure, and workforce. In the agile manufacturing era, a company achieves a competitive advantage by reducing its time-to-market and quickly addressing latent consumer preferences. To do this, the agile company can easily absorb new knowledge and innovations coming from the surrounding environment and quickly leverage them by repurposing and reconfiguring its production systems with the facilitation of IT and robust communication infrastructure. More importantly, no longer the firm does all this alone, but it can take advantage of external partners in temporary collaborations as this might represent the quickest and safest way to reach clients. Going beyond the traditional competition rules, firms become nodes in a “liquified” network whereby competitors, suppliers, and customers are interchangeable roles. In such a context, new organizational culture and workforce skills are required. Because responsiveness demands quick action, managers in agile manufacturers are more prone to delegate authority and decision-making. This is an effective solution only if employees are skillful and competent and when an atmosphere of mutual trust is generated.

### 3.2.2. Defining Organizational Agility

Overall, the report elaborated at the Iacocca Institute raised several compelling points and was very well welcomed by researchers, practitioners, and institutions. The essay accurately depicted the industry's ongoing conditions and contributed a possible path

for the future to come. Nonetheless, it could be argued that the core concepts remained chiefly in the form of a vision. The very notion of agility was ill-defined. As a result, during the decade that followed, scholars and practitioners rushed to provide more appropriate conceptualizations. Notably, over time no longer was agility solely associated with manufacturing. As the service sector had become far more prominent and servitization was consolidating, agility came to touch upon companies from virtually any industry and sector. As a result, the phrasing “organizational agility” became more appropriate. Table 3.1 summarizes the most notable contributions to defining agility.

*Table 3.1 Most prominent definitions of agility, organizational agility, and agile manufacturing found in the literature.*

<b>Source</b>	<b>Definition</b>	<b>Key arguments about agility</b>
Goldman et al. (1995) <sup>11</sup>	“Agility is dynamic, context-specific, aggressively change embracing, and growth-oriented. It is not about improving efficiency, cutting costs, or battering down business hatches to ride our fearsome competitive ‘storm’. It is about [...] succeeding in emerging competitive arenas, and about winning profits, market share, and customers in the very center of the competitive storms many companies now fear”	The attitude of bravely embracing change and market turbulence to gain a competitive advantage and profits.
Kidd (1995)	“An agile corporation is a fast moving, adaptable and robust business enterprise capable of rapid reconfiguration in response to market opportunities. Such a corporation is [...] a coordinated system in order to achieve a quantum leap forward in competitive performance by delivering capabilities that surpass those obtained from current enterprise practices.”	Speed and resoluteness in internally restructuring a company to be first movers in addressing new opportunities
Gunasekaran (1999)	Agility is “the capacity of surviving and prospering in a competitive environment of continuous and unpredictable change by reacting quickly and effectively to changing markets, driven by customer-designed product and services”.	Mastering the uncertainties of market change making customers one’s guiding light.
Sharifi & Zhang (1999)	An agile organization “is an organization with a broad vision on the new order of the business world, and with a handful of capabilities and abilities to deal with turbulence and capture the advantageous side of business”.	A firm’s abilities to sense environmental change and take advantage of it.

<sup>11</sup> As cited in Gunasekaran et al. (2019). Goldman et al. were among the signatories of the 1991 “21<sup>st</sup> Century Manufacturing Enterprise Strategy”.

Source	Definition	Key arguments about agility
Sanchez & Nagi (2001)	Agility “is a new strategy [...] represent[ing] the ability of a producer of goods and services to strive in the face of continuous change [...] in all facets of the business enterprise. [...] Agile companies are ones that have moved beyond tactical initiatives and have made fundamental changes in how they operate.”	More than a set of capabilities. A strategic attitude to live and prosper in a dynamic business environment.
Yusuf et al. (1999)	“Agility is the successful exploration of competitive bases (speed, flexibility, innovation proactivity, quality and profitability) through the integration of reconfigurable resources and best practices in a knowledge-rich environment to provide customer-driven products and services in a fast-changing market environment.”	An all-encompassing set of capabilities allowing firms to leverage knowledge, easily restructure, and thrive in turbulent environments.
Sambamurthy et al. (2003)	“Agility is the ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise”	Sensing opportunities and rapidly reconfiguring to seize and benefit from them.
Overby et al. (2006)	Organizational agility “is defined as the ability of firms to sense environmental change and respond readily.”	Sensing and responding to change.
Lu & Ramamurthy (2011)	“Organizational agility is a firm’s ability to cope with rapid, relentless, and uncertain changes and thrive in a competitive environment of continually and unpredictably changing opportunities.”	Surviving change by exploiting new opportunities.
Ravichandran (2018)	Agility is defined as “a firm’s capacity to respond with speed to environmental changes and opportunities.”	Fast reaction to dynamics and opportunities.

*Source: author’s elaboration, references cited in the text.*

Although the authors cited in Table 3.1 looked at the term from different perspectives, what one can make of these views is that agility represents a set of capabilities and other characteristics that a firm should have to effectively sense and respond to market dynamism. Agility is about mastering change, grasping new opportunities or addressing threats, and flexibly adapting to capitalize on them.

### 3.2.3. Enabling Organizational Agility

Having defined organizational agility, it is now relevant to understand how a company can exploit agility for its own benefits. That is, what factors contribute to enhancing a firm’s sensing and responding capacity. Building on the work of several authors



(Gunasekaran, 1999; Gunasekaran & Yusuf, 2002; Overby et al., 2006; Sharifi & Zhang, 1999; Sharp et al., 1999; Sherehiy et al., 2007; Tallon et al., 2019; Yusuf et al., 1999), five core enablers can be identified (Figure 3.1). Together, these factors synergically act to reinforce a firm’s organizational agility. No enabler alone suffices for a business to be agile, instead, each factor induces modifications in the others, and their interplay ultimately effects agility.

Figure 3.1 **Organizational agility enablers.**



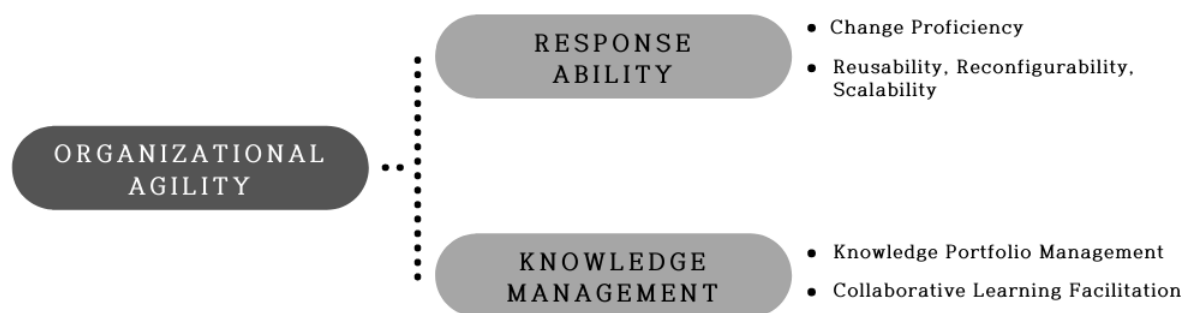
Source: author’s elaboration.

The first element in the puzzle is a firm’s strategy. To begin with, the firm should prospect to design value propositions that “enrich the customer” (Goldman et al. [1995] as cited by Yusuf et al. [1999]). That is, products should be more than about meeting a need. Instead, the firm should strive to provide an extended offering to increase customer satisfaction and loyalty. Subsequently, the firm should consider internal and external cooperativeness as fundamental guiding principles to achieve timely delivery of its propositions. Because speed and responsiveness in addressing opportunities, preempting resources, and mobilizing competencies and knowledge become fundamental, firms should realize that “going solo” is a sub-optimal option. Thus, an

agile strategic approach is to create temporary virtual enterprises. This results in a network of distributed core competencies, increasing each participant’s flexibility and responsiveness while spreading risks and uncertainties. Internally, an agile organization increases speed and responsiveness by institutionalizing concurrent engineering as the default new product development process. Breaking free of traditional stage-gate development approaches, the firm streamlines and condenses development aided by multidisciplinary teams. Finally, an agile strategy is one where the organization is designed to master change by spreading flexibility and rapid reconfigurability across its people and assets. In so doing, it is also strategically relevant that the firm leverages its people and their skills, knowledge, and experiences to obtain a sustainable, valuable, rare, and inimitable competitive advantage

A firm’s set of capabilities is the second agile enabler in the proposed model. Although agility *per se* can be seen as an organizational capability, realizing it requires additional competencies.

Figure 3.2 *Organizational agility enabling capabilities.*



Source: author’s elaboration on Dove (2001).

Dove (2001) modeled organizational agility as the result of a company’s “response ability” in conjunction with the effectiveness of its knowledge management system (Figure 3.2). Response ability identifies the capacity of the firm to act. That is, the extent to which it is either static or dynamic in the face of change. Response ability, in turn, is determined by two components. First, the company’s change proficiency, or the accumulated level of competency that the firm has matured in effecting change. Being proficient – or expert – at change means to be quick in delivering change, enacting it inexpensively, attaining a high-quality result, and having a system that has the scope to accept such change. Second, response ability springs from the company’s “reusable,

reconfigurable and scalable (RRS) structural relationships". RRS describes the type of organizational design of a firm that can set up its people, resources, and processes to reuse elements and reconfigure them in a scalable framework, thus enabling high adaptability. The other determinant of organizational agility is a firm's knowledge management system such that it can effectively identify the levers to act on change. Like response ability, knowledge management also results from two factors: knowledge portfolio management and collaborative learning facilitation. The former describes the knowledge stock that a firm owns and the strategy it adopts to identify, acquire, diffuse, and renew its knowledge. Collaborative learning facilitation, on the other hand, identifies the organizational elements that support knowledge in terms of creating and maintaining learning networks in the company. Collaborative learning facilitation is shaped by the firm's infrastructure, culture, learning events, and activities.

The third element in the agility enablers model presented (Figure 3.1) is people – meaning, a firm's workforce. While a firm can design its strategy, structure, and technologies to address environmental change, it is its people who ultimately sense and respond to that change. Therefore, it is important to delineate what skills are required of an employee in an agile organization. To answer this question is to look at the type of activities, routines, and interfaces the worker is exposed to. Agile businesses are flat, fast-moving, flexible, highly digitized. They present reconfigurable structures and processes, they are embedded in larger networks of temporary virtual enterprises, and they use concurrent engineering and multidisciplinary teams. To sustain this system, employees need to be highly trained in their idiosyncratic hard skills, but – more importantly – they need to possess several soft skills. Ideal agile workforce tolerates uncertainty, it joins forces with outsiders and works in teams with insiders, and it learns fast. It can take initiative, be autonomous and improvise, and be adaptive to take on changing tasks and job descriptions (Gunasekaran, 1999; Sharp et al., 1999). At the same time, the employees in agile firms know that they can rely on organizational support. Self-management and cross-functionality require top management backing. Executives and supervisors need to be confident and trust their employees, tolerating and accepting mistakes and avoiding second-guessing decisions or requirements. More importantly, they need to make their subordinates feel empowered to increase job engagement and satisfaction. In short, key is to shift perspective on a company's people from cost centers to be minimized to core assets to invest in (Sharp et al., 1999).

Fourth, in terms of organizational structure, because the aim is for the organization to be flexible, receptive to change, and quickly responding to opportunities or threats, an agile firm reflects the precepts of organic organizational design (Burns & Stalker, 1966). Hierarchy is loose, and structure is flat. Authority is mainly decentralized, and roles are ill-defined. Employees work in teams of people from different functions. Altogether, these structural elements favor accommodation of change via easy reconfiguration and repurposing. People are given more power to quickly take action while, within a mutable network, information can rapidly spread across the company to find its best use. Also, because authority is frequently delegated, decisions are autonomously taken by those who are “closer” to the business environment and to customers resulting in an even faster and more accurate response.

Finally, information technology (IT) is a fundamental agility enabler. As Overby et al. (2006) report, new technologies and digital advancements can have a twofold effect on organizational agility. On the one hand, IT is *directly* related to agility in so far as several emerging technologies could provide profitable commercial opportunities or improved means to extend a firm’s products value proposition. More importantly, however, IT can *indirectly* enable agility when acting as a complementor to other business processes and knowledge management systems. According to Sambamurthy et al. (2003), IT resources and capabilities allow the expression of organizational agility in several ways<sup>12</sup> and mediate a firm’s attainment of competitive advantage through strategic innovations. Later, Lu & Ramamurthy (2011) demonstrated how IT could benefit a firms’ agility distinguishing between three types of IT capabilities and describing how they enhanced sensing and responding capacity and internal flexibility facing change. In particular, Lu & Ramamurthy (2011) found that a firm with robust IT infrastructure capability collects and shares information better and faster, so decision-making is more efficient and immediate. Second, solid IT business spanning capability – reflecting the ability to structure IT resources so as to support strategy and vision – is described as resulting in easier and more rapid adoption of innovations, higher responsiveness, and flexibility. Finally, a strong IT proactive stance (i.e., the ability to innovate IT resources to capture

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<sup>12</sup> *Customer agility* represents the capacity to hear customers’ voices and take advantage of them to increase market knowledge and investigate opportunities for innovations. *Partnering agility* refers to the company’s ability to leverage and restructure its extended network of upstream and downstream stakeholders to acquire new knowledge or exploit new opportunities. *Operational agility*, instead, describes the capacity of the firm to rapidly redeploy its assets and processes in the face of new opportunities (Sambamurthy et al., 2003).

new business opportunities) is said to influence the capacity to discriminate between innovations that could benefit the company and those that would not. In other words, works on IT-enabled organizational agility show that IT can make a firm more agile by enhancing the breadth of resources and the quality of information that can be leveraged to improve sensing and responding capabilities in the face of environmental change (Overby et al., 2006). For example, market research analytics software that provides real-time data monitoring and analysis to find patterns and build scenarios ultimately enriches the firm's knowledge about the environment, thus improving its sensing capabilities. Conversely, emails and intranets are examples of IT resources that extend process reach by providing an easier and faster platform to connect stakeholders as well as means for more effectively responding to change. For a more in-depth review of IT-enabled organizational agility, refer to Tallon et al. (2019).

### 3.3. Agility in Software Development

#### 3.3.1. Overview and Antecedents

Although it might appear odd at first, the major contribution to the rise of enterprise agility as a new business management philosophy came from the world of software engineering. Here, several practitioners advanced new methods to approach software development that ultimately resulted in principles and practices that could not only benefit development teams or IT departments but the entire company.

Software development identifies all the processes involved in the creation of software components as well as *how* these processes are managed and performed in an orderly sequence to deliver value to and meet the goals of the customer. Traditional models to develop software are based on engineering-inspired principles and address the problem in a very rational way. While admitting that the project can be complicated and risky, they also postulate that mistakes can be eliminated, and uncertainty can become manageable if accurate upfront planning and forecasting are carried out. In other words, traditional software development methods assume that the best way to conduct the process always exists; the key is for the project lead to find it and, subsequently, have everyone involved follow through (Nerur et al., 2005). Put simply, the whole process reduces to an optimization problem. So-called "plan-based" software development

models, such as the archetypical “waterfall”, represent how these conjectures are applied in practice.

Under waterfall, the software development process is structured in sequential phases with sign-off points at the end of each phase (MacCormack, 2001). The project would sequentially go through each of these steps proceeding forward only after all the previous stage assignments are fully concluded. The tasks to be performed at each point are clearly stated from the very beginning and organized around standards and rules. Similarly, people’s roles and responsibilities are known and precise, with little to no room for improvisation or latitude to make decisions on one’s own. The resulting management style traces the principles of command and control, while extensive documentation facilitates the exercise of authority via a systematic recording of each resolution and outcome thereof. Heavy reporting also serves to codify project knowledge and learning, and it provides a formal means of communication across developers, internal stakeholders, and customers. As for the latter, other than this formal documentation, their degree of involvement during development is minimal. Projects typically begin by soliciting a complete and extensive set of requirements from customers in order to contextualize as precisely as possible the expected end result (Williams & Cockburn, 2003), but, after that, user involvement is terminated, and no consultation is likely to take place until ultimate delivery of the product. In other words, developers explicitly assume that the list of requirements initially obtained is complete and immutable. Similarly, it is taken for granted that no external change will occur that could significantly alter customers’ needs (Cohen et al., 2004).

As enticing as a rational, plug-and-play software development model such as waterfall might appear, since the late 1980s, it became clear that most of its assumptions were no longer tenable<sup>13</sup>. Procedures were too rigid, and practices were becoming frustrating for developers to follow (Williams & Cockburn, 2003). This was essentially attributed to the evolution of the business environment. The industry was moving at an ever-faster pace, change was inevitable and unresponsiveness to it an unforgivable mistake. Consumer needs and requirements were changing more frequently than in the past and emerging

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<sup>13</sup> In fact, Larman & Basili (2003) investigated the origins and evolution of iterative and incremental software development and traced back rudimentary examples of lightweight approaches well before 1970. In their review, what emerges is the variability of practices in terms of iteration length, time boxing, amount of upfront specification, and the like. Nonetheless, a common theme is clear, new approaches intended to get rid of sequential, document-driven, and stage-gate processes.

more definitely only during later development stages. The long time simply taken to document requirements at project inception would have turned them obsolete, let alone assuming that they would remain the same all over the development phases. On top of that, as the level of technological complexity increased, customers had often become unable to fully define their needs or to have a complete idea in mind about the product. Pursuing waterfall in these conditions would be counterproductive and, worse, it would lead to the accruing of a series of problems such as communication gaps across developers, overscoping of the project, unmeetable assumptions, lacking requirement validation, piling of useless documentation, and recurring after-delivery rework (Inayat et al., 2015). In short, customer goals would not be met, much of the work would be but a waste of time and effort, and clients would ultimately be dissatisfied

In an attempt to overcome traditional software development obstacles, practitioners turned to alternative models and success stories from other disciplines. Among them, two antecedents are particularly prominent. First, from Lean, they took the ideas of minimizing waste by cutting documentation, maximizing flow by breaking down development into smaller deliverables, exploiting demand-pull via customer involvement, empowering workers by giving objectives and not checklists, and continuous improvement via early delivery of output and feedback-based adjustments (Cohen et al., 2004). Second, software engineers looked at a seminal work by Takeuchi & Nonaka (1986). At its core, this paper argued that the traditional, “relay-race-like” waterfall approach to development should have been substituted by a “rugby-like” one based on iterations and overlapping phases. That is, development should proceed over a series of looping stages – iterations, indeed – much like rugby players get closer to scoring a try by passing the ball back and forth. Moreover, the authors cautioned to refrain from heavy upfront planning favoring, instead, short-term projections that leverage people’s creativity and accommodate change. Also, they warned that a successful product could only be obtained by eliminating command-and-control principles and letting people free to work and interact in multidisciplinary teams (Table 3.3).

*Table 3.2 Guiding principles of Takeuchi & Nonaka's (1986) new product development process.*

<b>Principle</b>	<b>Description</b>
Built-in instability	When the project begins, only broad goals and a general direction are given. Developers do not follow defined product concepts or specific plans but are let free to find the right way to reach goals. Creativity comes before plans.
Self-organizing project teams	Teams are autonomous. Thus, executives refrain from micromanagement, only to provide guidance, resources, and support. The team itself sets its goals and leverages members' diverse functional specialization to meet them. Diversity fosters new ideas and creativity. Left on their own devices, teams boldly take initiative and risk.
Overlapping development phases.	Working as cross-functional teams results in synchronization in pace as members share different external and internal knowledge at the same time. Substituting sequential, self-contained phases with overlapping phases results in greater acceptance of external change, eliminating possible between-stage bottlenecks, and speeds up the whole process.
Multilearning	Teams are in close contact with outside information to respond quickly to changing conditions. They are also knowledgeable of diverse skills to be versatile. They are encouraged to experiment and investigate new ideas even outside their domain.
Subtle control	Teams are not entirely uncontrolled, but management establishes subtle self- and peer-based control checkpoints to prevent instability. This can be realized through team member rotation, creating an open work environment, evaluating and rewarding people based on team performance, tolerating mistakes.
Organizational transfer of learning	Accumulating knowledge is not enough. Members should also be good at transferring it and absorbing that of others. This is achieved by mixing teams, institutionalizing meetings at regular intervals, enforcing high-level practices and methods.

*Source: author's elaboration on Takeuchi & Nonaka (1986).*

Inspired by these notable antecedents, several software engineers began to experiment and document new methods to develop software. Each of them surpassed plan-based models in different ways, but all shared common principles of a so-called “evolutionary-based” approach to development. These innovations addressed the business community's request for “lighter”, faster and nimbler software development frameworks (Abrahamsson et al., 2002). Therefore, they advanced many practices and work habits which, in different ways, effected iterative, incremental, self-organizing, and emergent development and aimed at increasing customer satisfaction (Cohen et al., 2004; Dybå & Dingsøy, 2008) (Table 3.4). The 1990s thus marked a flourishing period for the advancement of these lightweight methodologies. In 1995, for example, Stapleton developed “Dynamic Systems Development Method” (DSDM). In the same year, Schwaber & Sutherland documented their success with “Scrum”. In 1998 Cockburn theorized the “Crystal” methodologies. A year later, Beck presented “Extreme



Programming” (XP), and Coad and colleagues introduced “Feature-Driven Development” (FDD). Many of these exemplar methods had an enormous success, but all of them ultimately lacked a common, recognized theoretical stance. This was until 2001.

