Master Thesis

Scenario Analysis and Strategy Recommendations for NET Engineering
International Considering the Digitization until 2025

Applying the HHL-Roland Berger Scenario-Development Process to the
Architecture, Engineering, and Construction Industry

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Abstract
How will the German and Italian architecture, engineering, and construction industry look like in 2025? After a period of seemingly stagnant developments, the industry, characterized by high complexity, is on the brink of rapid change. This environmental turbulence poses great challenges for strategists. To account for uncertainty, this thesis executes a standardized scenario-based strategic planning approach to develop two sets of four scenarios for the architecture, engineering, and construction industry in Germany and Italy in 2025, based upon which strategies are derived. It is concluded that the German and Italian architecture, engineering, and construction industry revolves around two key dimensions: feasibility of projects, capturing the socio-politico-economic conditions, and speed of industry digitization, encompassing technological adoption. To benefit from positive and to mitigate negative developments stemming from these axes, strategic recommendations are developed that consider changes in key factors. This thesis is of relevance for stakeholders of the architecture, engineering, and construction industry, as well as parties interested scenario-based strategic planning.
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<th>Description</th>
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<tbody>
<tr>
<td>AE</td>
<td>Architecture and engineering</td>
</tr>
<tr>
<td>AEC</td>
<td>Architecture, engineering, and construction</td>
</tr>
<tr>
<td>ECB</td>
<td>European Central Bank</td>
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<tr>
<td>EU</td>
<td>European Unions</td>
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<tr>
<td>GDP</td>
<td>Gross domestic product</td>
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<tr>
<td>HOAI</td>
<td>Honorarordnung für Architekten und Ingenieure</td>
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<tr>
<td>KPIs</td>
<td>Key performance indicators</td>
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<tr>
<td>NET</td>
<td>NET Engineering International Group</td>
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<tr>
<td>R&amp;D</td>
<td>Research &amp; development</td>
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1 Introduction

As Heraclitus of Ephesus claimed more than 2500 years ago, change is the only constant in life (Mark, 2010). This assertion holds true not only in life, but also in the business world. Today, accelerating change, fueled by rapid technological, environmental, and social developments, penetrates every facet of the globalized economy and politics. Concurrently, incumbent companies and industries have been the subject of disruptions forcing them to drastic adaptations or resulting in their demise. In February 2007, shortly prior the release of the original iPhone, Jim Balsillie, then co-CEO of RIM, manufacturer of Blackberry devices, utterly misjudged the new entrant’s potential: “[Apple and the iPhone is] kind of one more entrant into an already very busy space with lots of choice for consumers … But in terms of a sort of a sea-change for BlackBerry, I would think that's overstating it” (Arthur, 2012). While Apple captured 87% of profits of the global smartphone market in Q4 2017, RIM is presently responding to their dramatically declining phone sales by transitioning into software (Kuranda, 2019; Sietz, 2018). Apple, now faced with declining sales of their most profitable product line themselves, is currently searching for ways to cope with the changing market environment to preserve their leading role (Apple, 2019; Campbell, 2019; Hardwick, 2019; Mullin, Alpert, & Mickie, 2019). These developments raise the question how firms can deal with rapid and seemingly unforeseeable changes in their market environments?

The architecture, engineering, and construction industry has been characterized by low digitization and stagnant productivity. However, recent technological advancements and industry developments question the status-quo. Consequently, industry players need to prepare themselves for potential disruption. Unprecedented levels of globalization and the advent of new technologies have not only led to more wealth, but also bred new degrees of complexity (Schwenker & Wulf, 2013, p. 12). Combined with higher degrees of volatility and ambiguity it causes environmental uncertainty (Schwenker & Wulf, 2013, pp. 12, 22). Uncertainty, defined as the inability to predict the future accurately, poses great challenges for strategic decision-making (Milliken, 1987, p. 136; Schwenker & Wulf, 2013, p. 12).
Nevertheless, strategic decisions remain essential to ensure companies’ future success (Schwenker & Wulf, 2013, p. 15).