*Table 3.3 Main differences between plan- and evolutionary-based software development methods.*

	<b>Plan-based software development</b>	<b>Evolutionary-based software development</b>
<b>Design process</b>	Deliberate and formal, linear, sequence of steps, separate formulation and implementation, rule-driven	Emergent, iterative and exploratory, knowing and action inseparable, beyond formal rules
<b>Goal</b>	Optimization	Adaptation, flexibility, responsiveness
<b>Problem-solving approach</b>	Selection of best means to accomplish a given end through well-planned, formalized activities	Learning through experimentation and introspection, constantly reframing the problem and its solution
<b>View of the environment</b>	Stable, predictable	Turbulent, difficult to predict
<b>Management style</b>	Command-and-control, management is controller	Leadership-and-collaboration, management is facilitator
<b>Communication style</b>	Explicit, formal knowledge management	Tacit, informal knowledge management
<b>Other key characteristics</b>	<ul style="list-style-type: none"> <li>• Avoiding conflict</li> <li>• Formalizing innovation</li> <li>• Design precedes implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Embracing conflict and dialectics</li> <li>• Encouraging exploration and creativity</li> <li>• Design and implementation are inseparable and evolve iteratively</li> </ul>
<b>Theoretical or philosophical roots</b>	Logical positivism, scientific method	Action learning theory, pragmatism, phenomenology

*Source: adapted from Nerur & Balijepally (2007), Dybå & Dingsøy (2008)*

### 3.3.2. The Agile Manifesto. Agile Values, Principles, and Practices

In February 2001, seventeen software engineers – the same people behind newly introduced software development methodologies – gathered in Snowbird, Utah (USA) to discuss the rise of evolutionary approaches. Recognizing that all models that they had proposed shared some common ground but lacked a united “theoretical and practical framework” and a strong “declaration of importance” (Williams & Cockburn, 2003), participants went on to build a joint platform for their findings. Together they dubbed

their innovative software development approaches “agile”. The choice was not accidental, but it purposefully echoed the earlier research on organizational agility (Section 3.3). Indeed, the notion of agility – seen as the ability to rapidly and flexibly creating and responding to change and the quality of being nimble, dexterous, and alert (Dingsøy et al., 2012; Highsmith & Cockburn, 2001) – was believed to fit well with the motives that moved the investigation of new ways to develop software. This was especially true as regards the characteristics of rapid adaptation to volatile market requirements, increased attention to customers and social aspects in the development process, as well as fast-paced delivery of value (Hoda et al., 2017). In a few words, Cockburn & Highsmith (2001) summarized the role of agility in software development as giving importance to people, effectiveness, and maneuverability<sup>14</sup>.

These “anarchist” software developers did not limit to come up with a new name, though. The foundations of their movement were collected and synthesized in a fundamental manuscript, the “Manifesto for Agile Software Development” (also known as “Agile Manifesto”). This relatively short essay traces the motives and the characteristics of agile software development that would set the base for future works. The Manifesto begins by describing the values of agile software development:

We are uncovering better ways of developing software by doing it and helping others do it. Through this work we have come to value:

*Individuals and interactions* over processes and tools  
*Working software* over comprehensive documentation  
*Customer collaboration* over contract negotiation  
*Responding to change* over following a plan (Beck et al., 2001)

From these statements, it can be derived that the new approach to development revolves around four pillars. First, countervailing the pernicious implicit assumption that processes are more valuable than individuals carrying out these processes, agile suggests prioritizing people and cross-functional teamwork instead. Although plans and processes are essential to give guidance, “agilists” contend that they can quickly become ineffective or, worse, counterproductive in today’s business environment where new circumstances impair old assumptions (Highsmith & Cockburn, 2001). Where processes

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<sup>14</sup> For a review of definitions and antecedents of agility in software engineering and information systems refer to Conboy (2009).

used to constrain people, agile, instead, stresses collaboration, self-organization, and empowerment so that uncertainty and change are dealt with individuals' creativity (Dingsøy et al., 2012).

Second, by getting rid of documentation, agile favors speed in delivering output. To substitute it, new methods rely on informal and ongoing communication across collocated teams (Boehm, 2002). Thus, knowledge becomes tacit, and it can effectively be spread only by ongoing oral communication and serendipitous encounters supported by job and team member rotation. Agile development contends that teams can be more effective and productive if information can flow freely across people and if – unencumbered by filtered documentation – decision-making and outcomes happen in a short period of time (Cockburn & Highsmith, 2001).

Third, giving priority to off-the-cuff, open-ended involvement instead of heavy formal intermediation, in agile development, customers actively shape and guide the development process acting as inexhaustible sources of new information and early providers of warning signals and feedback to improve the outcome of the development process (Dingsøy et al., 2012; Highsmith & Cockburn, 2001). The benefits are clear, developers will be eased towards constructing the most appropriate solution, and customer satisfaction will increase.

Fourth, abandoning heavy planning upfront in favor of ongoing adjustment to contingencies means accepting uncertainty and change – in fact, welcoming it (Dingsøy et al., 2012). To do this, developers should abandon an all-encompassing, “grand-scope” view of the development process to favor, instead, an iterative and incremental approach that regularly addresses and delivers smaller versions of working software adding new features at a time. Agile recognizes that businesses are complex adaptive systems. Thus, instead of inclusive rules, agile relies on minimum requirements or precepts suggesting what is appropriate to do in what situation. For the rest, agile entrusts people and their creativity to solve problems because creativity – not rules – is key in a dynamic environment (Highsmith & Cockburn, 2001; Nerur et al., 2005).

Agile, however, is not utter anarchy. It does not dictate to give up all forms of control. Instead, it turns to softer, adaptive prescriptions and routines. The Agile Manifesto itself lists a series of principles to guide the development process:

1. Our highest priority is to satisfy the customer through early and continuous delivery of valuable software.
2. Welcome changing requirements, even late in development. Agile processes harness change for the customer's competitive advantage.
3. Deliver working software frequently, from a couple of weeks to a couple of months, with a preference to the shorter timescale.
4. Business people and developers must work together daily throughout the project.
5. Build projects around motivated individuals. Give them the environment and support they need, and trust them to get the job done.
6. The most efficient and effective method of conveying information to and within a development team is face-to-face conversation.
7. Working software is the primary measure of progress.
8. Agile processes promote sustainable development. The sponsors, developers, and users should be able to maintain a constant pace indefinitely.
9. Continuous attention to technical excellence and good design enhances agility.
10. Simplicity – the art of maximizing the amount of work not done – is essential.
11. The best architectures, requirements, and designs emerge from self-organizing teams.
12. At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behavior accordingly. (Beck et al., 2001; emphasis added)

Principles alone, however, can offer but guidance and vision. The other way in which agility effects soft control on development is through *practices*. According to Recker et al. (2017), agile practices are meant to enforce either of three purposes. First, aiding management of the software development process by providing soft forms of planning, leading, or monitoring. Second, development practices help ease agile teams in meeting goals by guiding what actions should be taken in which circumstances. Third, socialization practices include prescriptions that address teams and how they should approach work, such as soliciting scheduling regular meetings to reflect on team performance. Socialization practices are also a valuable way to spread rituals and routines across members to favor development effectiveness. Table 3.5 provides a summary of the most frequently implemented agile practices, their purpose, and type.

Table 3.4 Selected popular agile software development practices.

Agile practice	Description	Type of practice
Small, collocated teams	Developers should work physically close to one another. Development iterations should be the exclusive domain of small development teams. This institutionalizes face-to-face communication at the expense of hardcore documentation, improves tacit knowledge sharing, and it also builds trust and morale. According to some methodology, a customer or user representative should be a permanent team member (this is frequently referred to as “on-site customer”). This would further support adherence to changing requirements and faster development.	Socialization
Cross-functional, self-organizing teams	Work should be shared among teams of developers whose members come from different functional backgrounds. This results in improved communication and problem-solving capacity. It enhances response extensively via diversity of views and group creativity. It also reduces overscoping and makes the development process more efficient. To make all of these more effective, agile dictates to give teams autonomy and discretion while having management resort to leadership and collaboration and act as facilitators or mentors.	Socialization
User stories	User stories are stylized, natural-language high-level descriptions of requirements or desired software features written in concert with customers and other stockholders in a form that can be easily accessible by even an unqualified crowd. User stories facilitate communication and understanding, substitute extensive documentation, and define the users’ goals.	Development
Requirement management and backlog	The backlog represents an aiding tool used to keep track of user stories and requirements. It comes in the form of a complete listing of prioritized items which is supposed to be accessible by all stakeholders.	Management
Iterative requirements and prioritization	Because requirements inevitably evolve as the environment and customers’ expectations change, developers should let them free to emerge and regularly update (added or discarded) and re-prioritize them aided by customer insight. Thus, unlike traditional methods where prioritization happens only once at inception, in agile, prioritization happens at each iteration. Moreover, while in traditional methods, prioritization is made according to many factors (e.g., business value, risks, cost, dependencies), in agile, it is only according to business <i>value to customers</i> .	Management
Continuous planning	Rejecting long-term planning, agile favors ongoing, contingent, and short-term planning before the beginning of each development iteration. This type of planning gets everyone on the same page with newly prioritized requirements and user stories so that the team begins working in the right direction.	Management

Agile practice	Description	Type of practice
Iterative development and time boxing	Software should be completed over repetitive cycles or loops, which are meant to deliver smaller, incremental versions of working software according to new short-term plans. Over these cycles, tasks mimic traditional development phases on a smaller scale, although they give up hardcore planning, standards, and norms. In most agile methodologies, iterations are also time-boxed. That is, they have to be concluded within a predefined time frame.	Developing
Prototyping	Frequent and regular prototyping in the form of incrementally developed operational software allows to receive feedback earlier on and entices customer satisfaction. A significant benefit is reduced need to document results by letting the customer play around, validate and refine solutions by using the software itself.	Developing
Review meetings and acceptance tests	At cycle end, stakeholders and developers meet to discuss developed requirements, backlogs, and user stories, demonstrate features and receive feedback. Acceptance tests (i.e., determining if solutions meet expectations) are conducted to verify accomplishments, thus promoting collaboration with users and aiding in reducing defects or regressions. Ultimately, review meetings increase customer trust in the teams.	Socialization
Retrospectives	Once each iteration is over, teams should gather to discuss their prior performance, mistakes made, or best practices found. Ultimately, retrospectives should guide how best to organize the team going forward with the project.	Socialization
Visual artifacts	Work items, requirements, and activities in progress and completed should be visually rendered to have everyone on the same page and understand workloads. This is known as Kanban.	Managing

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*Source: author's elaboration on Cao & Ramesh (2008), Inayat et al. (2015), and Recker et al. (2017). Notes: Practices attaining to very technical aspects of software development and coding (e.g., pair programming, code refactoring, etc.) were purposefully excluded from this list because beyond the scope of this review.*

### 3.3.3. Agile Methodologies and Scrum

The previous sections made clear that agile software development refers to a consistent common theoretical platform elaborating on the tenets of evolutionary development to propose a collection of values, principles, and a set of generally accepted practices derived from the Agile Manifesto. Materially, however, agility is expressed and enforced through *methodologies*. Agile methodologies are coherently organized, tried-and-tested development frameworks, systems, toolkits, or guidelines based on agile values, principles, and practices that can be applied to the software development processes.

Not all agile methodologies are made equal. In a seminal work on the antecedents of agility, Conboy (2009) specifies that methodologies can be very different from one another in terms of how they approach development and related business processes. Some methods – the author claimed – are prescriptive operational instruction (e.g., XP), others resemble project management handbooks (e.g., Scrum) or have a broader scope than software development *per se*, still, others seem like philosophical essays (e.g., Lean Software Development [LSD]). Thus, in theory, every software company could decide to take up the methodology that best fits its goals, product portfolio, and market circumstances – all in a very utilitarian fashion.

Since the time Conboy published his paper, however, things have changed. Many agile methodologies born in the 1990s and early 2000s are now obsolete and surpassed by more recent evolutions. According to Ozkan et al. (2020), only Scrum, XP, and LSD can genuinely be said to have survived, while new methodologies – such as “DevOps”, “Kanban”, “Scrumban”, and “Disciplined Agile Delivery” – are now emerging among consultants and practitioners. A description of all methodologies would be beyond the scope of this review. However, one of them – Scrum – deserves to be examined more in-depth because it has consistently emerged as the most widely chosen methodology among developers (VersionOne, 2020) and because its applicability extends beyond the exclusive software development domain<sup>15</sup>.

In the early 1990s, fascinated by Takeuchi & Nonaka’s (1986) “The New New Product Development Game” and by the progress made in evolutionary-based software development, two American software engineers – Ken Schwaber and Jeff Sutherland – elaborated an innovative iterative and incremental system development methodology which they called “Scrum”<sup>16</sup>. This new methodology, along with a thorough description of its working and implementation, was presented for the first time at the 1995 OOPSLA<sup>17</sup> Conference in Austin, Texas (USA). Refined and perfected over the years – especially by the infusion of agile software development principles (Schwaber and Sutherland were among the authors of the Agile Manifesto) – today, Scrum is an affirmed and very popular development methodology.

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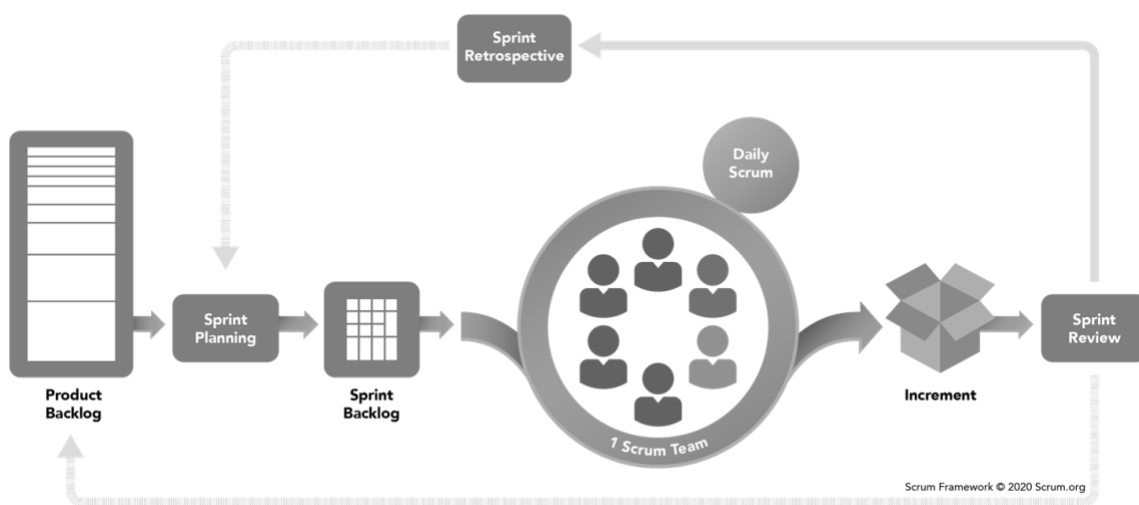
<sup>15</sup> For a general review of agile methodologies refer to Abrahamsson et al. (2002, 2003), Cohen et al. (2004), and Dyba & Dingsoyr (2008).

<sup>16</sup> The name “Scrum” echoes Takeuchi & Nonaka’s rugby metaphor (Section 3.4.1 briefly mentioned it).

<sup>17</sup> Object-Oriented Programming, Systems, Languages & Applications.

Based on the latest guide (Schwaber & Sutherland, 2020), the software development under Scrum should be the sole domain of an appointed Scrum Team of no more than ten people. The team will be formally responsible for delivering the finished, working product to customers according to a predefined Product Goal (i.e., customer’s expectations for the resulting software). The team is given autonomy by the company to perform. It is self-managed and structured in a cross-functional way. In particular, three separate figures can be distinguished in the team. First, a set of multidisciplinary Developers who actually perform the “mundane” development work in the form of so-called Increments – that is, concrete actions towards the completion of prespecified working items. Second, *one* Product Owner is responsible for maximizing product value and representing customers and other stakeholders' interests. The product owner is also given the responsibility to manage and order the items on the Product Backlog. The product backlog is a rolling listing of items – in the form of user stories (see Table 3.5) – representing all that needs to be done to deliver or improve the customer's product. Third, each scrum team is joined by *one* Scrum Master who acts as a mentor and facilitator for all other team members. He or she helps enforce and teach scrum practices, thus easing the way to improve value and remove roadblocks. The scrum master makes sure that scrum events take place regularly and within agreed time frames.

Figure 3.3 Visual representation of Scrum events. The Sprint and its components.



Source: scrum.org



Work under Scrum is paced by regular events (*Ibid.*). The most relevant and prominent Scrum event is the Sprint. The sprint is a repetitive one-month (or less) working “window” within which the team advances towards completing the chores related to a set of items on the product backlog, thus reaching the product goal. A sprint, in turn, is structured in four sub-events. First, each sprint begins by Sprint Planning, a phase during which the team agrees on the work to be performed over the upcoming timeframe. A Sprint Goal is defined, and, accordingly, a set of prioritized items from the product backlog are scheduled to be completed over the sprint. How each of these items is completed (one may call them actual “tasks” to be performed) identify the Increments. Sprint goal, selected items, and the plan itself to deliver them are collectively known as Sprint Backlog. Second, every working day during the sprint is commenced by a Daily Scrum. That is, a 15-minute meeting whereby each developer investigates progress toward the sprint goals and roadblocks found on the way, if any. Daily scrums are meant to improve communication and promote quick decision-making. Third, each sprint is concluded by a Sprint Review. The purpose of the sprint review is to discuss the sprint's outcome (i.e., delivered Increments) and present the results to customers and other stakeholders – working software. Based on feedback and the evolution of the market that may have occurred, improvements are discussed, and the product backlog may be updated. Reviews cannot last more than four hours. Fourth, along with the sprint review, a Sprint Retrospective is held internally across team members. This is the occasion to internally discuss team performance during the past sprint, analyzing what went well, what did not, and what problems emerged, if any. The result of the retrospective is a set of improvement points or advice to be implemented for the next sprint to improve team effectiveness. Retrospectives cannot last more than three hours. Once all the sub-events of the sprint are concluded, the sprint is also terminated. The team will have delivered a working software *as per* the items picked from the product backlog. At this point, a new phase can begin, and new items on the product backlog can be addressed. In short, a new sprint starts. Figure 3.3 provides a visual representation of a sprint and its components.

### 3.4. Agility Today: The Agile Enterprise

#### 3.4.1. Connecting the Dots

Today becoming agile is advocated as more critical than ever if companies wish to fend off disruptive changes happening in their business environments. As Aghina et al. (2017) report, market dynamism and quickness have generally increased over time. From customers to suppliers and investors, any of the company's stakeholders – now have urging and fast-changing needs pressured by international competition and expectations of sustainable growth. These concerns are further exacerbated by technological evolution. Digitization and automation are forcing companies to review their business models more frequently than in the past or face an otherwise looming commoditization. Provided the firm is fast in sensing and quickly adapts to seize them, new technologies can offer new ways to cater to customers, new types of offerings, and innovative means to create them (Gerster et al., 2020). On the other hand, new technologies result in consumers now having access to a plethora of digital tools and channels to reduce informational asymmetries vis-à-vis businesses, thus making them ever more in control of market transactions. Facing this shift requires companies to improve their corporate communication effort and create wider networks of players and actors to be leveraged in a fast-moving reality. Internally, businesses should also reconsider their workforce. Companies in the “creative economy” seek talented individuals to improve performance of increasingly knowledge-intensive tasks. The resulting war for talent not only requires companies to be ready to acquire skillful human resources but also to provide knowledge workers the right internal environment to effectively express themselves.

All these elements of change are complex for businesses to address, and urging them to be agile is easier said than done – managers and executives naturally look for methods and practices to facilitate the process. Unfortunately, other than a high-level description of capabilities and strategies, the original research stream on organizational agility offers poor guidance on how to actually implement agility. On the other hand, the way software developers approached the same concept was far more thorough and detailed while also proving very effective. Could it be possible to learn from them? Clearly, the foundations of organizational agility and the precepts of agile software development

operate on different levels and operational settings, but management is known for drawing from case studies and success stories from several different fields. Thus, while mainstream research struggles with narrow scrutiny of either area separately, their divide is far less evident in today's business practice. In a forthcoming paper, Salmela supports the view that business practitioners maintain a hybrid conceptualization of agility, whereby the principles and practices behind agile software development have crossed and merged with the capabilities required to reach organizational agility. Similarly, Naslund & Kale (2020) believe that "enterprise agility" represents "the 'new' popular management change method" owing both to the IT strain, in so far as improved methods to manage projects and operations are concerned, and to organizational agility, in terms of the abilities needed to adjust the company in the face of environmental change. In practitioner research, agile guru Stephen Denning (2015) indeed traced the cross-fertilization between agile software development principles and business management narratives back to the late 2000s. According to Denning, this happened because the existing notion of organizational agility (cf. Section 3.2) was too vaguely and "romantically" defined while lacking pragmatism and guidance on how to be implemented in practice. Agile development, on the other hand, drew inspiration from prior research but advanced thought-out recipes in the form of principles, time management frameworks, and other artifacts which not only had taken hold of the way that IT departments operated but could benefit processes, productivity, and workforce management anywhere in a business endeavor. Put simply, agile development methods began to be seen as the best tools to complement and truly effect organizational agility (Gerster et al., 2020).

A more in-depth investigation would reveal that, besides the need for a more pragmatic approach to agility, at least two other arguments can be raised to explain how agile development methods spilled over outside software. On the one hand, most companies today are experiencing similar problems – albeit on a larger scale – to software developers. Their offerings are encountering faster obsolescence, and existing business processes are frequently burdened by stifling structures and bureaucracy, which further bog down reactivity to new market trends, innovativeness, and creativity. Quickly and efficiently responding to change, listening to customers' voices, and involving them in new product development is just as important in software development as they are for every modern firm. On the other hand, companies are *most literally* facing the same

issues as software developers in the sense that – as digital entrepreneur Marc Andreessen (2011) once famously said – “software is eating the world”. This means that most of today’s market offerings, business processes, knowledge management systems, and decision-making mechanisms are mediated by lines of code (Denning, 2015). Therefore, the courses of action that lead to *digital* products, effect organizational learning, and determine business choices inevitably resemble software projects and, hence, look at evolutionary methods (i.e., agile) to substitute the rigidity of plan-driven approaches (Antons et al., 2019). Put simply, as software changed the way we work by, say, facilitating collaboration, providing real-time access to information, and giving tools to aid informed decision-making, it should be no surprise that it also inspired new management practices (Birkinshaw, 2018).