Traditional strategic planning focusses on the deduction of the one best strategy (Ansoff, 1965; Schwenker & Wulf, 2013, pp. 32, 44; Wulf, Meißner, & Stubner, 2010, p. 5). This once suitable approach now exhibits major shortcomings, as it does neither consider environmental turbulence, nor “prepare the company for the diversity of possible future developments” (Wulf et al., 2010, p. 7). Therefore, this thesis utilizes a different approach, namely the HHL-Roland Berger approach to scenario-based strategic planning. Based on two sets of four distinct scenarios outlining the state of the German and Italian AEC industry by 2025, strategies considering the imminent digitization for subsidiaries of NET Engineering International Group (NET), namely seecon Ingenieure GmbH, Spiekermann GmbH, and NET Engineering SpA, are derived.

The thesis is structured in four sections. First, the dynamics of the German and Italian AEC industry are discussed to provide an analytical foundation. Second, the theory of strategic planning, including the HHL-Roland Berger approach to scenario-based strategic planning, is elaborated. Thirdly, the HHL-Roland Berger approach to scenario-based strategic planning is conducted for the German and Italian AEC industry to ultimately develop strategies for seecon Ingenieure GmbH, Spiekermann GmbH, and NET Engineering SpA. Finally, conclusions are drawn, and limitations discussed.

2 The architecture, engineering, and construction industry
This section discusses the most important developments and drivers of the AEC industry. This is done to provide an analytical foundation of the prevalent market dynamics. Due to the complexity of the industry and the limited scope of this thesis only a selection of topics is discussed. During the review process it became apparent that German and Italian AEC industry exhibit overlaps regarding some topics but differ in others. Thus, this chapter is split into Germany followed by Italy.
2.1 The German architecture, engineering, and construction industry

2.1.1 Industry overview

The economic importance of the Germany architecture, engineering, and construction industry cannot be understated. In 2018, construction investments in Germany amounted to 352 billion € which constituted 10.4% of the country’s GDP (Statistisches Bundesamt, 2019). At the same time, the industry’s more than 365,000 construction firms employed 2.5 million workers which equal 5.5% of Germany’s entire working population (Staffa & Daniels, 2018b; Statista, 2019b) (Statista, 2019c). Generally, the construction industry can be divided into three parts; (1) residential construction (“Wohnbau”), (2) structural engineering (“Hochbau”) (3) civil engineering (“Tiefbau”) which constituted 61%, 25%, and 14% of industry investments in 2018 respectively (Statistisches Bundesamt, 2019). The development of construction investments and the growth rate of the industry since the year 2000 are depicted in Figure 1.

![Figure 1: Construction investments in Germany per segment (primary axis) in million € and overall growth rate in percent (secondary axis)
Source: Own illustration based on Statistisches Bundesamt (2019).](image)

Construction investments have been increasing since the year 2005. Growth has only been curbed by the 2008 global financial crisis but continued to surge by 2010 and grown by between 5% and 8% since 2015 (Statistisches Bundesamt, 2019). Figure 2 shows the total revenues of the architecture and engineering firms with
annual revenues larger than 17,500 € between 2007 and 2021. Revenues in 2016 amounted to 56.6 billion € (Statista, 2019e). The CAGR between 2010 and 2017 was computed with 3.6%, while the CAGR between 2017 until 2022 is anticipated with 1.8% (Statista, 2019e).

Figure 2: Annual revenues of architecture and engineering firms with revenues larger than 17,500 € expressed in million €; * = forecast
Source: Own illustration based on Statista (2019e).

### 2.1.2 General and specific growth drivers

General growth drivers in the AEC industry are the positive economic conditions, pronounced governmental supporting measures, internal migration, and positive net migration which drives residential construction (Baumanns, Freber, Schober, & Kirchner, 2016, p. 9; Euroconstruct, 2018). One indicator of Germany’s positive economic situation is its GDP growth depicted by Figure 3. The figure shows the marked economic downturn following the 2007 financial crisis and the successive recovery. Since then, the German economy has grown relatively stable at a rate around 2%, a growth that is forecast to decelerate slightly in the near future (OECD, 2019; Statista, 2019h). This growth rate coincides with an inflation rate of around 2% between 2018 and 2021 (Euroconstruct, 2018). Furthermore, the positive fiscal situation of the government facilitates high budgets for infrastructure and other publicly funded projects (Baumanns et al., 2016, p. 9). In this regard, the government has pledged investment volumes of roughly 270 billion € until 2030 for
transportation; 132.8 billion € will be allocated to streets, 112.3 billion € to railways and 24.5 billion € to waterways (BMVI, 2019). This investment volume is roughly 96 billion € higher than the volume of the previous plan (BMVI, 2019).