#### 3.4.2. Agility Beyond Software. Values and Areas of Change.

Having cleared the path for agile methods to scale up from IT departments to the entire firm, managers and executives need to learn how to implement them in practice. As much as agility advocates giving in authority and control and letting people and teams free to act, Rigby et al. (2020; 2016) caution that being agile is not about succumbing to anarchy. The authors, in fact, suggest going back to the Agile Manifesto for help and guidance while also proposing a new interpretation of agile values. First, individuals and interactions should be placed before processes and tools. To do so, agile executives – in line with the lead-and-collaborate principle – limit themselves to transmitting goals and ambitions (“what”) but entrust teams to find the best way to reach them (“how”). Empowering people who are down at the frontline, indeed, means recognizing that *they* are best suited to answer to stakeholders’ needs and to new developments in the business environment. This way, the companies will realize an oft-cited adage by Distinguished US General George Patton: “Never tell people how to do things. Tell them what to do, and they will surprise you with their ingenuity”. Second, agile enterprises should favor customer engagement over rigid contractual obligations. In practice, teams should continuously seek consumer’s voice and accept feedback because improved and valuable offerings only come from rapidly adapting to what the market is and will be demanding. Customers, however, are not just consumers in the market but also internal partners. When an agile team is developing some internal solution for another area in

the company, listening to their colleagues' requirements on an ongoing basis is just as important. Third, agility involves valuing working solutions more than documentation. In other words, when agile teams market new propositions or provide new internal solutions, they need *not* strive for them to be perfect. Perfection requires time and effort, but it does not achieve responsiveness and first-mover advantages. It is more important to deliver "good enough" solutions first, preempt resources and competition, and obtain earlier feedback and insights than to seek perfect results, which ultimately may have uncertain appeal or may end up being wasted resources. If once delivered, this good-enough solution turns out to be profitable or beneficial, agile teams can then incrementally add new elements to it and further increase value and reap the bottom line. By working this way, the company can address customer needs more precisely while progressively removing impediments in the process. Finally, an agile enterprise values flexibility more than it values heavy planning. A flexible firm can reconfigure when new opportunities come or when threats endanger its survival. To do that, agile teams are encouraged to experiment and take risks with the idea that the organization can learn and move forward even from mistakes. What an agile enterprise does not do, instead, is to commit to long-term plans. In a business environment that relentlessly evolves, heavy planning leads nowhere. Conversely, firms should be opened to frequently check and update their assumptions, re-prioritize their deliverables, and take few – but resolute – steps forwards at a time. Hence, to achieve balance, agile methodologies suggest assuming that the environment is stable exclusively during the short duration of an iteration. Only over a time-boxed increment can, thus, agile teams make commitments and plans – but for the very *short-term*.

The path to enterprise agility is not an easy one. Enacting the agile values which have been just presented is anything but simple because it requires a comprehensive organizational transformation affecting every corner of the firm – even those areas which may have stuck to traditional ways of doing business. In an effort to provide a coherent framework, practitioner literature has been suggesting considering the agile transformation from five points of view (Aghina et al., 2017; Brosseau et al., 2019; De Smet, 2018).

At the center of enterprise agility is the firm's strategy. While traditional companies assume that the key to success is to find an advantageous market position, stick to it, and optimize their production function to deliver an offering at a competitive advantage,

agile businesses have realized that profitability comes from moving fast along with new consumers' needs because competitive niches are not long-lived, and they are liable of inertia or path dependence. By following and anticipating the customer, the firm follows and anticipates its environment, and it is better fit to remain competitive for the long run. Realizing this strategy implies having a renewed focus on customer value, getting them involved, and co-creating solutions also with the aid of other corporate partners so as to create a networked platform to access and share new knowledge and insights. At the same time, however, executives should be wary of giving away unconditional freedom because unrestrained teams may tear organizational synergies apart (De Smet, 2018). Instead, leaders should indicate their people a "North Star". That is, they should infuse a shared purpose and point at the company's destination through a common vision.

Once a company's strategic intent is clear, structural considerations are next in line<sup>18</sup>. As most of this chapter should have made clear, agile enterprises knock hierarchy down in favor of a flat and diffused team-based layout. In fact, agility is said to solve the long-standing business dilemma of efficiency and dynamicity. Tradition tall, hierarchical, and bureaucratic structures may well be suited to achieve exploitation and efficiency when the environment is stable, but they are inflexible and clumsy in today's turbulent environment. Siloed functions, rigid lines of reporting, delegated authority, and limited latitude for autonomous decision-making slow down the company's reactivity and endanger long-term competitiveness. In other words, expecting growing companies to succeed by progressively increasing control and bureaucracy is but an illusion. Today, competitive businesses thrive on ill-defined, flat structures and agile teams that are flexible and scalable. Thus, projects and operations can be quickly taken up as soon as needed or dismantled if no longer viable. More importantly, teams are no knowledge silos because they gather people from different functional backgrounds with the intent of being quick and ready to face new challenges as they arise. Speed and dexterity are also facilitated by the elimination of rigid lines of reporting or indirect decision-making. Instead, teams are encouraged to promptly and autonomously take action, leaving managers and executives the roles of mentors and coaches while also giving them spare time to dedicate to the "big picture".

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<sup>18</sup> To be sure, this is not to say – as Chandler (1977) historically argued – that strategy comes before structure. Clearly, agile relies on very broadly defined strategy and structure that complement each other and mutate according to customers' changing needs and environmental dynamism.

In terms of processes, the agile enterprise moves away from detailed arrangements and checklists and turns to contingent planning in order to embrace change. Quick and effective decision-making is achieved by breaking down projects, tasks, and activities into smaller chunks, prioritize these items, and fitting them into rapid development cycles. During these short iterations, teams work closely with colleagues while listening to customer feedback. The aim is to deliver working prototypes (sometimes called “Minimum Viable Products” or “MVPs”) each time and then to engage in sequential improvements of the solution over time<sup>19</sup>. Managers do not impose standards for how teams should operate or move ahead, but they do implement “inexpensive” checkpoints. These are formatted events or artifacts like short daily meetings, review sessions, or visual representations of work in progress, facilitating open discussions about advancements made, roadblocks encountered, and implemented solutions. On the whole, reimagining business processes in an agile way should consider means to favor networking, knowledge cross-fertilization, and free expression of creativity.

As for human resources and culture, agility pivots around infusing an entrepreneurial mentality and empowering people. The role of managers and executives in agile enterprises is no longer that of being controller or planner, but acting as “servant leader”. Agile leaders teach their teams how to be autonomous, motivate them, and provide the right environment for them to take action. Leadership becomes about setting a direction or a vision and creating an organizational culture that enforces communities to experiment with the best path to reach the destination. As previously mentioned, agile leaders should also be in charge of disseminating a clear organizational purpose – an especially compelling responsibility in an agile enterprise that needs a common ground to avoid anarchy. Lastly, when it comes to the firm’s workforce, effective agility is premised by carefully selecting individuals who can embody the required competencies such as taking calculated risks, tolerate uncertain, being both collectors and radiators of new knowledge, and thrive for improving performance that may be outside one’s comfort zone. People also need to be trained at the soft skills required to collaborate in fast-moving, empowered teams where functional boundaries are no longer present, management direction and control are weak, and new challenges are the norm.

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<sup>19</sup> Again, it should be stressed that “products” need *not* be market offerings, nor “customers” necessarily are end consumers. An agile team may be working on a better internal solution, hence its “client” may be another business function.

Finally, the agile enterprise is a digital enterprise. Technologies unlock value and enable speed in reacting to the environment and opportunities. Unresponsiveness to new technological paradigms forecloses market opportunities and pushes the company into uncompetitive positions. Agility means being ready to extend product lines with digital products or, in any case, propositions that include digitized elements. More strikingly, though, agile players exploit new technologies to improve internal processes, operations, and knowledge management systems (these topics have been discussed sparsely in the chapter).

### 3.4.3. Principles, Practices and Frameworks in the Agile Enterprise

Like in software development, enterprise agility can be approached by looking at its principles, practices, and frameworks. Most of them are, in fact, inspired from prior successful experiences in software but adapted to wider organizational settings.

Practitioners generally concentrate on three core principles when describing how to embrace agility. First, agile players should be “obsessed with customers” (De Smet, 2018) – i.e., putting them at the center of operations. Denning (2013, 2016) has diffusely stressed how, differently from the 20<sup>th</sup> century firm which can take the liberty to sporadically scan the environment for opportunities, find viable propositions, and gradually optimize the selected solution in a relatively static market position, the 21<sup>st</sup> century firm should *continuously* listen and rapidly respond to customers’ evolving needs. Hence, the modern firm prospects to reposition and frequently repurpose to keep up with change. In other words, while traditional companies may be more prone to take an inside-out approach to outcompete incumbents, agile enterprises favor an outside-in attitude whereby listening to customer feedback and insight is a relentless driver of competitive advantage. By having everyone focused on addressing customer value first, the firm is ultimately in synch with its environment (or even ahead of it!), quickly realizing what products and activities are worth pursuing, what should be restructured, and what should be eliminated.

For an agile enterprise, however, “being obsessed with customers” has a much broader meaning. Because not every business area is directly facing clients in the market, internal agile teams – e.g., finance and accounting – should maintain a broader understanding of who their customers are. As Rigby et al. (2020) stressed, these teams



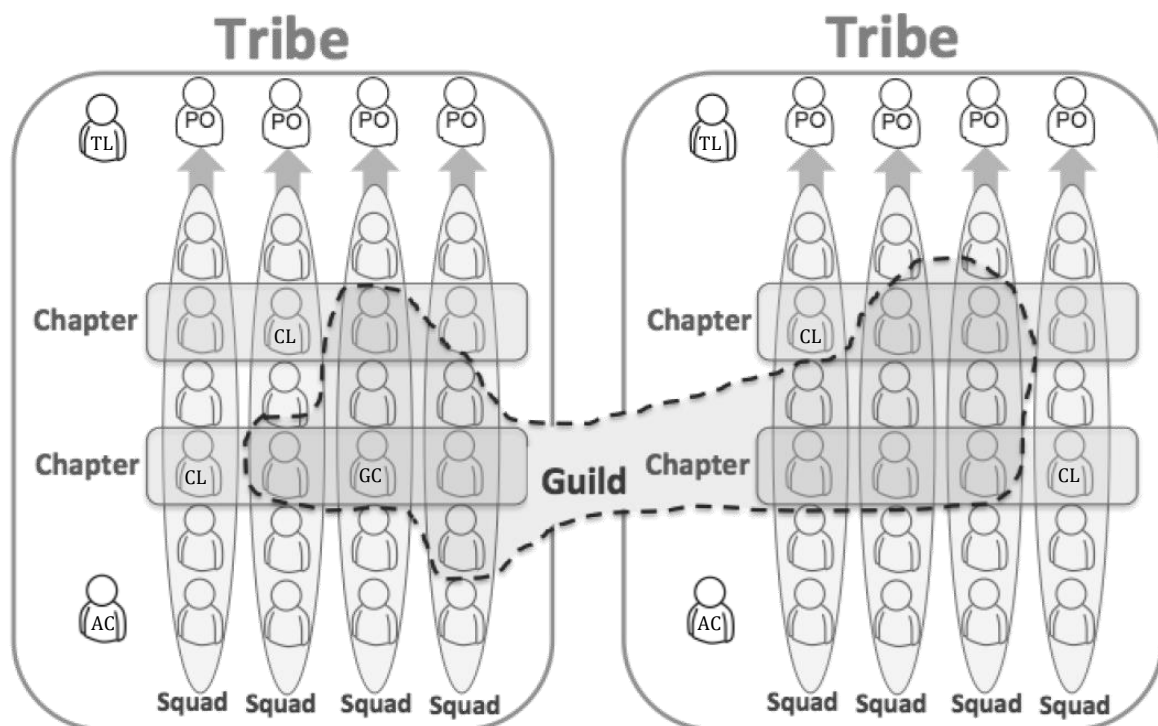
should treat all other internal parties as if they were their own clients. Thus, internal agile teams derive needs and requirements from different business areas and develop an output that will ultimately benefit internal processes, all following the precepts that an actual customer-facing team would.

Second, agile enterprises focus on people and team-based organizational structures. A fundamental principle for an agile player is eliminating hierarchy and functional silos, empowering people, and working in teams. Small autonomous teams whose members possess multidisciplinary expertise are more effective at delivering change and are more productive. Moreover, teamwork does not require heavy and formal means to spread information because teams thrive on ongoing and relatively inexpensive communicational informality, which facilitates knowledge dissemination and improves organizational learning. Ultimately, agile teams who are free to innovate and interact with customers learn fast, digest new information fast, and internalize it – hence, adapt to it – quickly.

Swedish audio streaming company Spotify was a precursor of agile teams. Its organizational design is lauded today as an exemplar framework for companies to adopt agility. The “Spotify Model” essentially represents a less formalized, less bureaucratic interpretation of a matrix organizational structure infused by an agile mindset (Kniberg & Ivarsson, 2012). The basic unit of the model is known as “Squad”. Resembling Scrum teams in a startup company (Subsection 3.3.3), Squads are small cross-functional teams responsible for developing specific elements of a product or service according to customer needs and in light of a long-term mission they have been assigned. Squads are self-managing and autonomous and adopt a variety of agile practices to deliver their output. Each Squad is represented by a Product Owner who aids team members in prioritizing activities (but no authority in how they conduct them) and interfacing with various internal and external stakeholders. Squads can also discuss with an Agile Coach whose role is to facilitate their ways of working. Squads that operate in related customer journey areas are collectively known as Tribes and are represented by a Tribe Lead. Each Tribe – which cannot be larger than 150 people and should be based in the same facility – serves as an informed, collaborative community working towards the same end. At regular points in time, it holds gatherings during which Squads present and discuss advancements in their area. Within the same tribe, Squad members who share similar functional backgrounds meet regularly to discuss their area of expertise and to

self-manage their roles and responsibilities within squads. These people are collectively known as a Chapter and are guided by an internal Chapter Lead. Finally, at times, different Squad members within the same or other Tribes can get together to tap into emerging needs or to address “architectural”, wider-ranging concerns. They are collectively known as Guilds, and a Guild Coordinator leads them. Figure 3.4 provides a visual representation of the Spotify Model.

Figure 3.4 *The Spotify Model.*



Source: adapted from Kniberg & Ivarsson (2012). PO: Product Owner, AC: Agile Coach, CL: Chapter Lead, GC: Guild Coordinator.

The third critical agile principle is to design teams’ activities so that they can frequently and rapidly release working solutions. Put differently, agility demands short cycles of learning and doing achieved by breaking work items down, increasing dynamicity, and prioritizing tasks. In short, companies should embrace working iteratively and address product requirements incrementally.

In terms of practices, agile enterprises retrace successful methods which proved successful in software development. A thorough list was given in Subsection 3.3.2. Here, some of those practices are proposed from the point of view of general management.

What should be overwhelmingly clear at this point is that enterprise agility is about teams – Rigby et al. (2020) actually define agile as “the business philosophy that relies on fast-moving, self-managing teams for innovation”. An ideal agile team gathers three to nine people with different expertise who are devoted full-time to tap into specific customer needs. The team is fully entitled to organize and meet its objectives as it deems appropriate with no external interference other than high-level guidance. Teams can be temporary when they are meant to address contingent issues or be permanent when they fulfill ongoing needs. In the latter case, agile teams can be intended to substitute entire functional areas of a business that used to be managed in more traditional ways. As Spotify demonstrated, agile teams can indeed be scaled to an organization as a whole. When this happens, coordination and hierarchy are substituted by a “team of teams structure”. Multinational component and industrial product manufacturer Bosch, for instance, has long been an advocate of agile, having adopted its principles and practices in several business units of its divisions (Rigby et al., 2020). The company has scaled agile teams from the very bottom up to the executive level. While each team – regardless of its level – is fully autonomous in performing activities, organizational cohesiveness is maintained by having sequential daily teams-of-teams meetings during which team leads discuss progress, escalate higher-level matters, and review backlogs at a progressively higher corporate level. Put simply, each team holds a daily meeting which, in turn, feeds a daily meeting at a higher level.

The way agile teams perform their activities is through incremental and iterative working cycles. During these cycles – commonly known as sprints – teams develop small, self-contained working solutions which can always meet a minimum set of requirements to add customer value. Over the following sprints, teams will add features to the given output based on feedback and new needs. The feedback can both come at sprint ending (review), or it can be the result of having customer representatives present all over the process (“on-site customer”).

Sprints are guided by a backlog which is a continuously updated listing of all output requirements and expectations taken from customers’ point of view. Items on the backlog are also continually re-prioritized so that teams can work on increments that will always provide the highest possible value to customers. Activities during the sprint are also facilitated by having a visual representation of workflow such as Kanban boards

(Figure 3.5) which team members use to divide responsibilities and understand progress towards sprint goals.

Figure 3.5 Example of a Kanban board in a typical office.



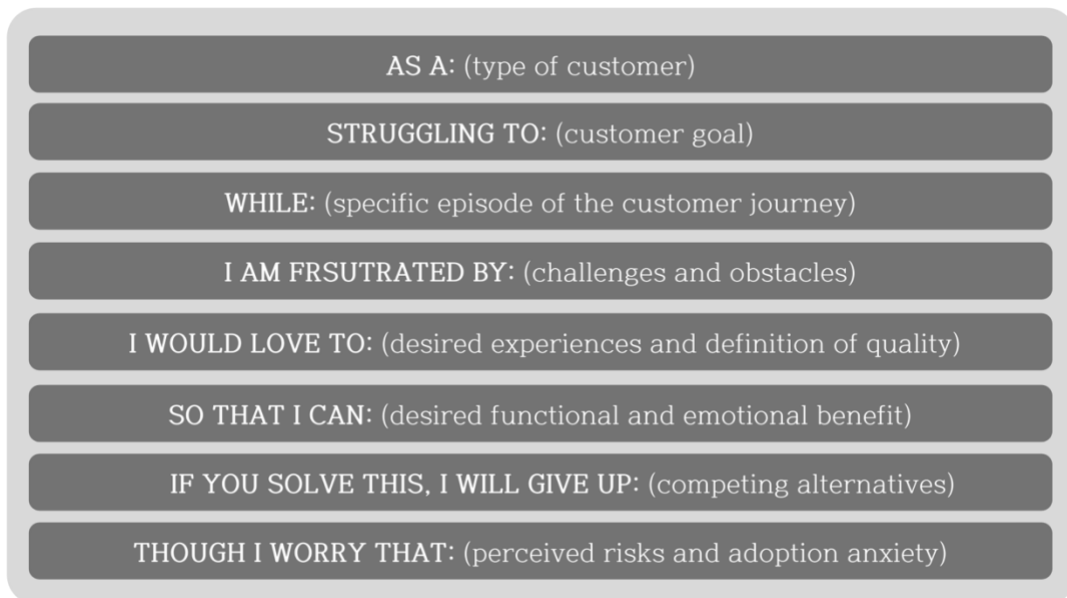
Source: patboard.com. Notes: Work items are represented by rank-ordered sticky notes and clustered in different categories according to their development progress. On the far left is the team's backlog ("BCKLG"), followed by the sprint backlog ("SPRINT") representing the items to be completed over the ongoing sprint. All other items are either scheduled for the present iteration ("TO DO"), they are being done ("DOING", "VERIFY"), or they are completed ("DONE").

To facilitate the drafting of backlogs, agile teams resort to so-called user stories. These are user-friendly, straightforward descriptions of what the customer desires and expects out of a given solution written in a very accessible language. Figure 3.6 provides a mock-up example of user stories.

Other relevant agile practices which are meant to increase tacit knowledge dissemination and increase transparency are regular meetings with time-boxed duration and scheduled agendas. Daily meetings – also known as standups – are 15-minute gatherings for team members to discuss prior increments, highlight roadblocks or bottlenecks encountered, and coordinate the way forward during the sprint. Reviews (or demo meetings) and retrospectives are two types of longer (three to four hours) meetings held at sprint end. The former is meant to present and release the working solution developed during the sprint, discuss it, and receive feedback from a wide audience (customers and other internal or external stakeholders). On the other hand, retrospectives are more “intimate” meetings where team members can reflect on their

performance during the sprint just concluded and advance ways to improve in the future.

*Figure 3.6 Mock-up of a user story.*



*Source: adapted from Rigby et al. (2020)*



## **CHAPTER 4. Why Does A&E Need Agility?**

### **4.1. Overview**

The whole construction value chain (CVC), inclusive of the A&E segment, represents a rather mature ecosystem tied to relatively traditional management schemes. Construction – being a very consolidated industrial endeavor – can be subjected to significant organizational inertia when it comes to business environment change or technological advancements. Similarly, the average actor in the chain is typically bound to traditional governance schemes, which have been only marginally affected by new business management trends. This is especially so in the A&E segment where, historically, players recognize themselves as professionals or professional firms and – as such – diametrically opposed to managerial arrangements.

The purpose of this chapter is to give an account of the major challenges that A&E firms are facing both in terms of management and governance and in terms of reaching production efficiency. These challenges are then assessed through the lenses of agile values, principles, and practices with the ultimate goal of providing a consistent answer to the question “why should A&E companies turn to agile?”.

The investigation presented will uncover how a managerial tension that elaborates on professional service firms' history and customs needs to be solved in the A&E sector. On the one hand, solo practitioners and a large share of small firms appear to be tied to traditional schemes which derive from the elitist treatment that most jurisdictions around the world have given professions. On the other hand, some small- and medium-sized A&E firms, as well as the most prominent players in the sector, have turned to modern approaches to conduct business inspired by the mainstream management discourse and in-synch with developments in the business environment.