Figure 3: Germany’s real GDP growth rate since 2007; * = forecast
Source: Own illustration based on OECD (2019) and (Statista (2019h).

Due to the marked capital intensity of the AEC industry, interest rates are an important industry growth driver. Figure 4 depicts interest rates since 2007 in Germany. It shows a drastic decrease since the financial crises and a prolonged period of low interest rates. While a slight increase in interest rates is forecast, the general interest rate percentage is to remain at similar low level at least through summer 2019 and “longer if necessary” according to European Central Bank (ECB) director Draghi (Srivastava, 2019). Accordingly, the interest rate level can be described as conducive for construction investments.
Regarding residential construction, increasing demand stems from positive effects of household incomes, economic prospects, demographic effects, financing conditions, and tax incentives, as well as subsidies for new building (Euroconstruct, 2018). Further drivers are private and commercial investors’ shift towards tangible assets and the influx of external and domestic migration (Euroconstruct, 2018). However, barriers exist in the form of construction land shortages, high construction cost, demographic ageing, excessive bureaucracy, bottlenecks in capacity, and project aversity manifesting itself in protests (Euroconstruct, 2018).

The demand for structural engineering in Germany was positively influenced by the economic situation, corporate growth, availability of financing conditions, stock conditions and vacancies, public debt and financing balance (Euroconstruct, 2018). However, barriers for growth exist. New governmental regulation, particularly regarding energy dampens prospects somewhat by shifting demand away from new conventional power plants (Euroconstruct, 2018). Additionally, the lack of suitable construction land, deteriorating labor shortages, and sharply rising construction prices constitute growth barriers (Euroconstruct, 2018).
Civil engineering demand is positively influenced by infrastructural conditions, available funds on EU, national, and regional level, economic growth, general financing conditions, and public debt and financing balance (Euroconstruct, 2018).

There are some particularities regarding the German civil engineering sector. Generally civil engineering in Germany is strongly dependent on public spending; officially half of investment are made by public-sector clients, however in practice public-sector owners stand behind many private businesses which are principals of civil engineering projects (Euroconstruct, 2018). One prominent example is Deutsche Bahn which receives billions of Euros for investment from the federal government every year (Euroconstruct, 2018). This renders the German civil engineering sector extremely dependent on governmental expenditure, be it federal or state wise, which in turn are highly dependent on the fiscal situation and the elected government and its policies.

Following the outlined growth drivers, the general construction outlook is positive. However, several obstacles remain. These include, among others, low productivity, over-utilized construction capacities, and rising construction prices, all of which are discussed in the following chapters. Before that current dynamics are elaborated.

2.1.3 The HOAI and the separation of planning and construction
HOAI is an abbreviation for Honorarordnung für Architekten und Ingenieure which can be translated to remuneration policy for architects and engineers. It provides security regarding remuneration for planning firms, i.e. architects and engineers, (EXPORO, 2018). By regulating and limiting the remuneration of planning firms separately from construction firms, the former are forced to compete on quality instead of price (EXPORO, 2018). What follows is the independence of planning firms from construction firms, resulting in planers acting as agents of principals by overseeing the proper construction (Verlag Dashöfer, 2018). In this context, principals refer to the principal clients, i.e. those who order the project. Thus, under the HOAI, the interaction between principals, planning firms, and construction firms can be simplified into the following steps: (1) principal commissions planning firm, (2) planning firm develops concepts, designs, and obtains construction permissions, (3) planning firm conducts tender with construction firms based on requirements, (4)
principal is supported by planning firm to choose the most-suited construction firm, (5) planning firm oversees the construction and ensure quality which includes extended liability. This current process under the HOAI is depicted by Figure 5.

![Figure 5: Simplified interaction of principal, planning firm, and construction firms under HOAI](image)

Source: Own illustration.

By abolishing the HOAI, planning firms would have to compete not only on quality but also on price. Following the rising price pressure, increased consolidation is likely to ensue and planning firms are prone to become part of construction firms (DAB, 2018; Verlag Dashöfer, 2018). In this case, a shift in principal-agent relationship would occur. Planning firms would not act as agents of principals, but of construction firms (Verlag Dashöfer, 2018). Consequently, principals would no longer be the clients of planning firms, but rather become clients of construction firms. Thus, by planning firms losing their independence, a typical principal-agent problem arises, leaving principals being less protected than it is the case under the HOAI (Verlag Dashöfer, 2018). The interaction between the three parties with HOAI being abolished is illustrated in Figure 6 and can be simplified as follows: (1) principal collects offers from competing construction firms, (2) principal selects a
construction firm and commissions them (3) construction firm conducts all relevant processes inhouse or sub-contracts planning firms based on price.

![Figure 6. Simplified interaction of principal, planning firm, and construction firm without HOAI](source: Own illustration)

Since the end of 2017, the EU commission is engaging on a lawsuit for breach of contract against Germany pertaining the HOAI (Bold, 2018). Germany is set to adhere to the HOAI, while the EU-commission maintains that the HOAI is infringing on the freedom of services and freedom of establishment (Bold, 2018). The verdict of the European court of justice on the matter is expected for early 2019 (Bold, 2018). Thus, at this point the outcome and the reaction of lawmakers to possible verdicts is unclear (Bold, 2018).

2.1.4 Productivity

Between 1991 and 2018 the productivity of the entire German economy has increased by 44%, as depicted by Figure 7 (Statistisches Bundesamt, 2019). However, the productivity development of the construction sector has been mostly flat with a 5.93% increase for the same 27-year period (Statistisches Bundesamt, 2019). This development is in stark contrast to other industries, particularly the information and communication sector, but also industries which were historically manual labor intensive, such as the manufacturing sector (Statistisches Bundesamt, 2019).
Given generally beneficial economic conditions, increasing construction investments, and broad technological progress this development raises the question how such little productivity gain was achieved in such an extensive time-frame. Productivity is usually driven by technological advances, optimized processes, and improved utilization of resources (Schwahn & Mai, 2018, p. 14). Although the construction industry is more dependent on external conditions, e.g. the weather, than other industries, there are five more significant key obstacles hindering productivity gains in the German AEC industry.

(1) The complexity of regulation, e.g. due to new material regulation, energy regulation, and fire prevention which is further exacerbated by state federalism, i.e. generally similar, but in detail different set of rules for the each of the 16 federal states (Stern et al., 2018). What follows are extensive documentation requirements and often unpredictability regarding the likelihood of permissions, particularly in large projects (Stern et al., 2018).

(2) Slow speed of permission processing, caused by the aforementioned regulatory complexity, slow and antiquated processes, and a lack of interaction between administrative bodies and permission applicants (Stern et al., 2018). This is further
aggravated by the lack of standardization of processes and templates, as well as the lack of bundling of super-regional competencies and capacities of authorities (Stern et al., 2018).

(3) Lacking adoption of modern construction trends, e.g. serial construction, lean construction, repeatable designs, and critical chain project planning, which have been shown to reduce costs, increase productivity and quality, and minimize resources, such as time, materials, and equipment required for construction activities (Stern et al., 2018).

(4) Inefficient management of construction projects, e.g. due to lack of transparency, the lack of meaningful key performance indicators (KPIs), the lack of incentivization, and the lack of collaboration-facilitating tools (Stern et al., 2018).

(5) Lack of digitization, such as the lack of industry-wide use of building information modelling (BIM), drones, and automation of repetitive tasks, causing inefficiencies (Stern et al., 2018). In this regard, there is a lack of political incentivization towards the industry-wide use of BIM (Stern et al., 2018). An explanation of BIM follows. It has been estimated that by addressing these key obstacles, productivity gains of 30% to 40% could be realized (Stern et al., 2018).

2.1.5 Skilled labor shortage
Growing construction demand is met by low industry productivity resulting in construction firms working at full capacity. In fact, the approximately 30% increase in construction investments between 2010 and 2016 was followed by a 14% increase in employees (Stern et al., 2018). Due to the stagnant productivity, the number of unfilled positions in the industry surged from 12,500 to 37,000 (Stern et al., 2018). To satisfy the construction demand a significant increase in productivity or number of employees, or a mix of both is required. Given stagnant productivity, it follows that in the short to mid-term 130,000 additional employees would be needed for the segment of main construction alone (Stern et al., 2018). This shortage of skilled labor pertains not only engineers, but also craftsman of various trades throughout the industry (Schwahn & Mai, 2018, p. 16). Given the demographic change of Germany, a steady decrease in the working population is expected which
can only be mitigated by net-migration effects, if the industry fails to achieve productivity gains (Schwahn & Mai, 2018, p. 16).