Additionally, this chapter will show how the characteristics of the services provided by A&E companies determine organizational issues in so far as knowledge intensity needs to be managed to address informational asymmetries suffered by customers and increased bargaining power of professionals relative to their company.

Finally, a brief overview of the managerial consequences of A&E companies being part of an intricate value chain will be discussed. A careful analysis of the network of players

and some kind of supply chain management is believed to make the job of A&E companies more effective and improve outcomes.

For each of these types of problems that A&E companies face in the way they do business, the second part of this chapter will try to find possible answers that agility can provide.

## 4.2. Understanding the Challenges in the A&E Sector

### 4.2.1. Professional Service Firms. Professionalism *versus* Managerialism

#### 4.2.1.1. *Traditional View*

Among the challenges that players in the A&E sector have been facing, lack of management and strategizing appears to be the most relevant. Section 2.5 of this review briefly touched upon the subject making general reference to several obstacles that could hinder a “managerial transformation”. The virtual absence of a structured management discourse in A&E is, indeed, critical for the sector’s path to growth, and a further investigation of the underlying causes for its presence can provide potential solutions going forward. Dimensional issues have been first considered as a contributing factor to the problem. As Italian A&E firms are mostly small-sized (see Subsection 1.3.2), the lack of formal control and governance mechanisms appears to be a direct consequence. After all, when a company employs a limited workforce and operates at a small scale, it naturally needs minimal managerial setup such as hierarchy and bureaucratic control mechanisms – it can, instead, rely on informal networks to conduct business. Nonetheless, it can be contended that dimensional factors only partially explain the point in question, or they can actually be symptomatic of a deeper issue. In fact, a more complete answer to the dilemma can be found by looking at the history and customs of the A&E sector in relation to similar occupations in the market.

Architects and engineers, just like – among others – lawyers, physicians, and chartered accountants, belong to a relatively distinctive and “self-contained” segment of the business world, that of professions in the service sector. Professional Service Firms (PSFs) conform very little to the mainstream management body of knowledge as, historically, they have been given special privileges by governments and societies that



differentiate them from incumbents in other industries and other players operating in the market economy. Only in the latest decades have PSFs turned their attention to organizational matters and managerial discourse as exposure to competition increased. Nevertheless, ties to traditional ways of doing business remain strong, and most PSFs – including A&E companies – are facing the tough duty to balance the extremes.

In general, the term “professions” is used to identify those occupations that present three essential characteristics: its representatives possess high educational qualifications, the market where they operate is strongly regulated, and workers comply with shared and codified job ethics. First, before practicing, professionals must have achieved specialized educational standards that are supposed to provide them with the necessary foundations to perform particularly knowledge-intensive tasks. This practically translates into professionals having to successfully complete several years at university and training on the job. Practicing physicians, for instance, can perform their occupation only after they have strengthened their expertise over – typically – more than a decade studying and perfecting the subject inside academia and on the field. The same is true for architects and engineers who both have to conclude university and work as apprentices for a certain period of time. Second, the environment where professionals operate is typically subject to tight normative restrictions and legal obligations, which – in several forms – are meant to protect the rights of incumbents, their clients, and society at large. In most jurisdictions around the world, professionals are forced to sign up to a system of registers (also known as “orders”) which public bodies or professional associations actively control. This means that acquiring educational and training requirements are not enough to obtain formal credentials to operate because access to professional registers can effectively be limited or barred. In the case of architects and engineers, access to their respective professional orders is conditional on passing a national examination. Besides these restrictions – that effectively enforce a sort of oligopolistic market – other binding rules have been historically actively shaping PSFs business life. To name a few, regulations typically prohibit PSFs from advertising their organization or offering more than one type of professional service at the same time. For instance, a PSF selling accounting brokerage could not provide law consulting even if its associates were professionally qualified to. On top of that, rules are frequently in place to establish minimum and maximum fees that the firms can charge their clients. Finally, even in areas that are not covered by

legislative constraints or in jurisdictions where normative requirements on professions are looser, professionals still need to abide by socialized principles that are actively enforced by professional codes of conduct. These behavioral charters explicitly define ethical thresholds and boundaries that professionals adhere to when practicing their jobs.

This brief overview made clear that professions are granted many privileges and obligations that may seem somewhat disproportionate or – one may argue – even illiberal. Actually, their rationale relates to the fact that historically most professions were thought to be of public interest. Consequently, governments were rather accommodating in providing legislative instruments and constraints that protected professionals from pure market competition. The idea was that – absent them – incumbents would have been pressured by market logic to undercut competitors in an attempt to maintain their market share, thus delivering suboptimal output that would ultimately damage clients but also society at large. Today, many of these privileges and obligations appear outdated or unfair. In fact, in several countries and jurisdictions, they are being lifted or progressively abandoned as today's business environment has made them obsolete or ineffective. Nonetheless, even where this system of benefits and constraints is being dismantled, its legacy looms large in the way PSFs do business to this day.

Von Nordenflycht (2010) argued that a professionalized and “educationally elitist” workforce, a strong ideology, and a market that remains mostly self-regulated and oligopolistic are essential factors to understand the way PSF traditionally compete. Shielded from pure market competition and influenced by ideological preconceptions, PSFs followed different logics to organize work and control workers. These approaches generally stressed autonomy, trust, commitment to competence, and quality. All values which have been associated with the concept of “professionalism” as opposed to the notion of “managerialism,” which – instead – stresses control, authority, efficiency, and result-orientation (Noordegraaf, 2015). Some sociological tradition expressly argued that the principles of managerialism and exposure to market logic could threaten the ideological constructs on which professions are founded, thus diverting PSFs' attention from optimizing propositions for their customers and society. Institutional theory analyzed the concept in a similar vein, arguing that professions ought to be defended from competition as they are “crucial for organizing non-routine tasks that require

expertise, individual autonomy [...], and legal and ethical responsibility” (*Ibid.*). More recently, authors who discussed management issues in A&E (see, for instance, Manzoni et al. [2014]) added to the same argument contending that reluctance to address organizational and strategic matters derives from professionals’ belief that their primary responsibility is to handle creative and aesthetical issues (architects), or technical and physical parameters (engineers) – not running business operations. Put differently, professionals tend to assume that time spent structuring their firm, organizing a coherent business model, or strategizing is wasted time that could have been put to best use working on a project’s plans and specifications.

The tenets of professionalism and the traditional view on the role of PSFs play have naturally reflected in the way they have historically organized. Greenwood et al.’s (1990) archetypical P<sup>2</sup> (i.e., professionalism and partnership) organizational model provides a compelling depiction of this approach. P<sup>2</sup> businesses are organized as partnerships among professionals who are each simultaneously managers and workers in the company. This means – as Brock (2006) described – that professionals not only own the business, but they also run its day-to-day activities and actively provide services to customers. Governance considerations such as efficiency and effectiveness are not the primary goals of the P<sup>2</sup> firm, which, instead, intends to create an internal environment that nourishes professional skills and the development of new knowledge over new projects and jobs (Pinnington & Morris 2002). In this matter, partners’ guiding principle is applying complex competencies to complex customer requests, which they do by engaging in a high degree of customization. Although, given these values, it would be rational to expect an ongoing synergic interaction across associates, in a P<sup>2</sup> PSF, each “professional-owner-manager” typically works independently from one another both in terms of clients which they serve and projects in which they are engaged – thus, each professional’s occupation is, in fact, fully self-contained. Unsurprisingly, strategic direction is weak because no partner finds time to discuss it as they are actively involved with many clients and projects most of the day. If ever some time is spent strategizing, the process is lengthy as it relies on building consensus among peers who may have different and conflicting views. In any case, long-term decision-making seldom relies on rational analyses but, instead, considers contingencies and one-off business opportunities. Similarly, there may be minimal emphasis on marketing or financial indicators both when planning and during implementation of new strategic decisions –

something which impairs the possibility to track progress or review effectiveness and results. While these types of activities could be delegated to non-professional workers, P<sup>2</sup> firms seldom give away power and, where non-professionals are employed, their role is marginal and generally attains to maintaining working facilities or providing support on mundane and administrative tasks. Because P<sup>2</sup> PSFs are usually small, there is no formal hierarchy, while coordination and control are kept by leveraging professionals' skills and reinforcing a clan-like organizational culture that embodies the values of professionalism at the expense of formal supervision and result-oriented control (Brock, 2006). Insufficient attention to control can also be witnessed by unstructured differentiation, which is not based on internal synergic considerations but rather on the interests of each partner-professional themselves (Pinnington & Morris, 2002).

#### 4.2.1.2. *New Trends*

Professionalism and the P<sup>2</sup> form may work well in the protected business environment which PSFs have been used to. Today – as externally-enforced safeguards are progressively disappearing – they are much harder to apply. As Pinnington & Morris (2002) argue, the elimination of strong legal boundaries, the disappearance of instruments of social closure, increased consumer pressure, and the “marketization” of the relationship between customers and professionals have been progressively deteriorating traditional organizational models while nudging PSFs towards market economy schemes and the pursuit of customers' material interest (*Ibid.*) Several factors are indeed forcing PSFs to turn to managerialism precepts and look at the mainstream management body of knowledge for guidance. According to Brock (2006), three essential drivers are speeding up this transition. First, since the 1980s neoliberal wave, professions have undergone a process of deregulation in the form of reduction or removal of statutory protection such as lowered entry barriers for newly graduates, lifting of advertising bans, or the possibility to offer multiple types of professional services at the same time. As a result of these transitions, competition and rivalry in the professional market have increased, and – with new and more modern PSFs entering the market – incumbents can no longer overlook structural efficiency, business development, or marketing activities. At the same time, they need to turn to potential factors that could bring a competitive advantage, such as technological renovation or a

wider territorial presence. Second, technological developments have changed how professionals perform their jobs. Time-consuming intellectual tasks have progressively diminished, being replaced by algorithms and computing. This resulted in a significant change in the competitive outlook. Entire segments of the markets have been commoditized or wiped out, and poorly technologically advanced players have been pushed out of business. In their place, PSFs that could offer consultancy and brokerage activities have been thriving. At the same time, digitalization changed PSFs' demand-side given the increased sophistication of their potential new customers. As new technologies offer consumers the opportunity to shop around more effectively, PSFs that are inefficient and not competitive hardly ever can hope to attract new clients. Finally, more demanding customers and globalization of services mean that customers can source services from all over the world, and providers can follow existing customers abroad. Globalization also resulted in competition across legislations, hence PSFs who operate in heavily protected ecosystems are unlikely to gain an advantageous position relative to foreign incumbents when legal constraints are lifted.

Ultimately, shifts in the business environment force PSFs to resemble other profit-seeking organizations. This means that the traditional P<sup>2</sup> archetype is being substituted by a new model which Cooper et al. (1996) labeled "Modern Professional Business" (MPB)<sup>20</sup>. The guiding principle of an MPB is that a professional firm can be more effective only if it is properly managed and if it looks at rationality and productivity. Reaching efficiency in processes and operations is an important matter, just as adopting marketing policies or engaging in long-term decision-making, such as strategic options (Pinnington & Morris 2002). Weighing strategic options is also made more rational by making explicit reference to financial and other indicators when planning and implementing courses of action. MPBs are more centralized. They make use of division of labor MPBs and cross-functional teams to achieve synergies. Rules are enforced on the basis of bureaucratic control and performance appraisal systems, meaning that productivity and output metrics need to be actively collected and analyzed (Pinnington & Morris 2002; Brock 2006). Hierarchical structures are implemented, and formal reporting lines substitute informal links with senior and executive roles at the top. This arrangement prevents professionals from taking diverging paths or isolate from the

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<sup>20</sup> Later Brock (2006) would elaborate on an even newer form which he labelled "Global Professional Network"

corporate in ways that could harm synergies. MPBs employ several non-professionals who can aid experts in managing projects and strategize. Formally, MPBs are corporates instead of partnerships. Increased cost structures, indeed, force firms to consider incorporating as a way to raise additional capital. With the risk of being sued for malpractice being higher, the corporate form also allows partners to be shielded from illimited liability.

#### 4.2.3. Managing Knowledge Intensity

The previous subsection stressed the heritage elements that influence the way PSFs conduct business. Even when PSFs adopt new management layouts, they still have to deal with particular issues related to the type of propositions they offer. PSFs are not like regular good-producing organizations or other service providers such as high-tech companies or software developers. PSFs are characterized by essentially three critical aspects that accrue to the fact that they belong to the world of professions. First, they deal with intangible inputs and outputs that are “encoded with complex knowledge” (Greenwood et al., 2005). For example, in A&E, although the firm ultimately delivers concrete building plans, their offering is intimately a service. This all the more so if one considers that increased value in A&E offerings can only result from an ongoing interface between designers and clients. Second, the offerings are rarely fully standardized, but rather each proposition needs to be customized for each new client. Third, their primary asset is a highly educated workforce which by and large demands autonomy and rejects bureaucracy stifling conditions.

A key feature of PSFs is, thus, their knowledge intensity. A knowledge-intensive business is one where workforce skills and experience are critical to running the company and where robust knowledge management systems need to be in place to operate efficiently and smoothly. In the setting of PSFs, knowledge intensity has been described as leading to two main consequences which may affect management decisions. First, because a PSF systematically deals with informational contents which require substantial prior literacy to be decoded, a significant informational asymmetry exists between professionals and clients, resulting in a condition whereby the latter perceives “opaque quality” (von Nordenflycht, 2010). Consider the case of a customer discussing the design of a building with an architect or assessing preliminary engineering plans. Unless the customer

possesses some background knowledge, they are very unlikely to fully understand what is being examined. Potential issues can go undetected, and mistakes are carried over downstream in the project so that when discrepancies are eventually found, it is too late to make amends. Worse still, the customer may be unable to attribute blame for the issue given the number of actors involved and the different stages the project has gone through. This means that when consumers have to deal with PSFs, they are frequently unable to assess their counterparts' relative quality or competence before the ultimate conclusion of a transaction (and maybe not even then!). Likewise, the PSF cannot rely on objective metrics to exhibit its alleged superior position and competitive advantage – the customer is unlikely to possess the means to judge them appropriately. While, at first sight, and in light of traditional economic discourse, this unbalanced condition should play in the PSF's favor, in reality, the asymmetry can endanger firm-customer trust and, more broadly, the wellbeing of the market. To attenuate the issue, PSFs have to resort to other indirect hints to signal quality, such as leveraging their public status and appearance, or more generally, advertising elements that provide “social proof of competence” (Greenwood et al., 2005). These could range from very mundane aspects – such as employees' dress codes, the strategic location of offices, and aesthetic qualities of the premises – to more formal hints like case histories, referrals, partnerships with recognized brands, or other kinds of certifications. Alternatively, the PSF may consider contractual or normative requirements to further express their commitment to clients. For example, they may introduce clauses that punish suboptimal qualitative results or enforce strict codes of conduct beyond the ones that are already mandated by law (von Nordenflycht, 2010). According to Greenwood et al. (2005), any PSF ultimately wishes to increase its reputation in the market in an attempt to institute a virtuous cycle whereby it can attract talents, decrease non-value-adding expenditures (e.g., marketing), reach new clients, and charge premium prices. On the negative side, though, PSFs need to be aware that thriving exclusively on reputation can divert attention from other relevant organizational issues while also imposing limits on a firm's strategy, especially when it comes to differentiation. For instance, unless the company differentiates in related business areas and advances a balanced portfolio to the market, there is a risk that consumers perceive the firm's lateral proposition to be suboptimal or only incidental, to the detriment of reputation and, thus, appeal to new clients. What a PSF can learn from this is that differentiation does not originate from technological complementarities or

synergies as in traditional business but can only be sustained by perception and reputation in the market (*Ibid.*).

PSFs' knowledge intensity, however, can also result in other internal dynamics that are worth considering. Because knowledge ultimately resides in people, PSFs are firmly dependent on their human resources – their skills and experience – to effectively translate inputs into output and, hence, remaining competitive and thriving in the market. A highly educated and trained workforce is needed to encode clients' requests and effectively customize offerings. Thus PSFs are continuously on a quest to acquire and retain talents that could bring the firm a competitive edge. This condition, however, results in the potentially unwanted side effect in so far as each professional is invested with increasing prominence to exercise disproportionate power over the corporate. This, again, is a problematic asymmetry following the knowledge-intensity of the PFS which needs careful management, especially during economic surges or an active labor market when PSFs may find themselves in the position of having to cope with high mobility and relatively weaker bargaining power. As a matter of fact, not only does this put pressure on financials (i.e., higher salaries to pay), but it also endangers the firm's matured expertise pool if workers threaten to leave the company and “bring tacit knowledge with them”. Consequently, the corporate is forced to be more condescending to its workforce to the detriment of tighter control or centralization. Von Nordenflycht (2010) defined this managerial issue as “cat herding”, meaning that coordinating intellectually skilled human resources is especially cumbersome when people have a strong moral stance, significant outside options, and a strong hold over the firm. In such circumstances, PSFs are forced to accommodate professionals' desire for more autonomy cutting formal organizational processes and hierarchical control that would stifle independence or, worse, act as incentives for workers to leave the company and possibly bring clients whose trust they won along with them. Conversely, PSFs should thus give in authority and bureaucratic restraint in favor of greater decentralization, loose reporting schemes, and stronger empowerment while leading on the basis of coaching, nudging, and persuading. Of course, this is no easy transition, particularly when the firm could have seized additional benefits from centralization such as higher efficiency, potential synergies, and increased organizational learning – this tension has been thoroughly discussed in the previous subsection. As a consequence, workforce dependence and cat herding issues force the PSF to find the right balance between



autonomy and control. Simultaneously, were the firm solutions to be ineffective, PSFs should address another pernicious problem, knowledge management. As briefly introduced in Chapter 2, coordination, knowledge dissemination, and organizational learning are frequently lacking in A&E and PSFs. A robust knowledge management system can substitute centralized processes while also improving the diffusion of skills and competencies and avoiding knowledge pitfalls if professionals leave the company.

#### 4.2.3. A Look at the Construction Value Chain. Productivity and Efficiency

A parallel challenge for the A&E sector can also be found by taking a broader look not only at similar industries but at the construction value chain (CVC), in which players in the industry typically operate. A famous work by the McKinsey Global Institute (2017) investigated the big problem of poor productivity growth in the CVC and advanced potential solutions going forward. Although this work was clearly centered on the whole value chain and frequently focused on construction in a strict sense, it described several pain points and suggestions on how to solve them, which also affect the A&E sector. After all, Subsection 1.3.1 of this review described how direct interactions among players in the supply chain are increasingly tighter to revive the construction industry by shortening project durations and exploiting synergies earlier on.

The CVC is both heavily regulated industry and highly dependent on the public sector for sustained growth, it is highly cyclical (see Subsection 1.4.1), several segments of the chain are struck by heavy recourse to informality or corruption, and most involved sectors comprise a large number of small players which are frequently poorly efficient. A fragmented industry with undersized actors, indeed, is unlikely to benefit from scale economies. While this may be self-evident in capital-intensive segments like pure construction works, this also holds for A&E firms where a larger workforce and project scale can benefit experience curves and improve knowledge and learning. On top of purely economic benefits, more prominent players also take advantage of improved reputation in the market (cf. 4.2.2) by leveraging extensive experience and many clients to be held as evidence. On the other hand, small players are left with inefficient scale economies, poor reliability in the market, more mundane tasks and projects to work with, and, ultimately, no incentive to adopt more sophisticated techniques or means. All these factors affect the chain's productivity, especially because the market becomes

opaque and contractual agreements between suppliers and buyers allocate risk and reward ineffectively. Directly related to that, the industry ends up suffering in terms of delivery time and performance results which are also exacerbated by failure to apply project management systems appropriately and employing a workforce that may “suffer” from skill mismatch. Not surprisingly, these circumstances end up squeezing CVC margins and, consequently, propensity for players to make productive investments or innovate.

The McKinsey Global Institute report (2017) lingered on some crucial aspects of the CVC that affect productivity. A summary of them is given in Table 4.1.

*Table 4.1 Major pain points and challenges in the CVC and the A&E sector.*

<b>Pain point</b>	<b>Description</b>
Increasing project complexity	Larger and more complex projects – mainly in the non-residential or infrastructural segment – are becoming the norm. Achieving timely and qualitative delivery requires increased attention to coordinating among all players involved in the supply chain. Notably, even small projects may lead to coordination problems as the technical features of buildings and customers' demands are becoming more sophisticated. Just as complicated are repair and renovation work which in developed economies like Italy are increasingly common as the existing obsolete infrastructural system needs updates. Designing and engineering in such projects are made complex by several environmental constraints that condition activities and tasks.
Extensive regulation	As the CVC is highly regulated, bureaucracy is frequently a problem insofar as it causes delays (e.g., long times to get public approval) and hinders seamless coordination among the actors and stakeholders involved while also causing increased uncertainty. The problem is exacerbated when public bodies commission these works as they typically enforce tighter constraints.
Informality and corruption	Extensive regulations and bureaucracy in the form of a number of expensive and time-consuming approvals and inspections can have the undesired side effects to incentivize informality and corruption in an attempt to (illegally) cut the corners. Resorting to informality ultimately discourages players from making investments, especially when it comes to the workforce.
High fragmentation	The CVC is dominated by small players with poorly sophisticated means and outputs. Limited size hinders the possibility to innovate, while geographical dispersion and customized output do not drive players to seek higher efficiency. Because the industry is frequently very opaque from the customer’s point of view, there is no further incentive to improve productivity to reach a competitive advantage.