Disparate construction demand and supply arising from the lack of construction capacity and low labor productivity, as well as increasing construction investments is causing construction prices to rise; since 2015 price increases have surged from 1.6% p.a. to 4.5% p.a. in 2018 (Euroconstruct, 2018; Stern et al., 2018). Consequently, rising construction investments do not cause a symmetrical increase in realized projects. A good example is that 10% annual increase in residential construction investment between 2010 and 2016 led to an increase of 6% of developed space (Stern et al., 2018). As a result, price per square meter surged by 15% (Stern et al., 2018). This is not only true for residential construction, but also for civil engineering and structural engineering (Stern et al., 2018). Consequently, rising construction investments are expected to lead to higher construction prices, if productivity and capacity gains cannot be achieved (Stern et al., 2018).

Skilled labor shortage persists also on the federal and communal level. After years of austerity, public positions responsible for permissions and the administrative side of construction projects are sparse; between 1991 and 2010 these positions have decreased by 35% and between 2011 and 2016 they decreased an additional 10% (Stern et al., 2018). This shortage of skilled labor on a federal and communal level causes delays in granting financial aid and granting permissions for various projects including roads, digital infrastructure, and energy infrastructure (Stern et al., 2018). Thus, despite the positive economic conditions and project order situation as well as extensive federal and communal financial aid, projects cannot be realized in a timely manner because of the bottleneck resulting from the shortage of skilled labor of construction firms and authorities (Stern et al., 2018).

2.1.6 Digitization

One clear cause of low productivity is the slow progress of industry digitization. In contrast to other industries, the construction sector exhibits the lowest degree of digitization only comparable with agriculture, mining, and hospitality (Stern et al., 2018). This is noteworthy, as 93% of construction firms agreed that the digitization will be key factor in shaping their processes (Schober & Hoff, 2016). However, there
seems to be uncertainty on how to realize the benefits of the digitization (Schober & Hoff, 2016). Furthermore, the construction industry lacks in the adoption of digital methods and lean processes which have been the focus of development in other industries over the last ten years (Stern et al., 2018). There are a number of digital trends which already yield benefits in the construction industry due to their partial implementation. They include electronic tendering, digital procurement, smart construction site logistics, the usage of unmanned aerial vehicles (UAVs), and 3D laser technology, as well as BIM which provide transparency and efficiency while facilitating coordination and optimizing activities (Schober & Hoff, 2016).

BIM “is a digital planning method for construction in which all stakeholders have access to the same database” (Schober, Hoff, Lecat, De Thieulloy, & Siepen, 2017, p. 5). It facilitates collaboration, increases efficiency, provides transparency, enables benchmarking, and ultimately reduces cost (Schober et al., 2017). Because it helps overcoming issues stemming from the high degree of industry fragmentation, its impact has been deemed strongest compared to other industry trends (Schober et al., 2017). Productivity gains can be realized through BIM by professionalizing contractors´ work by means of a connected construction site (Schober et al., 2017). BIM´s adoption will lead to an influence shift of stakeholders by causing decisions to be made earlier in the construction process (Schober et al., 2017). The power general contractors currently yield over selection of material suppliers and brands will be nearly completely transferred to technical planers who, after the extensive implementation of BIM, will be able to choose without consulting the craftsmen (Schober et al., 2017). Despite these imminent and dramatic changes, there exists a discrepancy between planning firms´ and construction firms´ evaluation regarding the importance of BIM (Schober & Hoff, 2016). Architects and engineers deem the technology as game-changing, while construction firms underestimate it (Schober & Hoff, 2016). In international comparison, Germany lags behind in the adoption of BIM (Stern et al., 2018). While other countries have already made BIM mandatory for certain projects or implemented government strategies, Germany is using support programs and is planning on making BIM mandatory for infrastructure projects by 2020 (Schober et al., 2017). Generally, the uncoordinated
European efforts regarding BIM are impeding adoption (Schober et al., 2017). Notwithstanding BIM’s potential, several barriers to its full implementation exist:

(1) Personnel needs to be adequately trained to utilize BIM’s full potential (Schober et al., 2017). This likely includes re-assigning responsibilities, involving one or more BIM manager within organizations (Schober et al., 2017).

(2) Overcoming the fragmentation of the industry to develop BIM standardization, which would allow the compatibility of different BIM solutions (Schober et al., 2017).

(3) Addressing contractual matters arising from the usage of BIM: data ownership, payment handling, responsibility assignment and more (Schober et al., 2017).

(4) Increasing levels of adoption on a regional but also industry level in order to profit from BIM’s benefits (Schober et al., 2017).

(5) Lack of firms with more than 250 employees, that possess the resources and experience to develop and adopt digital methods broadly (Stern et al., 2018). In Germany only 12% of industry revenue is generated by firms of this size and none of the ten largest construction firms are of German origin (Stern et al., 2018).

### 2.1.7 Industry structure

With over 365,000 construction firms and more than 129,000 planning firms the industry is highly fragmented (Staffa & Daniels, 2018a; Staffa & Daniels, 2018b).

In the construction sub-sector, firms with fewer than 100 employees have consistently generated more than 70% of industry revenues over the last years (Baumanns et al., 2016, p. 14). Simultaneously, there is no visible trend towards consolidation; in fact, between 2011 and 2016 the number of construction firms has been growing by 0.6% per year (Staffa & Daniels, 2018b). This fragmentation coincides with low revenue shares of firms with more than 250 employees and the fact that no major construction player is of German origin (Stern et al., 2018).

The number of architecture and engineering firms has been decreasing by 0.5% annually between 2011 and 2016 (Staffa & Daniels, 2018a). Despite this slight consolidation, the AE segment of the industry is still highly fragmented. In 2016, AE firms with fewer than ten employees constituted 90.4% of firms (Staffa & Daniels,
2018a). These firms employed 40.5% of industry workers and earned roughly 30% of industry revenues (Statistisches Bundesamt, 2018). Contrastingly, only 3.5% of AE firms had 20 and more employees; these firms employed 43.9% of industry workers and generated 53.9% of total revenues (Statistisches Bundesamt, 2018).

2.2 The Italian architecture, engineering, and construction industry

2.2.1 Overview

Between 2007 and 2017, the total construction investment of Italy has decreased by almost 25% (Euroconstruct, 2018) In 2017, the overall investment volume for the Italian construction sector amounted to 168.42 billion €, which constituted 9.76% of the country’s GDP (Euroconstruct, 2018) (OECD, 2019). In the same year, the industry employed 1.42 million persons equal to 6.17% of the country’s labor force (Statista, 2019f) (Statista, 2019j)). In 2017, construction investment was composed of 49.58% residential construction, 29.75% structural engineering, and 20.67% civil engineering (Euroconstruct, 2018). Expressed in Euros, these shares equaled 82.1 billion €, 49.3 billion €, and 34.2 billion € respectively (Euroconstruct, 2018).

Figure 8: Construction investments in Italy per segment (primary axis) in million € and overall growth rate (secondary axis); e = estimated, * = forecast
Source: Own illustration based on Euroconstruct (2018).

Figure 8 shows the development of the Italian construction sector output since 2015. The figure shows positive overall growth of 0.5% to 2.1% annually. residential construction has had minor negative growth in 2015. Structural engineering has been growing positively throughout the review period. Civil engineering, after a
strong growth of 4.8% in 2015, exhibited negative growth in 2016 and 2017 but is expected to grow by 3% in the coming years. The development of annual revenues from architectural and engineering in Italy since 2010 is depicted by Figure 9. The graph shows that revenues in this sector have been fluctuating (Statista, 2019i).

Figure 9: Annual revenues in Euro from architectural and engineering activities in Italy between 2010 and 2015
Source: Own illustration based on Statista (2019i).

2.2.2 General and specific growth drivers
Generally, growth drivers for the Italian and German construction industry concur. However, their manifestation differs somewhat. Figure 10 depicts the Italian GDP growth rate since the year 2000.

Figure 10: Italy’s real GDP growth rate as a percentage since the year 2000; * = forecast
Source: Own illustration based on Statista (2019g) and The World Bank (2019).
It shows the negative economic consequences of the financial crises in 2008 and 2009 followed by a short recovery in 2010 and 2011 which led into a small recession in 2012 and 2013. Since then, growth has been positive and is forecast to continue so in the near future, albeit slightly extenuated (Statista, 2019g; The World Bank, 2019). This growth is forecast to coincide with an inflation rate of 1.5% to 2.0% between 2018 and 2021 (Euroconstruct, 2018).