Pain point	Description
Misaligned contractual structures and incentives	Studies have shown that contractual structures across players in a construction project supply chain affect productivity. On the one hand, compensation schemes such as lump-sums are typically more efficient and effective than cost-reimburse, which instead incentivizes slack. On the other hand, contractual agreements that inappropriately spread risks and responsibilities across participants or do not contemplate cooperation elements frequently lead to less productive outcomes and increased litigation as players' interests are misaligned.
Inefficient design process and investment	<p>A&amp;E activities seldom resort to standardized plans and specifications, preferring to customize every element of new projects they take up. This tendency drives productivity down while affecting profit margins due to increased costs which could have been avoided. Although standardization may be seen as tasteless or poorly appealing in some market segments, there are indeed components that can effectively be modularized without affecting aesthetic qualities.</p> <p>Another issue in the A&amp;E sector is the significant gaps between the ending of design activities and the beginning of actual construction, which results in wasted time, lost knowledge, and poor continuity – also factors dampening productivity. This gap, however, is not only intertemporal. As discussed in 1.3.1, traditional delivery methods do not contemplate an active interface across A&amp;E, owners, and building contractors. This chasm can compromise the effectiveness of designers' work in the later stages of the project while giving them undue responsibilities. While integrated project delivery methods are the optimal solution, a partial fix can be obtained by giving more time and attention to design phases to address even the most subtle customer requests, design elements, and external constraints. This will avoid significant rework, construction mistakes, and time and cost overruns.</p>
Suboptimal owner requirements	When owners commission building projects, they are seldom fully aware of contractors' quality because they know little about how the industry works, and prior market experience is likely minimal. Frequently, owners have not formed a complete idea about their desired outcome or cannot effectively spell it out. Both circumstances are likely to result in built assets that do not live up to expectations, especially when – as it is often the norm – dialogue between owner and any of the construction industry players is very sporadic after project inception.
Underinvestment in digitization and innovation	Players in the CVC systematically underinvest in technology and digitization. Technological take-up, conversely, is expected to improve stakeholder interactions and knowledge management. Even where players adopted digital tools, there are still obstacles in so far as unmatchable technological ecosystems are used across players in the supply chain.

*Source: author's elaboration on McKinsey Global Institute (2017).*

### 4.3. The Role of Agility

#### 4.3.1. Agile in the A&E Management Transformation

The description of the A&E sector given in the previous sections and sparsely in other chapters of this review portrays players in this segment of the economy as being on the verge of a fundamental organizational decision. On the one hand, they may stick to a very traditional evolutionary path tied to the concept of professionalism but bound to ultimately become obsolete as the market is increasingly liberalized, rivalry expands, and the business environment evolves. On the other hand, A&E firms can embark on a more challenging but prospectively brighter journey that entails a management revolution and the departure from the “peaceful isolation” within the protected professional environment that is quickly becoming unviable even in fairly conservative business settings like the Italian one. As risky as it appears, the latter option is the only one that can provide the means to achieve sustainable growth for players in the sector. Still, it is also a hard choice in so far as it has to overcome organizational inertia and oppose professionals’ ideological priors. It is in the midst of this organizational transformation that A&E companies can consider organizational agility and agile principles or practices to ease the transition and achieve profitable outcomes.

As professional markets are progressively encountering deregulation, A&E firms face the pressing necessity to adapt to market volatility and elaborate organizational structures and strategies that can cope with new competitors, emerging threats, and new opportunities in the market. At a high level, this resembles the motives behind agile transformation (Section 3.2). Just like in other industries, A&E companies are experiencing more substantial environmental turbulence than in the past. Consequently, players are required to possess capabilities to understand said market dynamism, possibly anticipating its evolution and devising appropriate and timely reactions that could provide a competitive edge. Put differently, sensing and responding capabilities – the heart of agile thought – are increasingly relevant for firms in the A&E sector because higher sector rivalry and new, more efficient entrants compel them to find new and better ways to meet changing customer needs while seizing opportunities and fending off threats. Agile capabilities, such as the capacity to react to market dynamism by being proficient at change while having an organizational structure that can easily be

reconfigured (Subsection 3.2.3), are fundamental to cope with increased uncertainty which is further exacerbated by technological developments and innovations in the digital domain. Possessing agile capabilities means being able to tame environmental advancements that – if left unattended – could disrupt A&E activities and related working processes, reducing players' competitiveness. Thus, an agile A&E firm that can master change also acts as a game-changer for the entire sector by outcompeting incumbents or new entrants through adaptation and innovativeness. At a strategic level, organizational agility dictates to “enrich the customer” and being “obsessed” with them. A&E firms should hence be wary of their market demand and understand what type of developments occur in there. Digitization of services and the creation of virtual marketplaces have been reducing consumers' informational asymmetries and arming them with effective instruments to shop around for the best and least expensive propositions. The fact that A&E offerings – by their very nature – are poorly standardizable and highly customized should not deceive businesses into avoiding marketing expenditures and related customer-centric activities because consumers today actively look for data and information to compare different players while seeking physical or virtual touchpoints with them. To this end, an agile A&E firm maintains close contacts with current and prospective clients so as to cater to their needs and meet project requirements more effectively. This is especially relevant when – as it is common today – consumers' requests become more sophisticated but still ill-defined in the early stages of development. Therefore, having customers' voices heard regularly prevents designers from missing potential needs that remained latent at first but emerged only as time went by and initial project plans and specifications become clearer. Strikingly, increased recognition of customers as active players in the design development process brings about side benefits. A company that is seen as caring for its clients is very much likely to experience higher retention and loyalty, improved satisfaction, and ultimately enhanced reputation in the market.

Introducing agility in A&E can also have an additional set of advantages because it can act as an instrument to obtain organizational ambidexterity. Indeed, businesses in the sector need to achieve a level of flexibility that is strong enough to address internal tensions that derive from conflicting interests across professionals with one another and between human resources, in general, and the underlying corporate structure.

The assessment that opened this section might have given the impression that A&E firms should pursue the principles of managerialisms and the logic of organizational hierarchy or bureaucracy no matter what. In reality, this statement may be too trivial as the world of architecture and engineering cannot possibly base decision-making on a blind pursuit of profit maximization or production efficiency as most other businesses in the economy – such as mass manufacturers – would do. The services they provide are too tightly tied to knowledge-intensive processes, they are extensively customized, and they frequently have a public good character. Moreover, output is repeatedly influenced by creative and aesthetic considerations which move past pure market or efficiency logic while lingering on qualitative requirements. These factors counter standard management or organizational arrangements. As Manzoni & Volker (2017) argue, A&E companies are used to experiencing these types of tension, especially when architectural-artistic projects make up a large share of their product portfolio. However, the same unbalanced condition also emerges if engineering tasks require a level of technical or professional attention that is incompatible with management processes and timings. To counter these tensions, the firm needs to develop ambidextrous competencies such that artistic and technical consideration can complement the quest for higher economic performance, efficiency and aesthetics can coexist, financial goals and desire to meet ever-new qualitative and proficiency benchmarks can coalesce. From a strictly economic perspective, balancing these extremes is especially important because it ultimately affects the A&E firm's sustainability over its lifecycle existence. That is because overlooking efficiency and productivity can impair the company's profitability in the short term. It disrupts cash flows and forecloses the possibility of committing sums for future investments. Conversely, when an A&E firm neglects artistic or technical proficiency in developing projects, it can jeopardize its long-term survival because it is effectively disregarding those explorative activities or experimentation beyond current business scope that can bring new knowledge or innovativeness to the system or improve the company's reputational standpoint in the market. Thus, according to Gotsi et al. (2010), the arduous duty of A&E companies is to encourage designers to switch back and forth between their professional role – where artistic or methodical aspects naturally dominate – and clerical or consultancy chores that are meant to follow up on business-related matters (Manzoni & Volker, 2017). In other words, more broadly, balancing A&E firms' opposing forces has to do with addressing

designers' preferences for higher autonomy, individualism, and commitment to competence which frequently undermine corporate concerns for attaining internal synergies and higher efficiency, which, instead, would come from division of labor, departmentation into organizational functions, and a result-orientation working approach.

In this organizational dilemma, agile is found to fit perfectly. A core principle to bring agility to the company is indeed that of empowering people and giving precedence to human interaction over bureaucratic processes and rigid control mechanisms. At the same time, however, agility is not anarchy because softer forms of governance and a lead-and-collaborate arrangement are enforced. Put differently, agile can introduce a mild structure and discipline without hindering the creative and autonomous qualities needed for architecture and engineering activities to thrive. This is achieved by organizing people into self-managing, cross-functional teams that can bring different expertise "to the game". A team-based organizational structure is flatter, poorly hierarchical, and sufficiently decentralized, thus countering the archetypical A&E firms where, instead, power is given away to single individuals. That is, competencies and tasks are still divided or delegated but at a group level. Moreover, routinizing teamwork – i.e., having designers with different functional backgrounds collaborate on the same project – eliminates risks that any professional pursue their own material interest or that their attention diverts from core project targets out of some unnecessary quest for aesthetic or technical sophistication. Where coordination is needed, synergies with other parts of the business are requested, or the corporate expects to economize on centralized business processes, agile suggests appointing liaising roles such as product owners (cf. Scrum) who can act as the teams' project managers (PM). They will be responsible for coordinating team activities while easing dialogue with clients and intermediating with senior associates or partners at executive level. Importantly, PMs refrain from micromanaging their subordinates focusing, instead, on coaching and diffusing a sense of purpose as well as transmitting the company's values and mission.

As the previous lines suggest, introducing figures like PMs and separating teams of designers – who are responsible for day-to-day operations – from executive roles frees up time for the latter to dedicate to long-term organizational issues. While senior associates may have a professional background, their occupation is no longer tied to designing but, instead, it is focused on planning and strategizing. Therefore, an agile A&E

firm goes beyond being an organization “for professionals by professionals” (Brock, 2006), contemplating non-professional jobs and distancing executives from operative roles into managerial functions. People at the top of an A&E company can now dedicate time and effort to think about “the big picture”. That is, instead of being actively absorbed by everyday issues and frantically run after contingencies as they arise, they can now analyze environmental trends and new consumer needs in a more structured way, defining the company’s mission and values, devising an effective business model to reach untapped opportunities and developing new courses of action in the face of uncertainties or threats – in a word, they can strategize. Because mundane designing activities are entirely delegated, their involvement with junior architects and engineers may be limited to coaching or mentoring while indicating a “North Star” that can guide them towards a common destination.

#### 4.3.2. Agile to Manage Customers and Workforce

As Subsection 4.2.2 made clear, A&E companies also have to address organizational issues that arise from their high knowledge-intensive business. On the one hand, governing knowledge intensity may be an arduous task because it affects the firm’s approach to market its value proposition and the type of relationship it has to create with its customers. On the other hand, a knowledge-intensive company is also one where workforce has a proportionally greater bargaining power that limits the extent of bureaucratic or hierarchical control that the corporate entity can exercise. However, introducing agile principles and practices can prove an effective instrument to attenuate both these tensions caused by knowledge intensity.

As for the demand side of the market, A&E companies require tools to soothe informational asymmetries between professionals and their clients. Because rarely does the customer have enough prior literacy to decode the informative content enclosed in designers’ plans and specifications, the firm has to devise strategies to eliminate or curtail the resulting perceived opaque quality using means other than infrequently sharing too formal work-related metrics. Absent any form of intervention, there is a high chance that designers and clients misunderstand each other when defining the characteristics of the built asset and its functional features. This may be very risky as it can compromise the final value of the asset or, at best, lead to frequent redesigning,



which may drive up costs and overwhelmingly delay actual construction phases. Worse, when an A&E firm systematically overlooks this asymmetry and solutions thereof, its reputation in the market may be at stake.

This customer-firm divide has been extensively discussed in the agile software development literature (see Subsection 3.3.1). In that setting, unresponsiveness to the client and the systematic tendency to miss product requirements or expectations due to incomprehension between developers and customers were among the reasons why traditional plan-based development methods became untenable and were soon abandoned in favor of agile. Since similar problems seem to apply to construction projects and other A&E activities, introducing agile methods also in this sector may be beneficial.

One of the core values of agility is, indeed, to engage the customer and collaborate with them regularly instead of resorting to rigid contractual arrangements and obligations. This is accomplished if clients' voices are heard, and a permanent interface between them and the company is realized to receive constant feedback and adapt project development accordingly. Similarly, the A&E firm should commit to delivering prototypes or smaller working solutions – such as using modularized plans – earlier on with the intent of increasing customer satisfaction and engagement. For instance, introducing iterative designing may actually diminish the period between project inception and the ultimate handover of plans and specifications. In other words, short working cycles effectively break the design process down into small and recurrent deliverables. At each iteration, architects and engineers get to talk to the customer and discuss new requirements or re-prioritize design elements that need to be devised in subsequent work cycles. A&E firms may also consider using user stories (refer to Figure 3.6) to facilitate communication and convey designing requirements in a “language” that any of the involved parties can access and understand. Moreover, using Scrum's Sprint approach (Subsection 3.3.3), much of the asymmetries between designers and clients are eliminated because at regular intervals review sessions are held where project advancements are shared, new information is collected, and customers' feedback is received and digested. On top of that, direct and frequent client involvement increases their commitment to the project, resulting in a reduced likelihood that project requirements and plans go adrift. Consequently, higher satisfaction is also expected to increase while, at the same time, an atmosphere of mutual trust is generated across

internal and external stakeholders to the project. In short, using agile is expected to provide A&E firms the necessary social proof of competence to grow their reputation in the market and attract new audience.

Agile, however, is also expected to benefit the company's supply-side in so far as workforce and knowledge management is concerned. Previous discussion showed how knowledge intensity gives an extensive amount of power to each designer at the expense of the corporate as a whole. By their very nature, managing creative or technically expert professionals is in itself fairly complicated as they are culturally resistant to forms of control – let alone when they can exercise a strong bargaining power or have compelling outside options to fall back on. As a consequence, the A&E firm cannot easily enforce control mechanisms, governance systems, joint planning, or spread strategic direction. However, foregoing any form of centralization and management can compromise the firm's long-term survival while also wasting potential sources of economies of scale or specialization. The previous section has already anticipated how agile can advance a win-win situation.

An agile A&E firm should detach senior designers from day-to-day operations and give them a managerial and strategic occupation. They will be responsible for guiding the company forward, setting broad objectives, and focusing on *what* should be attained, not *how*. Lower in the hierarchy, junior designers should be organized in several small teams with a cross-functional background and invested with a high degree of autonomy and decision-making power so that any lost independence – that was found in traditional A&E firms – is made up for. Employing designers who can each master different disciplines is expected to reduce tensions across peers or individualistic behaviors because the team is structured to thrive on ongoing collaboration. The cultural positiveness that agility generates is expected to create an environment where everyone is committed and empowered, leading to increased job satisfaction and reduced turnover.

A firm that attains high retention rates is likely to possess an internal network of people where new information spreads fast and effectively. Nevertheless, the company should not overlook the fitness of its knowledge management systems – especially in sectors like A&E, where knowledge is typically widely tacit. To make up for any potential knowledge pitfall or lacking dissemination of new pieces of information, an agile A&E firm resorts to regular events like planning, standup, or retrospective meetings and

instruments like Kanban boards. Planning sessions are typically held before the start of a new sprint. They are the occasion for team members to discuss among each and with the customer about designing requirements and project expectations. During planning, the team can assimilate new knowledge or accommodate feedback and additional information coming from different stakeholders or the external environment at large. Standup meetings are short, time-boxed gatherings across team members meant to get everyone on the same page as far as project advancement is concerned. These meetings are held daily before beginning working sessions. They are the occasion for each team member to discuss completed and in-progress tasks and potential roadblocks going forward. Finally, retrospectives are longer review sessions where teams can scrutinize their performance after completing a sprint. During retrospectives, the team digests new insights and considers alternative working approaches based on feedback they had received while presenting the results of previous development cycles to customers, PMs, and other stakeholders. Besides these face-to-face discussions, teams can manage knowledge via physical or virtual artifacts such as Kanban boards. As presented in Subsection 3.4.3, designers can use this board to annotate and rank tasks and activities that need to be performed by the team. Where each item on the board is assigned to an owner, the Kanban board is an effective and inexpensive project management instrument. Moreover, when items are regularly updated and re-ranked with customers' help (maybe using user stories as a reference), designers can quickly grasp new project requirements and update plans and specifications accordingly.

In a larger A&E firm where several developing teams work on different projects, there may still be a risk that PMs or executives cannot provide enough liaising capacity to spread precious learning across teams or provide sufficient knowledge cross-fertilization that could benefit the company as a whole. In these cases, an agile A&E firm can consider adopting a “pseudo-matrix” structure inspired by the Spotify Model (Subsection 3.4.3). By creating so-called Chapters of designers who come from the same functional background, the company can encourage the dissemination of field-specific skills and achieve peer-based learning. For example, when any professional needs assistance from someone else from their same field – but outside their team – or when anyone has important news to share, they can rely on Chapter meetings to discuss issues or present new working best practices.

### 4.3.3. Agile to Reach Productivity and Efficiency

As part of the construction value chain, most A&E firms around the world suffer from low productivity. As Subsection 4.2.3 discussed, there are several reasons behind this problem, many of which are clearly beyond any single company's scope. Regulatory matters, for example, require the intervention of “enlightened” governments or the coordination of public authorities and trade associations. Other issues, however, can be addressed by innovative and socially active players themselves. This is the case of curtailing delays and project cost overruns or strengthening formal and informal cooperativeness with companies up- or downstream the CVC. Boosting the diffusion of digital tools or new technologies that can, say, improve designing processes or streamline relationships across other actors in the supply chain are examples of best practices that virtually any financially healthy player can take up. In many of these instances, agile principles and practices can be strikingly important.

With construction projects increasing in size and complexity or being compound by several external or internal constraints, especially in renovation works, agility can bring a structured but lightweight approach to project management. For example, breaking the venture down into smaller deliverables and institutionalizing iterative development cycles (i.e., Sprints) have been frequently reported to enhance productivity and reduce the chances that the overall project gets delayed or costs levitate. Put differently, companies can benefit from time and speed efficiency.

Using agile to arrange relationships across players in the supply chain could also help overcome major stifling contractual negotiations and enforcement. With cross-functional, collocated teams being the norm, different actors can coordinate much more efficiently. Simultaneously, the adoption of agile events and artifacts – such as regular meetings, user stories, and Kanban boards – can facilitate project management and knowledge dissemination. Importantly, compounding an agile approach and related practices with an integrated project delivery method can solve the long-standing gap created between the design and construction phases of a built asset project.

Finally, agility can play an essential role in the digitalization of the construction industry – especially when it comes to the introduction of Building Information Modelling (BIM). Because BIM complements 3D CAD designing with the creation of a digitized, virtual construction environment and a repository of information about the project, it can act as

a common platform that can enhance many of the company's agile capabilities. On the one hand, it improves change management as it is an instrument that can be used to rapidly and flexibly adapt project development in the face of environmental and project change. On the other hand, it provides a nimble and dexterous tool to collect and act on new knowledge. Moreover, because any stakeholder to the construction project can have access and work in the BIM environment, this technology facilitates concurrent engineering, thus favoring a reduction in time to complete projects and closer, ongoing collaboration across parties involved.



## **CHAPTER 5. HOW ARE A&E PLAYERS ADOPTING AGILE?**

### **5.1. Overview**

The architecture and engineering sector is quickly changing, pushed by new processes, materials, evolving customer requirements, and new technologies. As this happens, companies in the industry also need to grow, finding better ways to organize and manage projects while adapting to new technologies, environmental dynamism, and increased market competition. In this context, a significant role can, in fact, be played by agile philosophy. From a broad perspective, the previous chapter investigated why the architecture and engineering sector should adopt agile principles and practices to reach higher efficiency and outcompete incumbents. The hard part is, however, is to follow up on agile aspirations and find the right path to infuse an agile way of working inside the company. With the present chapter, attention is therefore shifted to how companies should introduce agility in everyday business activities and at a strategic level. By turning and looking at how successful companies introduced agility in other industries, A&E firms can also improve their performance and reach a competitive advantage.

The chapter will first consider the existing experience of agile adoption in the A&E sector. Although not many works analyzed this issue in great detail, they can still provide valuable insights to aid the agile transformation process in other realities. In general, extant research focused on finding agile ways to reduce project duration, streamline relationships across actors in the value chain, or address risks and opportunities that emerge all over design development. Central to these works is devising strategies to surpass traditional project management methods and standards which are perceived as too dogmatic and monolithic. To counter them, new principles and practices are advances to open up design phases to new ideas and environmental change.

The second part of the chapter will focus on the case in point of this review, presenting how ArchLiving approached its agile transformation. The motivations for change are initially addressed, while Subsection 5.3.2 will be dedicated to describing the actions taken by the company to adopt agile principles and practices gradually. This will uncover how the process has been primarily experimental and aided by an external agile coach.

Finally, the chapter is closed by summarizing the expected benefits and challenges that ArchLiving will have to face as the agile transformation becomes more consistent.

## 5.2. A Look at Previous Experiences

### 5.2.1. Motivation

Although existing experiences of agile adoption in the A&E sector – or the construction industry in general – are relatively limited, research in this direction has attempted to find answers to common problems witnessed in the field. Most of these works are indeed motivated by acknowledging that the construction value chain is anchored to traditional ways of doing business but simultaneously beset by a challenging and rapidly changing business environment that calls for managerial transformation. Many, for instance, argue that a severe gap can be seen between the way that players are accustomed to handling projects and the necessary organizational characteristics that they should embody to compete amidst new stakeholder relationship schemes, innovative resources and technologies, increased rivalry, and customers who are becoming progressively more sophisticated and demanding (Sakikhales & Stravoravdis, 2017). In this context, although the most prominent and largest players began a process of renewal that can secure them a competitive edge, the vast majority – and increasingly the small-sized segments of the market – are struck by severe organizational inertia and conservativeness into following poorly effective and inefficient models that could soon push them out of business (Bahceci & Holmgren, 2014). Despite the availability of modern means and tools that can facilitate innovative work activities and improve collaboration across different stakeholders, these design and construction firms have been pursuing methods that will quickly become outdated.