Due to the capital intensity of construction projects, interest rates play a key role for the Italian construction industry as they do for Germany. Figure 11 depicts the development of long-term interest rates since 2007.

![Figure 11: Italy’s long-term interest rates since the year 2007](image)

Source: Own illustration based on OECD (2019).

The figure shows that interest rates have peaked in 2012 with 6.5% (OECD, 2019). Since then, they have decreased drastically and fell below the 2% mark in 2015 (OECD, 2019). Lately, a slight upwards trend is visible. Overall, the relatively low interest rates are conducive for the AEC industry. However, a future surge could offset the positive effect of Italy’s economic recovery on the construction demand.

The permission process constitutes a serious barrier to construction activities in Italy. Not only is it excessively time-intensive but also unduly expensive: the average time
to obtain a permission for building a warehouse is 227.5 days (European Commission, 2019). This is 73.5 days longer than the high-income OECD average (European Commission, 2019). Permission cost constitute 3.6% of the total cost of the warehouse; this number is two percentage points higher than the OECD high-income average (European Commission, 2019).

Furthermore, corruption is an Italian problem. 50% of Italian citizens indicate that corruption and abuse of power is an issue when obtaining building permits (European Commission, 2019). More generally, the risk for corruption is considered high for businesses, and very high for public procurement due to the large amounts of resources involved (European Commission, 2019).

Residential construction demand increase originated from positive effects of household income, economic prospects, tax incentives and subsidies, and real estate prices (Euroconstruct, 2018). However, uncertainties for residential demand loom; the fragility of Italy’s economic recovery and its impact on investors’ confidence, questionable effectiveness of renovation incentives, the country’s flat demographic development, changing demand following changes in household structure, and persisting liquidity bottlenecks of private and commercial principals (Euroconstruct, 2018).

Structural engineering demand was positively influenced by economic growth, corporate profits, tax incentives and subsidies for renovating, and stock and vacancies (Euroconstruct, 2018). However, political uncertainty remains, including high public debt which constitutes a growth barrier (Euroconstruct, 2018).

Civil engineering demand was strongly driven by the country’s infrastructural conditions, which refer to the need for new infrastructure or its renovation (Euroconstruct, 2018). Additionally, available EU, national, and regional funds, economic growth, and environmental issues and energy policies were positive influencing factors (Euroconstruct, 2018). However, elections and the high public debt of Italy constituted barriers to growth (Euroconstruct, 2018). A detailed discussion of Italy’s debt follows in chapter 2.2.4.
2.2.3 Productivity

Between 1995 and 2015 Italy’s labor productivity in the construction industry decreased by -1.5% p.a. (McKinsey Global Institute, 2017). During the same period, the entire economy exhibited a labor productivity growth of 0.4% p.a. (Ehmer, 2016). This overall increase was realized by other industries, including manufacturing, retail, education, health care, and transportation (Ehmer, 2016). Despite issues hindering productivity being well-known, there has been a slow and in the case of Italy even negative development (McKinsey Global Institute, 2017). This is somewhat of a conundrum, as the knowledge and the tools exist and have existed for some time (McKinsey Global Institute, 2017).

The issues underlying the poor productivity development of the industry are a global phenomenon (McKinsey Global Institute, 2017). Additionally, productivity issues are not distributed equally among industry players; in fact larger firms exhibit much higher productivity than smaller ones and a higher degree of specialization is associated with lower productivity (McKinsey Global Institute, 2017). Infrastructure and civil construction players exhibit the highest productivity with approximately 120% of the industry, while specialized subcontractors on average exhibit 20% lower productivity than the sector average (McKinsey Global Institute, 2017). The McKinsey Global Institute (2017) identified ten causes of low productivity which can be divided into external forces, industry dynamics, and firm level operational factors:

Externally, three factors constitute productivity barriers: (1) rising project and site complexity due to brownfield-, refurbishment-, and repair-orientation, (2) extensive regulation, land fragmentation, dependency on public-sector demand, and its cyclical nature, and (3) informality and corruption. Industry dynamics encompass (4) the highly fragmented and opaque construction industry, (5) misaligned contractual structure including risk allocation, and (6) inexperienced buyers in an opaque market. Firm-level barriers include: (7) Inefficient design processes and lack of standardization, (8) inadequate project management and execution basics, (9) insufficiently skilled workforce, and (10) underinvestment in digitization, innovation, and technology, stemming from low margins and the tense liquidity situation.
It is estimated that addressing these ten factors could result in productivity gains of 48% to 60%, which would bring the industry on par with the total economy’s productivity (McKinsey Global Institute, 2017). Additionally, addressing these issues could result in 27% to 38% in cost savings (McKinsey Global Institute, 2017).