Evidence suggests that the traditional *waterfall* project management remains by and large the go-to approach that players adopt when taking over a new construction venture. As anticipated in Chapter 3, following waterfall (or plan-based) development precepts means that project handling is a rigorous, sequential, and stage-gated process grounded on a rigid progression of requirement elicitation, planning, developing, and demonstration. Thus, when the endeavor begins, designers are meant to elicit *all* project specifications in the form of a thorough, all-encompassing record about what clients



expect out of the built asset, including aesthetic and technical qualities, functional characteristics as well as project constraints such as timing and budget. Since waterfall project management is premised by the assumption that circumstances are entirely predictable and that customers can fully express their desires straight away – with little or no likelihood that these will evolve over time – requirement elicitation truly needs to be as exhaustive as possible because results are indeed “set on stone” in so far as they will provide the unique guidelines for all future operations. Based on this list, and once a stakeholder analysis is performed, architects and engineers would then begin planning project realization in great detail. This involves, among others, scheduling technical and economic studies, negotiating with third parties, managing contracts, planning development of variations, revisioning documents, managing risks and safety, defining qualitative thresholds, and – of course – pacing the generation of blueprints and specifications according to design phases and regulations (see Subsection 1.3.1).

Heavily planning project rollout is typically the norm, and its purpose is to effectively manage uncertainty and have everything under control during subsequent development. Put differently, because the project can be influenced by contingencies or by stakeholder decisions, designers’ response is to plan even in more detail so as to account for as many future states of the world as possible. When this phase is finally over, actual designing begins. In traditional waterfall development methods, this stage is the sole domain of A&E professionals with no regular interface with clients expected. As supporters of waterfall argue, this makes sense because thorough user input had already been recorded during earlier elicitation and planning phases, so that no more insight would be necessary. Designers should have all the elements to do their job, and any possible emerging scenario has already been accounted for. As for customers, then, they will ultimately have a say on project outcome when *final* blueprints and specifications are eventually demonstrated or showcased. If everything meets expectations – as it is implicitly assumed – the output will be approved, the project will be closed and handed over<sup>21</sup>.

If we lived in a flawless world, waterfall project management would fit perfectly because it is very rational, efficient, and sequential. However – as much of this work should have made clear – this is no perfect world. Not very different from the plan-based software

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<sup>21</sup> The designs will be tendered out or directly executed depending on the delivery method – cf. Subsection 1.3.1.

development methods that dominated the sector until the late 1990s (Section 3.3), waterfall does not work because the environment changes in ways that may be unpredictable. Furthermore, customers, too, are very much likely to change their minds during project rollout. This can be easily proved by the fact that the vast majority of construction projects are systematically reported as running behind schedule or exceeding budgets because circumstances force designers to rework or amend mistakes. Consequently, the effectiveness of traditional project management methods is rightfully being questioned, and discussions uncover numerous aspects that contribute to its failure in practice.

An important realization in today's A&E activities is that customers may contradict themselves or make themselves unclear during project realization. In fact, projects rarely commence with clients having a fully formed idea about what their needs are and what the project specifics should be – other than, possibly, a rough conception for the desired built asset. After all, they may not be keen on the ins and outs of designing, so it may be hard for them to express their wants. This implies that when designers initially elicit requirements, they only get to translate client expectations into blurry project goals and an ill-defined development scope which may be biased by one's priors or by mutual incomprehension. Only when designers actually begin working does ambiguity reduce for customers to go into more details about their expectations. Unfortunately, no such ongoing dialogue is expected in waterfall, which instead anticipates all critical decisions at early project phases while neglecting most user insights that could come later during designing. Consequently, possibilities to benefit from new knowledge are foreclosed, impairing the effectiveness of outcomes while leading to unsatisfactory plans and specifications that will be inevitably sent back for rework. The project will accumulate delays, and costs will rise.

Even assuming that customers have fully formed requirements from the very beginning and that they would stick to them all along the way, it overlooks an even more profound concern. Other exogenous circumstances also mutate during project realization, and new contingencies will arise that may threaten seamlessly planned project operations (e.g., supply chain problems, cash flow disruption, litigation, regulatory intervention, etc.). Most of these events may be unpredictable. Nonetheless, traditional project management posits complete foreseeability and capacity to plan for any future state of the world. Designers would then spend a lot of time and effort making forecasts and

devising responses to future scenarios presuming that uncertainty or ambiguity can be avoided as a consequence. On the one hand, this translates into a nonnegligible amount of resources spent on planning even for the long term instead of actually performing project operations. On the other hand, this approach may do more harm than good because it neglects the formulation of actual nimble processes to respond or accept unexpected change but forces to go back to earlier project phases and update all plans – effectively resulting in inflexibility or inelasticity.

In short, assuming no uncertain future is simply inapplicable, especially in complex and long-lasting projects where unaccounted for environmental change does frequently happen, and to stop the undertakings and start over the project management procedure (i.e., elicit, plan, design) is highly inconvenient. Clearly, waterfall project management can result in accrued delays and the piling of exceeding expenditures.

However, effecting a radical transformation of the A&E sector does not solely pass through abandoning a project management method in favor of a modern alternative. A series of other – more specific – critical areas need to be addressed beforehand. In particular, communication and knowledge management issues, internal and external collaboration problems, and the introduction of new technologies that can aid activities and decision-making effectiveness are hot topics for A&E firms transitioning to new organizational schemes.

First, in most A&E companies, communication is reported as being poorly effective. This is an essential matter because functional communication positively impacts knowledge management systems and organizational learning. How information is shared across employees is typically a function of the structure that the company adopts and the processes used to handle a project. Traditionally, A&E firms follow a hierarchical set-up and divide activities into functions. While this arrangement may benefit vertical communication, it does poorly in terms of horizontal information sharing. Put differently, the company may well possess an adequate knowledge system inside each discipline but unsatisfactory cross-functional synergies due to siloed information. In tacit knowledge environments – such as architecture and engineering – this segregation can harm cross-fertilization of ideas or, worse, effectiveness of work processes that require new contribution from different functional areas.

Recently, several A&E companies – including ArchLivIng, the case in point of this review – experimented with creating multidisciplinary teams in place of departmentation of the

business. This surely attenuated communication problem, yet poor team management may still hamper professional effectiveness, especially when workload is inadequately distributed, roles and responsibilities are unclear (e.g., “Who is in charge? Who are we reporting to?”), or if a group mentality or cultural backing are missing. In this sense, it is also crucial that the company institutionalizes a communication plan which can take the form of group rituals or, more directly, establishing a coherent meeting structure. The most productive and innovative companies have typically enforced a series of scheduled, recurring events across designers themselves – or including internal and external stakeholders – to discuss the project’s status and any potential issue found on the way. Some gatherings may be weekly or even daily, while others may occur once, twice a month, or more infrequently. Among these meetings, there usually are sessions that can directly involve the customers. This is undoubtedly positive. Nevertheless, evidence indicates that most of these meetings are not in sync with project development (i.e., they are not paced with project rollout). They may lack a clear agenda, or topics up for discussion are not prioritized. This leads to the undesirable consequences that discussions are rerouted from core subjects towards “management of the details”. Meetings, hence, last for an overwhelmingly long time and, still, they may overlook many potentially important issues. Instead of moving further scrutiny elsewhere among the people who are directly involved with specific matters, people get carried away by technicalities. Many participants may not get the chance to talk or contribute their knowledge because of this approach – their time was simply wasted. In the long run, if circumstances like these systematically occur, meetings become utterly useless, and people will be unlikely to show up again.

Second, poor collaboration and coordination among different stakeholders – including costumers – can contribute to inefficiencies in A&E. Like communication, improving collaborative work in a company can be obtained by eliminating hierarchical rigidities and creating teams. Also, because A&E activities involve many stakeholders both during the design process and downstream when contractors are involved, the firm has to devise strategies to interact with them, acquire, or transmit information and knowledge about the project. Sporadic meetings or concentrating dialogue only at early development phases has been proved to lead to misunderstandings and design errors which cause delays and rework. Better outcomes, instead, are obtained if architects and engineers receive ongoing feedback and insight. Moreover, when accompanied by an

organizational structure that abandons centralization and hierarchy, the company can also achieve higher flexibility in a dynamic business environment. This is all the more so if designers are given much more latitude and empowerment to make decisions independently.

Third, the A&E sector can fully modernize if it adopts new technologies and digital instruments. ICTs can provide great qualitative benefits both to communication and coordination requirements of the firm. In particular, they may act as adequate substitutes for heavy documentation and an otherwise too slow information exchange system. Moreover, instruments like Building Information Modelling (BIM) can help customers and other stakeholders visually understand construction projects while also working as a device for early error detection and a standardized platform for different parties to grasp project characteristics better. In reality, however, most A&E firms are reported as using unsophisticated Computer-Aided Design (CAD) and frequently preferring to transmit hard copies over digitized ones. Although this may be a problem that extends to the whole construction value chain (e.g., contractors may reject software or use incompatible digital ecosystems), it is also frequently related to an untrained workforce who cannot fully make use of the most recent designing technologies. Because these tools can bring tremendous advantages, especially to the most technical and engineering aspects of the job, an A&E that can smoothly adopt BIM and other technological means would achieve a consistent competitive advantage.

### 5.2.2. Solutions

Change and dynamism are variables that cannot be eliminated from modern construction projects. Although managing the design phase is undoubtedly challenging, resorting to heavy planning and scheduling can complicate matters even more, especially in the long run. To overcome traditional project management methods' rigidities, A&E firms need to consider alternative flexible and adaptive models. That is, designers need to adopt strategies that can accept change even late into project development. At the same time, higher effectiveness and efficiency in the process can be obtained by improving communication, coordination, and information sharing across project participants – inclusive of customers and other relevant stakeholders or parties downstream the value chain. In this context, evolutionary-based development methods

(3.3.1) along with agile principles and practices are well suited to modernize the sector and have been already partially considered in the field. More specifically, studies of agile in design and construction have generally agreed on some fundamental elements that could significantly benefit the sector, with a few works attempting to contribute alternative project management methods. In particular, the need to restructure the planning timeframe is a recurring theme, along with breaking the design development process into smaller, more manageable “chunks” and deliver them iteratively. Research also focused on enforcing a regular and structured meeting pattern during project development and allocating projects to teams instead of leveraging hierarchical or functional constructs.

As for planning, several authors argued that, because too much of it is counterproductive but too little can also cause problems, the “agile solution” is to trade off planning detail with covered time horizons (Johansson, 2012; Liviniuk, 2019). Designers are, hence, advised to avoid detailed planning of decisions that will happen long from the present or which may be significantly influenced by surrounding uncertainty in the meantime. Instead, they should make a more precise plan only for the short-term while leaving room for adjustment over the longer term. In particular, five different levels of planning are proposed to account for this. The project *vision* should take a broad perspective and consider the venture’s complete lifecycle. Because this is the longest-term plan, the vision only broadly describes what the project is about and its purpose. It should be easy to communicate, and it should not require significant documentation to be shared. The *roadmap* is slightly more detailed than the vision but still loose in scope. It may cover a couple of months into project development, and it should be focused on describing what results are expected to be reached and in what order over a specified timeframe<sup>22</sup>. These “results” are not too precisely defined to avoid introducing rigidities (they can be considered mid-term objectives). While the vision is typically so loosely defined that circumstances are unlikely to require it to be modified, the roadmap may well change frequently over time as customers, and the environment evolve. Results on the roadmap are subsequently further broken down and prioritized in a specific *deliverance plan* (or sequencing plan) which covers a shorter period and describes schedules and expected milestones to be attained through a backlog. The deliverance plan is a more granular

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<sup>22</sup> The roadmap substitutes the Work Breakdown Structure (WBS) found in traditional project management.

account of deliverables that is constantly updated in terms of priorities and whenever the underlying roadmap is modified. Finally, a *cycle plan* (or sprint plan) defines the working cycles and activities required to complete a milestone over a period covering a few weeks. A cycle plan's details are generally agreed upon after receiving feedback from customers following kick-off meetings and previous deliverables. During each cycle, design teams create *daily plans* dividing activities into tasks and assigning them to each group member. The process is also aided by visual artifacts like a project or team board.

This kind of tiered planning approach advanced by proposers of agility in A&E naturally leads to a second relevant agile contribution – the introduction of incremental development and iterations (Miller, 2015). Designing activities should be broken down into smaller sets of tasks to provide a working or deliverable solution every time a design cycle is concluded. These tasks are then prioritized so that designers – having clients in mind – seek the highest value-adding activities first. Furthermore, iterations should be timeboxed to achieve higher focus and the right amount of time pressure. Such an approach favors designers' concertation towards the identified project goals reducing delays and satisfying the customer. Iterative processes also reduce delays and rework. Not necessarily because either are directly eliminated, but because when problems are found, they are simply rolled into the following overlapping activities during planning with no major rework needed at the end (Tomek & Kalinichuk, 2015). Finally, with iterations, problems are discovered earlier on in the process because deliverables are frequent, and feedback can be received straight away.

Sakikhales & Stravoravdis (2017) proposed an iterative framework to bring agility into construction projects' design phase<sup>23</sup>. In their model, the project goes through three major steps: briefing, iterations, and closing. During the brief phase, designers identify the project's purpose and a preliminary definition of expected quality and budget. An initial list of requirements is also collected to derive an initial backlog and get an idea of project duration and complexity. The brief is also the occasion for all stakeholders to agree on a standard data exchange format and a knowledge management system. The second phase in the project – known as iterations – consists of a series of looping cycles, each lasting from a couple of weeks to one month, during which designing, analyzing,

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<sup>23</sup> The work also tried to address the need for sustainability in designing by facilitating the process of alternative designing.

and adapting are performed. This is an ongoing process of determining project characteristics, adopting design solutions, creating alternative designs, analyzing performance of plans and specifications, revising concepts and aesthetics, and receiving feedback for the following cycle. Finally, at close, the project is finalized, reviewed, and handed over to the customer for the bidding or execution phase.

In a similar vein, Hussien (2017) also advanced an iterative framework for design and construction. Acknowledging that the sector needs improvements in terms of communication, collaboration, and visual understanding, the author discussed introducing an innovative model – labeled “argile” – which combines agile practices with the use of augmented reality software. This framework is expected to introduce quickness and effectiveness in project realization through short-term planning and iterative development leveraging ongoing feedback and new insights. With few fixed conditions (typically, deadlines and goals), argile accommodates change even late in development and creates an environment conducive to cooperation and higher mutual understanding across different stakeholders. The use of prioritized program or product backlog and incremental development is also expected to reduce delays and improve design output fitness. The author distinguishes between four mechanisms (or cycles) that are at play in an agile construction project. The first mechanism, “plan”, involves actively involving stakeholders in project development and prioritizing their requirements. Early project phases – like inception and feasibility – are dominated mainly by plan mechanisms. During these phases, project objectives are identified, and initial technical and economic studies are carried out. At the end of the plan cycle, an initial project backlog (which will be constantly updated later) is generated, roles and responsibilities are allocated, and an expected project lifecycle is indicated. The second mechanism, “implementation”, describes the cycle of realizing project requirements and sharing their implementation. During implementation, the project goes through its evolutionary development. That is, several sprint-like incremental design iterations are performed to explore and deliver project requirements according to the backlog. “Delivery”, the third mechanism in the model, describes the distribution of results downstream in the construction value chain according to priorities. During deployment phase – once a sufficiently large number of sprints is concluded – resulting project specifics are transmitted for later operations (e.g., execution). Designing then concludes with the post-project phase when overall output is assessed with respect to expectations



and subsequently handed over. A fourth mechanism is described – called “collaboration” – which concerns the creation of a communication and collaboration ecosystem across all project stakeholders to facilitate information sharing and project understanding. All phases of the project are affected by collaboration mechanisms.

As the iterative methodology *par excellence*, some works also discussed the introduction of Scrum in A&E. In their case study, Streule et al. (2016), for instance, studied how a development team composed of seven designers with five different functional backgrounds<sup>24</sup> addressed a construction project to be realized according to Scrum methodology and aided by an agile coach (a Scrum master). In the research, the team was taught how to work with agility and began by appointing a product owner (PO) – previously a senior project manager – and generating a product backlog along with clients and other stakeholders. In line with Scrum, the backlog was structured in such a way that items were broadly defined or based on keywords (examples included “create floor plans”, “define load-bearing elements”). The team knew that all items would have subsequently been subdivided into smaller activities and tasks for sprints and iterations during each working day. Designers and other stakeholders quickly got used to meeting at the beginning of each cycle to select a re-prioritized subset of items from the project backlog to be delivered during the sprint itself (i.e., a *sprint* backlog). Initially, this selection process was solely based on team members’ prior experiences about duration and effort typically required to complete similar tasks. Later on, because this approach was poorly objective, the team adopted a practice known as “planning poker,”<sup>25</sup> which aided team members in more accurately and collectively allocating effort and timing. This was done having a 5-working-day sprint in mind, with Mondays reserved for sprint planning and Fridays devoted to reviews and retrospectives. However, after some time, sprint duration was extended to two weeks as timing had become too tight, and clients

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<sup>24</sup> Designers were trained in architecture, building physics, civil engineering, cost estimation, interior designing.

<sup>25</sup> Planning poker (or Scrum poker) is an agile practice used to generate consensus among team members around project features which entail estimations of effort, duration or other metrics. In a typical “game” of planning poker, each member of an agile development team is dealt ten identical cards. Each card shows a number sampled from the Fibonacci sequence (e.g. 1, 2, 3, 5, 8, 13, 21, 34, 55, 89) or an alternative simplified sequence (e.g. 0, ½, 1, 2, 3, 5, 8, 13, 20, 40, 100). In each round of the game, given a specific metric of a project feature to be estimated, each participant selects a card from his deck and places it faced down on the table. The chosen number reflects the person’s best estimate of the metric in question. Together, participants will move on to turn their chosen cards upside down and motivate their decisions. The goal is to reach a mutual agreement on a unique number to be assigned to the given metric. This means that team members will have to negotiate and make compromises in an environment that is arguably free of bias. A side benefit of planning poker is also uncovering who in the team is best fit to address which matter.

had troubles attending each meeting. The Scrum Master pushed that the team also defined a sprint goal before commencing every cycle with the purpose of having everyone working towards the same direction and stimulating them always to ask themselves whether their contribution was genuinely adding value or getting the team any closer to the goal itself. When the answer was “no”, the team acknowledged that sprint planning or activity prioritization had been poor, and more discussion or stakeholder insight were needed. During each sprint, the team got used to gathering daily for standup meetings, during which discussion on progress or roadblock could be held. Sprint running was also facilitated by a Kanban board created in the premises (and digital version online), tracking progress and participants’ duties. At the end of each sprint, 4-hour review sessions – extended to clients and other stakeholders – were organized with a clear agenda involving the presentation of the delivered increments, the backlog items completed, and the ones left. Time for “questions and answers” was also allocated as well as an allowance for preliminary discussions of upcoming sprints. Before beginning a new cycle, the team acknowledged that some “reflection time” was vital to evaluate their performance and consider actions to improve going forward. During these retrospective meetings, problems like the unfitness of activities with respect to goals – as mentioned above – could be thoroughly addressed. Streule et al. (2016) reported that, on the whole, adoption of Scrum was positively accepted by designers who, in turn, confirmed their interest in expanding its use in the future. In particular, participants reported that daily scrums, despite their short duration, were an excellent occasion to learn more about each other’s areas of expertise. Notably, a pain point was found in the product owner's figure (PO), who was mostly unable to perform their role and duties in the team because contemporarily involved in other non-agile construction projects. Ultimately, the PO served as a sort of sponsor for the project and the team during meetings with customers.

Gless et al. (2017, 2018) –active proposers of agility and BIM in A&E – also studied the effectiveness of Scrum in construction design conducting a series of experiments on the field and in an educational environment. In particular, his works uncovered a series of practices that could improve effectiveness of Scrum methodology in the field. Among them, the combined use of a “conceptual matrix” (also known as “design matrix”) with planning poker appear to be the most compelling. Through a conceptual matrix, scrum teams are encouraged to list their design intentions and all the known needs to be

solved. This is a kind of brainstorming activity whereby designers pitch and confront their ideas and interpretations to realize customers' project requirements. In short, the procedure involves the completion of a matrix listing project elements on each row, and technical, graphical, or artistic notes on columns. The latter describes design intentions for the respective elements. Aided by other stakeholders, ideas on each cell are then formalized in keywords or short sentences, which – later – could provide preliminary user stories to fill in the project backlog. The conceptual matrix has been reported as an excellent communication and cooperation booster and an effective “project icebreaker” because it forces constructive debate and dialogue across designers and customers since the beginning of the undertaking. With a completed conceptual matrix, designers move on to attribute complexity, duration, and ownership of the listed items. These decisions are eased by a “game” of planning poker (see above) so as to avoid bias and – increasingly – to unearth who in the scrum team is most knowledgeable of and best suited for what design activity. In the conducted experiments, Gless also tested effectiveness of the roles of product owner and agile coach. Like in Streule et al. (2016), he found that in practice, their duties frequently end up overlapping so that just one person could perform them. Team members were often reported as seeking solutions or help with technical, managerial, or coordination problems from both PO and agile coach. However, both proved to be effective liaisons with clients and other external stakeholders.

All the cited studies clarify that enforcing iterative and incremental development rest on the assumption that working processes run smoothly aided by unconstrained flow of information and cooperativeness across professionals and other stakeholders. This is undoubtedly favored by enforcing an effective meeting structure based on so-called “reconciliations”. Unlike traditional project management, where gatherings are infrequent, typically unstructured, poorly paced, or uncaring of external stakeholders, agility involves a coherent pattern of purposeful reconciliations. Because work is split into increments, meetings with clients and other involved parties should happen both at the beginning and at the end of a cycle. On these occasions, designers can discuss project characteristics and priorities, thus updating work to be done according to new feedback received. Besides these events, however, agile also dictates scheduling regular *internal* meetings across the people who directly work on the project. More specifically, weekly or daily meetings can be used to track progress regularly and deal with contingencies.

More infrequent gatherings can also be organized with other internal stakeholders on specific matters. What is essential is that designers also commit to meet up and discuss their accomplishments or deficiencies during development. Retrospective sessions, indeed, are a great occasion to learn from mistakes (Miller, 2015). In any case, to prevent debate from derailing, all these meetings should last for a previously agreed time length, and they should stick to a defined agenda. Any other matter that may arise during them should be dealt with elsewhere and only among the directly involved people. For example, Kumar & McArthur (2015), for example, applied an agile meeting structure in a case study involving the creation of design plans and specifications with BIM. The authors distinguished three types of interactions. First, architects and engineers met every couple of days either over short (5-10 minutes) standup meetings or over half-an-hour-long “design chatters”. The former was dedicated to discussing progress and upcoming activities to be scheduled for the day, while the latter focused on analyzing solutions and determining the level of detail to be designed. Second, many client meetings were organized in the form of collaborative working sessions, informal presentations, or more formal design reviews. Collaboration sessions began with displaying current BIM models and moved on to jointly investigate further design options, alternatives, and potential solutions. Informal presentations were mostly dedicated to showcase and communicate designed elements, while formal reviews involved senior and partner designers' contribution in presenting progress and next steps. Notably, all client meetings were reported to be an important occasion for designers to receive feedback on their job and re-prioritize activities to be performed during upcoming cycles. Third, depending on necessities, some designers could schedule meetings with other disciplines outside their team – or also outside the company – whose purpose was to receive knowledgeable insights on technical aspects of designing (e.g., energy analyses, mechanical engineering, etc.). These types of gatherings happened when a design team lacked professional expertise in a specific field or when – although a team member was trained in the discipline – they needed peer confrontation.

Another relevant game-changer of agility in A&E is working in teams. As a matter of fact, small groups of designers (usually 5-9 people) who have different functional backgrounds have been reported as leading to increased productivity and higher speed. Also, because agile teams are given much more freedom to work independently, if problems emerge, they can be dealt with fast and nimbly. In empowered teams, project

managers take on coaches or facilitators' role, practically aiding in solving conflict and running operations smoothly. Exploiting small, close-knit groupwork facilitates communication, especially when information is highly tacit. As Tomek & Kalinichuk (2015) describes, this is a significant revolution from a business management perspective. Workflows and organizational processes change as the A&E firm becomes flatter, duties and responsibilities change, and information flow becomes more informal. Also, thanks to agile's iterative and early delivery approach, construction value chains can be "shortened" via concurrent engineering thanks to a constant interface among architects or engineers, contractors, and clients.

### 5.3. Agile at ArchLivIng

#### 5.3.1. Why Agile?

The path towards agility at ArchLivIng has not been sudden or "big-bang" – as in the words of Rigby et al. (2020). Instead, it has developed over some half a decade during which the company has experimented with substituting heavyweight project management processes and methods with lightweight approaches and innovative modes to conduct business. Moreover, intertwined with this requirement, was the necessity to avoid management chaos and devise functional strategy and structure capable of facing rising demand in the market, an expanding workforce, and the need to handle complex projects more efficiently. More than anything, however, the company was seeking a strategy to reach a competitive advantage in the market and secure sustainable growth.

As discussed in Chapter 2, since its inception, ArchLivIng experienced at least two waves of expansion which initially were not paralleled by proper organizational rearrangements. This was because the firm came from a small, startup-like context that strongly conditioned ease with which it could move away from this arrangement. Initially a small business, ArchLivIng could leverage a close-knit group of employees – frequently just a few meters away from one another – where information could spread fast and reach its rightful recipient effectively so that decision-making happened quickly and firmly. Also, with a relatively limited scale and an undifferentiated product line, handling projects was not too complex. Professionals could easily divide across different

endeavors with ease and without losing focus. Consequently, catering to customers' needs was facilitated, and time management did not result in significant constraints. Partners and senior designers' control over operations were stronger because they were actively involved most of the time. Thus, there was also little need for formal reporting lines. Like in most design firms, partners and senior could quickly and directly liaise with all of the customers – or their representatives – effectively and personally sponsoring the project.

Later on, as new segments opened up and with the aim of becoming an experience-based actor in the Italian A&E landscape (See Section 2.4), ArchLivIng began expanding its scale and profit as new demand grew and unique expertise could be put in use in alternative types of projects – thus, effectively branching out or differentiating its offerings. Development was initially complemented by economies of scale and scope and resulted in higher visibility in the market, which acts as positive feedback favoring further expansion. On the downside, however, the company was progressively facing an organizational discontinuity which quickly surfaced a series of new challenges to be addressed.

Although growth was not objectively far-fetched, ArchLivIng's numbers were large enough to potentially create problems. For starters, with a larger workforce located in larger premises, control could be attained only by instituting some kind of hierarchical lines of reporting or bureaucratic processes. Furthermore, in a sector whose activities are primarily dependent on public authority approvals, a larger customer base and several projects contemporarily opened can lead to difficulties in managing time and induce poor reactivity upon new requests or sudden advancements in project phases. This is because pace may be dictated by external factors which the firm has no control over and which, in turn, may lead to periods of frantic work and other times of stasis. Moreover, a diversified product offering can – on its own – cause employees to lose focus because different discipline or functional knowledge may be required at the same time, and “jumping back and forth” can lead to chaos.

Overall, organizational responses to these drawbacks typically consider implementing delegation, spreading working policies, and scheduling regular meetings. As discussed elsewhere in this review, however, when these instruments are too rigidly applied in a dynamic and ambiguous business environment, they can do more harm than good. For this reason, ArchLivIng looked at alternative drivers of organizational transformation

coming from many new narratives emerging in the strategic management literature and, increasingly, in practitioner research. Partners and senior designers have indeed pushed for an open-minded approach to evolve business, with professionals being exposed on several occasions to managerial novelties sometimes coming from the construction industry, at other times from other business environments. During interviews with designers at the company, the necessity to renovate the firm with a coherent approach to better address customers' project requirements and handle new endeavors with systematic but "non-stifling" methods frequently emerged. Thus, it is no surprise that – as one senior designer recalled it – when they first met the agile approach, its principles, and its practices, managers recognized it to be a perfect match.

However, it is one thing to consider agile as a fitting solution to many of the company's structural issues, but actually realizing the transformation is a much more challenging task. As many of the agile precepts move counter to traditional methods in the sector, change is increasingly tricky in an entrenched business environment like that of architecture and engineering, which have been shaped by a professionalized culture and regulatory constraints or protections for many years (see Chapter 4). Any improvement for players in the A&E sector must, hence, pass not only through innovation in processes or project management techniques but also through significant cultural and workforce transformation. Moreover, actors cannot hope to find a plug-and-play solution in agility. As many proposers of these methodologies argue, it takes time and adaptation. Some aspects of the agile recipe may not fit some industries, so companies should find workarounds or alternatives.

Fortunately, ArchLivIng realized that agile transformation is based on trial-and-error and sought support from experienced agile coaching to more carefully apply agile values, principles, and practices at an operational level. That involved using agile instruments and workflow and begin their experimentation on a small scale with the aim of extending it to the whole firm soon.

## 5.3.2. Agile in Practice

### 5.3.2.1. *Changing Culture*

As anticipated, agile transformation at ArchLiving has been more of a journey than a destination. When the company decided to adopt agile, it realized that it first had to devise an appropriate organizational culture. In fact, many agility proposers argue that changing culture – i.e., the explicit and implicit beliefs or assumptions that shape workers' behavior and actions in the firm – is among the first and foremost elements to be considered when approaching agility. In other words, an organizational culture that reflects agile values and mindset is a necessary precondition and a major determinant of a successful agile transformation. In any business setting, however, the process of cultural change is not an easy one. Indeed, people and processes inertia or conservativeness can easily impair a compelling take up of a new cultural paradigm.

Knowledgeable that the management literature is beset with examples of firms making grand gestures to innovate their culture only to find that behavior and actions quickly go back to the status quo not long after measures have been taken, ArchLiving was cognizant that infusing an agile mindset would have taken time and effort.

In the beginning, the company's approach was to "go solo" – that is, effecting the transition with its own means and capacity. To do so, one partner and a senior designer – who had previously stood out for their internal and external networking skills – were appointed as champions of the transformation process. Together, they were given full responsibility to address the question and to take action in advancing change. To that extent, their decisions and moves initially traced classic cultural change measures. As a first step, the "transformation champions" committed to re-define and lay down the company's values along with a new vision and mission. The purpose was to create simple and easily transferable statements that could reflect the critical tenets of agility, the core principles of the A&E profession, as well as – obviously – ArchLiving's own ideals and purpose. Because the Agile Manifesto suggests prioritizing individuals and interactions over rigid procedures, the company stressed collective "engagement", or ongoing internal dialogue and idea cross-fertilization, as one of its key values. Dynamism and curiosity were also indicated as among the cornerstone characteristics inside the firm. These values reflect principles like openness to change, innovativeness,



creativity, and willingness to experiment and take risks – all of which are also central in the agility discourse. Moreover, as part of its commitment to serving customers' needs with diligence and care, ArchLivIng marked work ethics as another core value in the way it intended to do business. Resulting ideals such as professional honesty, pragmatism, and trustworthiness could hence effectively intermingle with those agile priorities like customer involvement and ongoing collaboration.

With top management's approval, the transformation champions moved on to socialize the new values. This involved communicating and infusing those cultural elements among the company's workforce, including educating employees about the meaning of each principle and explaining what their declinations would be in day-to-day business practice. Using role modeling and assisted by partners and seniors who backed the initiative, both explicit and implicit cues were used to spread the new culture. As a result, ArchLivIng strengthened vital structural elements such as flatness and a short chain of command. This also translated into giving junior designers much more autonomy while organizing them in teams to leverage cross-functional expertise. Meanwhile, more subtle control was retained by using a sort of matrix layout whereby, on the one hand, senior project managers would lead and support teams, acting as coaches and intermediaries both with customers and with internal stakeholders. On the other hand, horizontal links were established across designers trained in the same discipline to maintain organizational synergies and function-specific connections.

Overall, the actions initially taken showed positive results and were a good step forward. Nonetheless, as discussed in Subsection 2.5.2, other issues remained to be solved. For instance, teamwork was not fully functional at first, and an actual multidisciplinary set-up was lacking. Measures or rituals to strengthen a team mentality were also inadequate or missing, while an unbalanced workload caused teams to operate at a different speed. Therefore, as teams would lack specific functional expertise or be disproportionately weighed down by activities, they frequently had to seek assistance from designers in other teams. This would result in tension both inside and across teams while complicating the job of members who had to divide between two or more groups. Project managers recalled how on several occasions, the firm would end up operating as one big crew (sometimes gathering up to twenty members!), inevitably forcing executives to halt activities, split them, and re-create teams once again. As one might expect, under these circumstances, communication and coordination would

suffer, generating informational gaps and chaotic business processes, which would perpetuate delays and lead to future reworks of the underlying activities. Meeting structure would also deteriorate. On the one hand, because people were overwhelmed by tasks beyond those of their own team, they could not find time to dedicate to discussions, thus further crippling the group's consolidation. On the other hand, when people did have time to meet up, conversation would end up lasting for an overly long time to cover all issues on the table, with no clear focus or agenda. Furthermore, given the larger number of projects which the company was handling and with no explicit approach to maintain an active dialogue with customers, there was a risk that the latter's needs and requirements could be overlooked only to focus on designers' own technical or aesthetics preferences.

#### *5.3.2.2. Introducing Agile Practices and Tools*

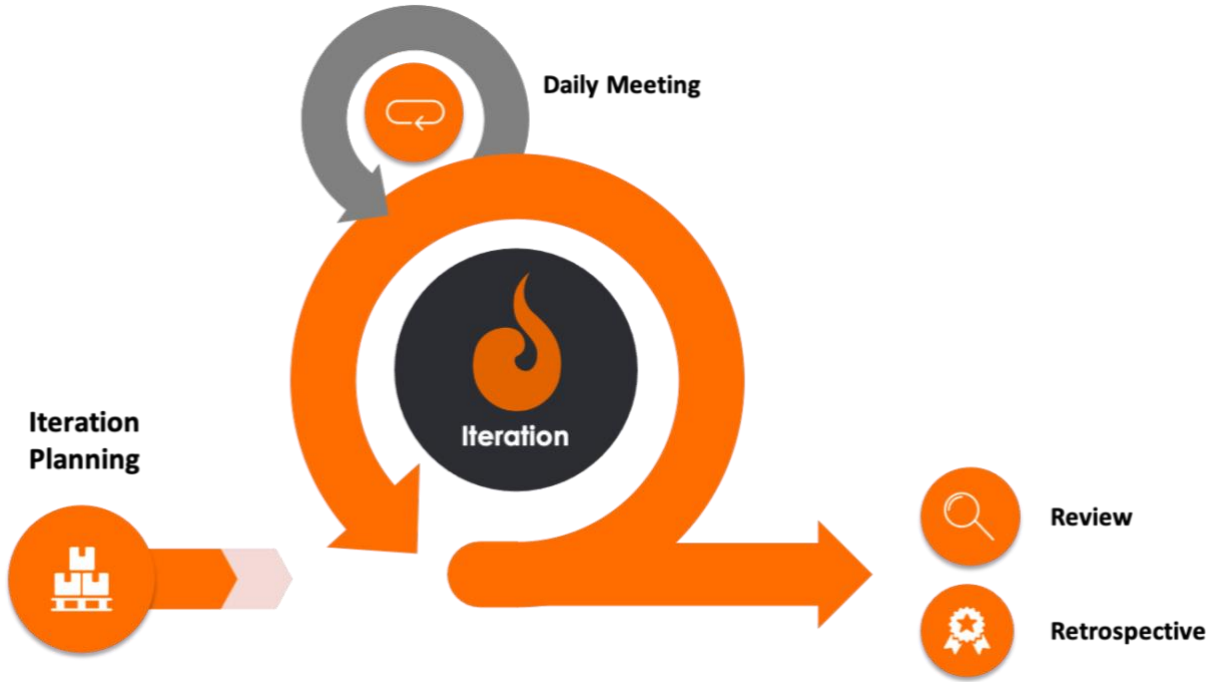
In an attempt to address the resulting pain points, ArchLiving hence decided to seek assistance from the outside. With the aid of an external agile coach, the company moved on to manage the agile transformation at a more granular level. To begin experimentation, executives selected a project which had just reached operational level and decided to test principles and practices in more detail. The objective was to start using agile methods more specifically so as to understand what would work, what would not, and if there was room for improvements. Ultimately, however, the idea was to validate the agile way of working at a small scale to escalate it – at a later time – to all new projects and also to the whole organization.

The project – namely, designing a new fire station in a large city in Northern Italy – was assigned a cross-functional team headed by a Project Manager (PM) responsible for leading activities. In particular, her job mostly traced Scrum's Product Owner's characteristics, such as maximizing the team's deliverables on behalf of the customer, keeping track of project requirements, aiding the team in assigning priorities and maintaining a transparent work environment that would favor the dissemination of tacit knowledge.

Guided by the agile coach, the team examined agile values, practices, and operational instruments more in-depth with the purpose of identifying elements to apply inside their activities. Together, they first committed to testing the effectiveness of a “fluid

process” to steer project realization (Figure 5.1). This consisted of breaking down design development into smaller sets of tasks to be realized over the course of a series of recurring iteration. The ultimate aim of this new design management approach was to introduce more flexibility and adaptiveness in the system. As previously discussed, there are many benefits to using an incremental and iterative development process. For instance, in between iterations, stakeholders could provide feedback and document their requirements more precisely so that designing can be updated as a consequence and needs are addressed correctly – thus, avoiding mistakes that would delay later operations. As for designers, in turn, they could more appropriately focus on value creation as they would be no longer constrained by a monolithic, one-off development process that is unresponsive to change.

Figure 5.1 Fluid process

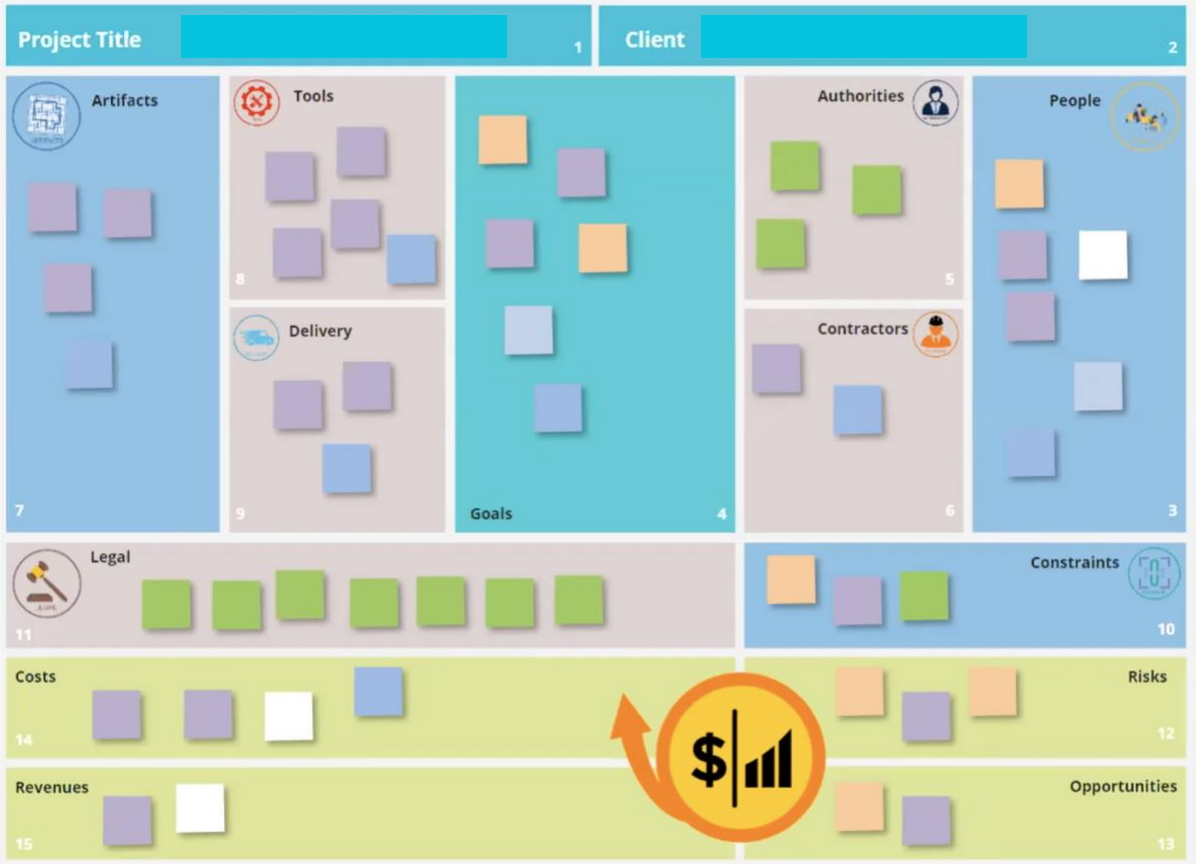


Source: adapted from AgileBIM Conference (2020).

Because the fluid process has to be interpreted as an aspirational and empirical approach, the first iterations were primarily taken as trials. Initially, they were scheduled to last one week. On the first working day, the team would meet and plan operations for the upcoming cycle. Based on a set of duties needed to advance the whole project, an inventory of activities was sampled according to priorities and the extent to which they would add value to the customer. Subsequently, these activities would be

further split up into tasks and assigned to team members. Designers, in turn, would complete all their tasks during the duration of the iteration, and on each working day, they would have to meet up and discuss progress. Daily meetings were the occasion to reinforce dialogue and strengthen team cohesion, and, of course, they were meant to update one another on task realization or report any roadblock. Led by the PM, who took charge of emerged bottlenecks, daily meetings were timeboxed to increase focus and engagement. At the end of the week, a review session was scheduled, and customers (or their representatives) were invited to attend. During this meeting, the team presented the iteration results showcasing completed activities and remaining tasks. Customers and other stakeholders assessed the released output so the team could annotate feedback or insights to be leveraged in the following iterations. After the review, the team would take some time to reflect on their performance, their organizational capabilities, and the efficiency of their processes. This retrospective meeting – which also concluded the iteration – should have resolved with a set of actionable teamwork improvements for the remainder of the project.

Figure 5.2 Project Canvas,



Source: AgileBIM Conference (2020).

As the team gained experience with the fluid process and iterative designing, they progressively made adjustments to the way of working. The first improvement concerned the extension of iteration cycles from one to two weeks (or ten working days). This change was dictated by time constraints and was due to team members frequently having difficulties breaking down deliverables and scheduling tasks. Moreover, some additional time was needed to reach a consensus and agree with customers on requirement prioritization. Also, an extended time frame reflected the fact that activities had to be paced with formal design phases (1.3.1) to avoid problems with norms and regulations. Besides time concerns, the agile coach advised the team to introduce some structural support over sprint rollout. As a matter of fact, improvements could also be realized by creating transparent project artifacts to aid team members in better pacing and managing iterations. To solve this issue, designers devised two visual tools. First, they started a Project Canvas to improve group communication, facilitate the team in understanding problems and solutions, and more generally systematically guide them over the course of project realization. The Project Canvas (Figure 5.2) is an organized board listing all core aspects of a given project that can integrate or even substitute preliminary design documents if adequately managed and constantly updated. The Canvas is structured in different areas, each of which reflects a specific element of or stakeholder in the project. During initial phases and at any time over the project lifecycle, team members would report and update their notes on each area of the project. For instance, the section labeled “People” should concisely describe all parties who have a direct interest in project realization. These include all primary stakeholders (cf. 1.2) for which value is generated or which can directly influence the project’s value creation (e.g., customers, users, the design team itself, and other firms). This list excludes “Authorities” and “Contractors” which, in turn, are reserved a specific area of the Project Canvas. More specifically, the former defines all relevant public bodies (e.g., municipalities, regional offices, etc.) which typically approve, reject, or finance the project's realization, while the latter includes all firms or professionals which may be subcontracted specific activities of the endeavor. The area on the canvas labeled “Goals”, instead, delineates all primary objectives that the project should attain. To aid their identification, team members should answer the following questions: “what do *People* perceive as value-adding? What do *People* expect out of the project?”. In this setting, it is

also vital that designers document whether identified objectives are shared across all stakeholders, whether some goals may create tension across People<sup>26</sup>, as well as ascertaining that goals are not at odds with one another. “Artifacts” and “Tools” describe all elements that the design team needs to realize to complete the project, along with the hardware or software used to deliver them practically<sup>27</sup>. The sections labeled “Constraints”, “Legal”, “Risks”, and “Opportunities” record all the aspects which may limit project realization (e.g., time, costs, clients’ requirements, regulations) or that may open up new possibilities for designers or other stakeholders to seize. Finally, on “Costs” and “Revenues”, team members delineate all profit streams and cost drivers.

Second, the team and the agile coach created a Kanban board – rebranded “Design Board” – to keep track of activities and tasks during iterations. The Board was also used to quickly identify each task's respective owners, and in general, it facilitated prioritization of effort during iterations while aiding designers in maintaining focus on generating value on behalf of the customer. Like a regular Kanban board, the Design Board (Figure 5.3) is divided into five columns used to distinguish among the phases a given activity can go through. On each column, activities are represented by sticky notes and order from top to bottom according to how urgent or valuable they are. Each sticky note provides a short description and expected duration<sup>28</sup> of the activity itself and recalls the project name and phase. The first column, “Project Inventory”, is inspired by Scrum’s sprint backlog, and it lists all tasks that the team has to complete over the course of the following *two* iterations (i.e., typically, one month’s worth of work). When an iteration begins, team members select activities from the inventory and move them under the column “To Do”. Echoing Lean, designers should fill up the column so that the sum of all activities’ duration adds up to the duration of the iteration. On each working day, following the daily meeting and based on priorities, each designer picks the activities they were assigned from the “To Do” list, places them under the heading “Doing”, and follows up on realizing them. Whenever a task gets blocked by either internal or external factors, designers place it on the column “Waiting”. As previously mentioned, it will be the team and PM’s responsibility to address any potential underlying bottleneck and “unlock” the activity. Finally, every time a task is concluded, it

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<sup>26</sup> This typically happens where customers and final users are not the same person.

<sup>27</sup> For example, a project may be realized using BIM and may require plans and specification to be sent via email or be printed out.

<sup>28</sup> Typically measured in working days.

is moved under the heading “Done”. At the end of the iteration, the Design Board can provide an easily accessible tool to summarize team performance and output during review sessions. Also, it can showcase activities that were delayed or blocked, and which will be re-scheduled for the following iteration.

Figure 5.3 Design Board.



Source: AgileBIM Conference (2020).

5.3.2.3. Escalating Agile

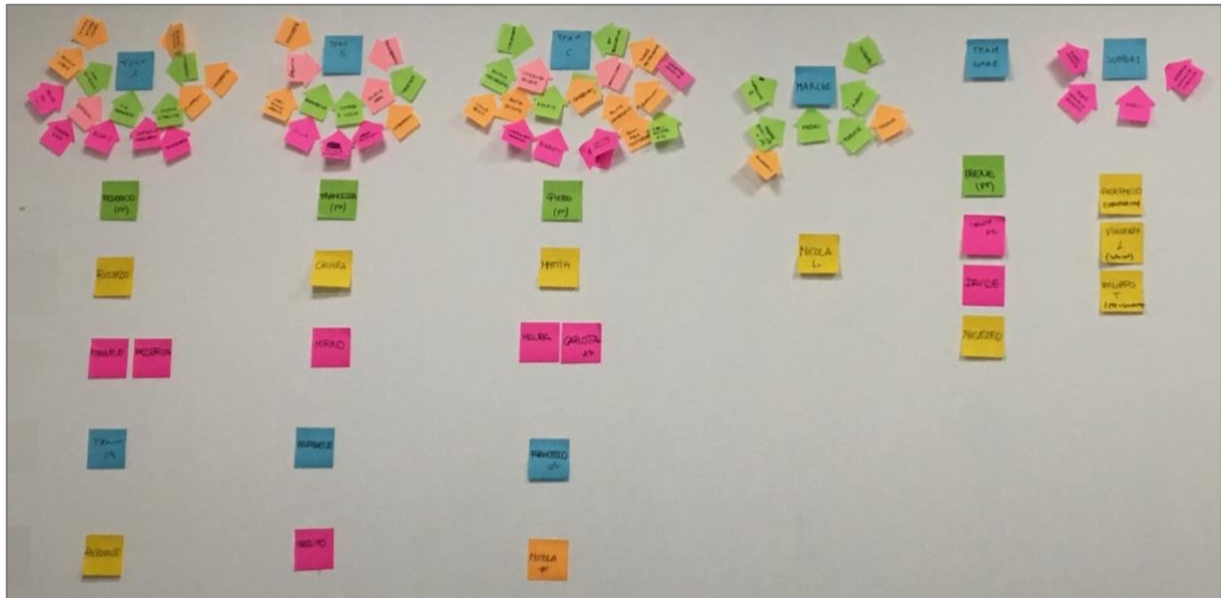
More recently, as iterations and agile tools were quickly becoming operational in the selected project, ArchLiving began analyzing how to escalate agility to other projects and the whole firm. In particular, this endeavor took two streams. On the one hand, senior designers agreed to restructure the company’s teams with the intent of realizing a genuinely multidisciplinary set-up and optimize workload distribution. On the other hand, executives began developing an organization-wide Kanban board that could support management of all projects in a lightweight manner.

With the agile coach's help and after a thorough review of the company’s workforce, senior designers and partners restructured the firm in a total of six teams (Figure 5.4). Four of them were actually agile teams<sup>29</sup> handling the company’s design and engineering projects in their entirety. The remaining two teams did not follow a precisely agile way of working. With fewer members and no PMs, they performed support functions that would not require ongoing cooperation with any of the agile teams and maintained relatively more autonomy<sup>30</sup>. Each of the four agile teams, instead, was assigned four or five members with different functional backgrounds and was led by an appointed Project Manager (a senior designer). Echoing the Spotify Model (3.4.3), members who came from the same discipline but belonging to different teams were also organized in

<sup>29</sup> Three of the agile teams took care of the design phases. While “Team Gare” (“Tenders Team”) was assigned responsibility to manage the tendering process for new construction projects.  
<sup>30</sup> Some of their members were also operating at a physical distance.

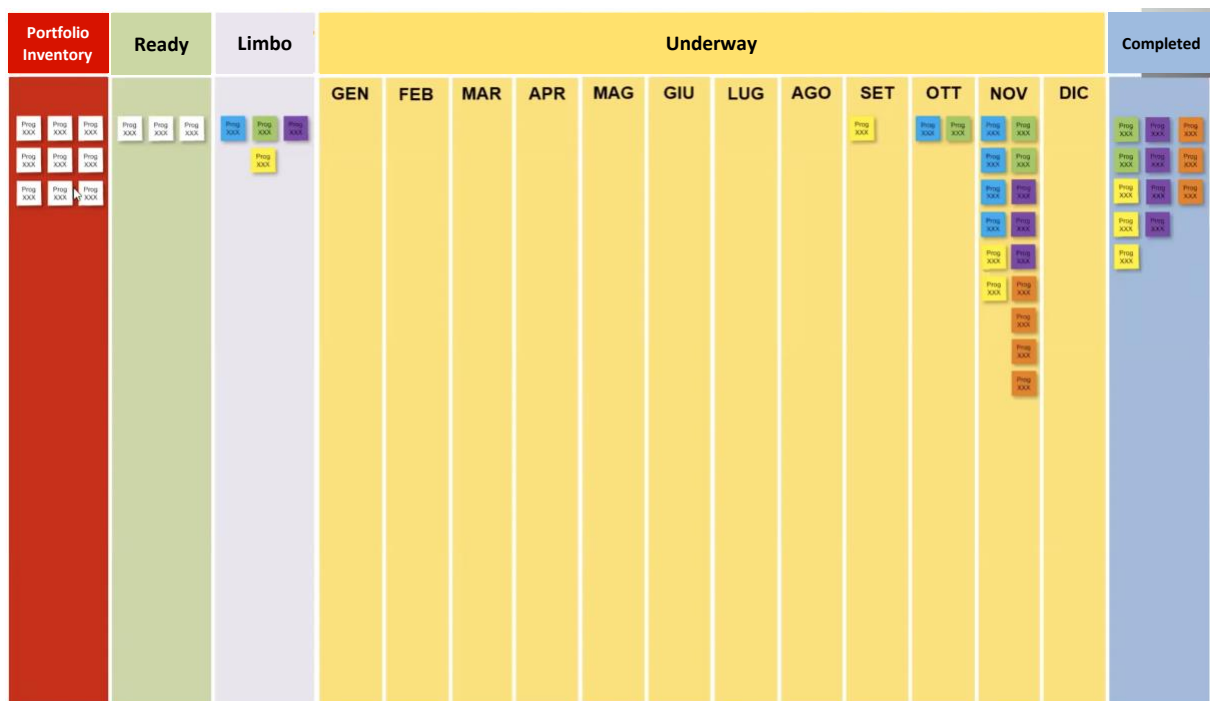
chapters and – coordinated by an internal area lead – they would schedule regular meetings to discuss innovations in their discipline or confront each other’s works. Finally, senior designers assigned existing projects to each new team.

Figure 5.4 ArchLiving’s teams.



Source: picture taken by the author. Notes: blue sticky notes on top report team names. Square green cards represent each team’s PM. All other square sticky notes represent team members; color coding is used to distinguish between members’ functional backgrounds. Arrow-shaped cards indicate projects assigned.

Figure 5.5 Portfolio Board.

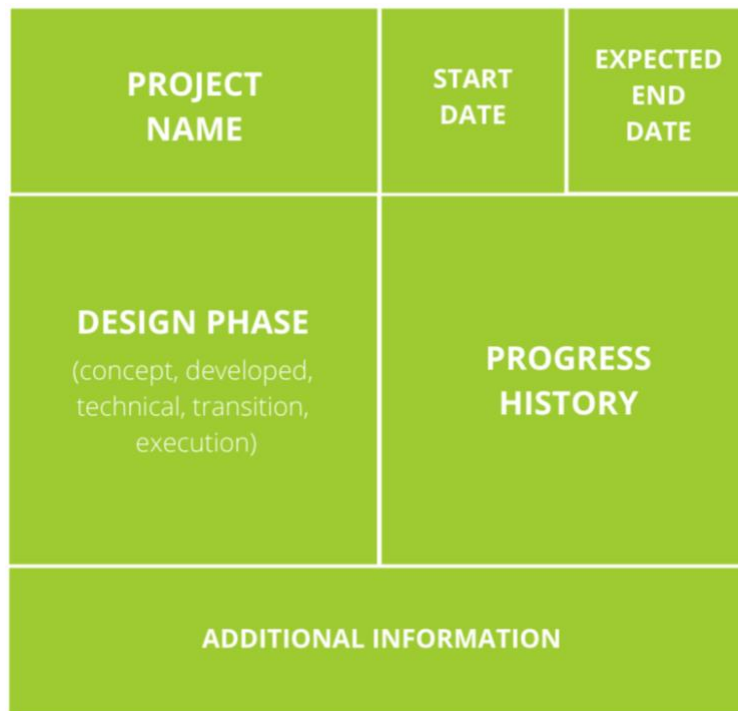


Source: AgileBIM Conference (2020).



ArchLiving's executive also devised an additional artifact labeled Portfolio Board to guide the company to strategize and clearly define business priorities. Like the Design Board, the Portfolio Board (Figure 5.5) is used to track project status for the whole firm. On the board, each project is represented by a sticky note with color-coding used to indicate the team which owns the project and a series of notes used to contextualize the project, define its expected duration, and provide additional information (Figure 5.6). When a new project comes in, its assigned sticky note enters the board under the heading "Portfolio Inventory". At this stage, the card is white because no team is initially set to the project. When the project becomes ready to be operations – typically when customers sign the contract or accept the quotation – the card moves into the "Ready" column. At this point, a Portfolio Board meeting is called across all PMs from the agile team and a previously appointed Portfolio Manager. Together, they further scrutinize the project and its characteristics and decide which team will take care of its realization. The decision is usually informed by how workload is currently distributed across teams and considering whether some specific knowledge or skills are needed that only some team may possess. Once the project is allocated, it becomes formally operational, and its sticky note is placed under the heading "Underway". This section is divided into months, so a project will move from month to month as the team iterates its development. Because projects which are not pushed forward stand out, the Portfolio Board provides an early warning system in case of delays or organizational issues. Sometimes, however, projects are stuck because external factors – such as public bodies delaying approvals – block their advancement. If this is the case, the project card is placed on the column labeled "Limbo". This way, teams will be constantly reminded of suspended projects and, thanks to the notes written on the card, will find it easy to take the project up again when obstructions are lifted. Finally, when the team completes all project activities, the sticky note is moved to the "Completed" column and will remain there until the customer has fully paid for the venture. Overall, the Portfolio Board provides a very informative visual artifact that can aid project prioritization and allocation of workload across teams and determine the company's progress.

Figure 5.6 *Mock-up of a sticky note used to represent a project on the Portfolio Board.*



Source: AgileBIM Conference (2020). Notes: the color of the sticky note indicates the team which owns the project.

#### 5.4. What Could Be Expected from Agile in A&E?

It would be difficult to find a conclusive answer to whether the adoption of agile at ArchLivIng led to undisputed benefits because – as of the time of writing – the agile transformation was still in progress. Surely, since the company’s executives first encountered the agile philosophy, significant organizational changes have been implemented that contributed to providing more order and structure without encumbering the firm with otherwise heavyweight business processes or procedures. An essential part of the transformation, for instance, was the introduction and socialization of its values in the organizational culture. Although cultural transformation is typically a tough endeavor, ArchLivIng and all its people were fully invested in the transformation to the point that the transition was relatively smooth and positively perceived. Later on, with the help of an agile coach, ArchLivIng introduced more granular instruments, which injected further agility in the system and provided a great push towards lightweight project management and more effectiveness in teamwork. Notably, the company’s “agile journey” was not without *faux pas* or mistakes. ArchLivIng realized that some elements of the agile way of working would not have added value to

the system or, worse, could have introduced tension or conflict. After all, as thoroughly discussed in Chapter 3, agile should not be taken as a well-defined recipe, especially outside the world of software development, where experience and literature are limited. Thus, for instance, the company decided not to adopt some clear-cut methodology – like, say, Scrum. Instead, ArchLiving followed the principle of “build-measure-learn” and – aided by the agile coach – it empirically determined those practices and tools which would have generated the most value both for the company itself and for its customers. As a matter of fact, forcing agility is always advised against. Instead, people should be taught what “doing agile” means and gradually make adjustments as they feel is right. Because agility is beset by positive feedback loops, however, it could realistically be expected that in the near future new agile elements – which were previously discarded – will be added to the system.

Although clear metrics are missing, many benefits are expected from the adoption of agility at ArchLiving. First, customer relationship management is likely to improve significantly because agile’s incremental and iterative development process involves constant dialogue with clients and a higher level of transparency. Over the course of sprints, customers get to “look and feel” the project being realized, and, thanks to an open interface with designers, they can provide new feedback and update their requirements early on. Therefore, the risk that designers “fall in love” with their own job to the detriment of customer expectation (2.5.2) is significantly reduced. On top of that, misunderstandings, design errors, or clashes – which ultimately lead to downstream delays or rework – will be substantially reduced. Overall, this is also expected to increase satisfaction and build trust among the customer base, which also adds to positive externalities in the market insofar as the company’s reputation is concerned (cf. Subsection 4.2.3). Second, using multidisciplinary teams instead of formal hierarchy or bureaucracy will improve the dissemination of tacit knowledge and boost idea cross-fertilization. Moreover, because team members are given more autonomy and decision-making power, the company’s responsiveness and adaptiveness will be enhanced. Designers will also be more motivated and committed to delivering the best possible output, thus increasing overall productivity. Unencumbered by day-to-day contingencies, ArchLiving’s executives will, in turn, have more time to think about strategizing and giving a sense of direction and purpose to the whole firm. Of course, an effective team-based architecture also requires a functional meeting structure. In this

sense, using sprint-like events will solve many of the problems the firm encountered (2.5.2) and enforce a more efficient flow of information. Third, the introduction of activity backlogs (or inventories) will improve the company's programming capacity and resource allocation. Moreover, differently from the past, backlogs are taken as "living organisms". That is, when new customer insight is received, or circumstances force project characteristics to mutate, backlogs will consequently be updated so that designer will add to the development process only "fresh" and truly value-increasing elements. Furthermore, with the aid of Kanban-like artifacts, distribution of workload from the backlogs – across teams and intertemporally – is also likely to receive a boost. Consequently, time management will be enhanced by avoiding periods of frantic or overwhelming work sessions to meet deadlines or the generation of delays. Fourth, backlogs' very nature as living organisms correlates with benefiting the company's planning approach. Using agile planning means adopting a constant improvement approach. Only the project vision and high-level goals can genuinely be static over the long term, designers, instead, plan over the short-term and quickly move to make these plans operational. As a consequence, learning is fast and continuous and can be leveraged in the subsequent planning cycles. This is expected to provide significant benefits to ArchLiving in terms of effectiveness or fitness of output while reducing delays or reworks. Moreover, because a higher focus on details is introduced, the project is more likely to remain on budget while minimizing the chances that regulatory inspections halt progress.

To be sure, the agile transformation will also encounter many obstacles and challenges. To begin with, the construction value chain and the multitude of its actors (see Section 1.2) constitute a relatively entrenched business environment where organizational or process change is hardly ever accepted. This will force ArchLiving to seek constant mediation with non-agile partners or find ways to transmit agile values and principles so that external stakeholders understand how the company is accustomed to operating. Second, the industry's rigid procedures and externally enforced development phases will translate to the company having little latitude to derogate or introduce flexibility. Also, contracting requirements and other regulations may curb nimbleness while forcing to resort to comprehensive documentation. These aspects clash with many agile precepts. Nonetheless, for the very reason that the development process is lengthy, complex, and dynamic, many could argue that a host of activities or processes could still

be handled with agility. As an agile player, ArchLiving's challenge is hence to balance lightweight practices and tools with more formal means depending on the circumstance and the nature of the underlying activities. Finally, the company may find it challenging to enforce ongoing customer involvement during project development. This is because clients may be frequently distracted by their own occupations or may be simply unavailable. When this may create problems (e.g., lacking feedback, vision, or sense of direction), Project Managers aided by executives should try to seek higher engagement. They should disseminate and transmit the values of the agile way of working while maintaining more informal ties with clients. However, if this is not enough, PMs must be ready to take on the role of "project challenger" and act as if they themselves were the customers.



## CONCLUSIONS

Traditionally described as technologically mature and stable, in the latest decades, even a sector like architecture and engineering (A&E) has entered a renewed phase of increased volatility and uncertainty caused by greater rivalry, more intricate customer requirements, and faster-paced digitization. As these dynamics unfold, other segments of the economy – which have been at the forefront of innovation and rapid market makeovers from the start – have already devised lightweight organizational methods and tools to keep up with new developments and ambiguity. These principles and practices, collectively known as “agile”, are said to boost firms’ proficiency in sensing and responding to change insofar as they aid them in quickly seizing new opportunities, fending off threats, and gaining a competitive advantage. From the agile body of knowledge itself, companies in the A&E sector can also potentially take up ways to improve their own governance and management in the face of an ever more turbulent business environment. A forerunner in this direction, ArchLivIng is a growing organization based in Northern Italy that has distinguished itself from most incumbents in the industry for its entrepreneurial attitude and its business management competencies. The company, which has been experimenting with the application of agile ways of working and instruments over the recent years, represents a compelling case study to investigate the latitude for organizational agility in the A&E sector.

This research aimed to fill the existing gap concerning the adoption of agile principles and practices outside high-tech companies by discussing their introduction in a relatively traditional business environment such as architecture and engineering. The inquiry was guided by two central questions, namely why organizations in the sector ought to look at the agile philosophy to address the increased dynamism recorded in the market and how A&E companies can manage the transition to enterprise agility, including what methods and tools are most appropriate in light of the processes and customs found in the industry.

Based on an analysis of the challenges faced by A&E firms and studying the courses of action taken by a company – ArchLivIng – in the process of its agile transformation, enterprise agility is found to provide notable benefits to the industry such as improved customer relationship management, enhanced communication and collaboration across

professionals, and better handling of project time that will ultimately increase the quality of output, reduce delays, and avoid significant reworks.

Despite the objective organizational and market distance between architecture and engineering companies and top-notch technology or information system providers, results indicate that an A&E firm can also introduce principles and practices pertaining to the agile body of knowledge. This, however, will not be without challenges because players will find it difficult to interface with the multitude of non-agile actors found in the agile value chain, and conflict may arise with traditional project procedures.

Overall, this review presents limitations inasmuch as little quantitative data could be collected due to the agile transformation in the case study analyzed being still ongoing at the time of writing and initial results expected only in the near future. The study was also hindered by limited previous investigations to be used as possible platforms for this thesis both in the sector and concerning enterprise agility.

As this work can be said to represent a preliminary study, future research should commit to collect additional quantitative and qualitative data on the field and consider taking a broader perspective on the whole construction value chain.



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