2.2.4 Public debt
As discussed in regard to the growth of different construction segments, the high government debt of Italy plays a key role. This is because construction, particularly infrastructure, is highly dependent on public sector spending (McKinsey Global Institute, 2017). The government’s willingness to spend is dependent on their general policy convictions but also on the fiscal situation. Italy’s fiscal situation is tense. In 2017, government gross debt as a percentage of GDP totaled to 131.8%, 16.4 percentage points higher than 2010 and 49.3 percentage points higher than the EU average in 2017 (European Commission, 2019). In the same year, Italy’s deficit as a share of GDP was -2.3% compared to the -1.0% EU average (European Commission, 2019). While government debt is expected to decrease moderately in the near future following primary surplus and nominal growth, considerable financial resources are required to cover the debt (European Commission, 2019). Consequently, this capital used for interest and debt repayment cannot be invested into infrastructure, education, innovation, or to lower the tax burden, all of which could enhance growth.

2.2.5 Access to funding
As the construction industry is extremely capital dependent, access to sufficient funding is of considerable importance and plays a role in the cost-structure of firms. In Italy, access to finance is difficult, especially so for construction firms. In this regard the country has been ranked 126th out of 138 for the year 2017 (European Commission, 2019). One reason is the sup-bar performing Italian financial markets, which caused corporate lending to decrease (European Commission, 2019). Another cause is the amount of bad debt and non-performing loans held by the construction industry. In 2016 the construction industry held 43.3 billion € equal to 27.4% of total bad debt in the Italian economy and 30.3% of corporate non-performing loans (European Commission, 2019). Consequently, banks have
become more risk averse and reduced their loans to the construction industry (European Commission, 2019). In this regard, smaller loans have become more expensive than larger ones, leading to smaller enterprises being disadvantaged compared to larger firms (European Commission, 2019). Generally, the amount of outstanding loans to the construction industry has decreased by 21.8% between 2010 and 2016 and the volume of new loans has decreased by 68% during the same period (European Commission, 2019). This tight lending situation has exacerbated the situation of the highly indebted construction industry causing its poor performance (European Commission, 2019). This is because construction firms which are stripped for cash and facing disadvantageous loan conditions are unlikely to invest into productivity-enhancing technology. Consequently, the construction industry is in need for alternative funding options.

The described general lack of financial support can be seen as a construction cost driver; residential construction cost have increased significantly, while non-residential prices have stabilized (European Commission, 2019). Overall construction prices in Italy are somewhat stable. Between 2015 and 2018 the annual increase in price rose from 0.3% to 0.9% and an additional 0.5% increase p.a. is forecast until 2021 (Euroconstruct, 2018).

2.2.6 Payment tardiness

Resulting from high public debt and the generally difficult access to finance, another issue pertaining the Italian construction sector emanates: late payments have become the norm. In fact, 96.3% of payments in the construction industry are settled after the due date; 12.4% of payments exhibit delays up to 30 days, 44.3% have a delay of 30 to 90 days, 14.7% delays of 90 to 120 days, and 24.9% delays of over 120 days (European Commission, 2019). These numbers are even further exceeded by payments from public administration; the average waiting time for payment from public administrations was 156 days in 2017 (European Commission, 2019). Even worse, VAT reimbursement, constituting 10% to 22% of the total amount billed, can take up to 470 days (European Commission, 2019). Consequently, outstanding payment for a total value of 8 billion € existed as of 2017 while the industry is facing liquidity issues of 1.3 billion € p.a. from this practice
To solve these liquidity issues, firms have to take out loans with disadvantageous conditions and consequently lack the necessary funds for investment that would improve their competitive situation, i.e. increase productivity or future proof for the imminent digitization.

2.2.7 Digitization
Comparing the state of digitization of the construction industry of Italy to Germany reveals strong similarities. In fact, Italy’s digitization is delayed and compared to other industries, it is the second to least digitized, alike Germany (European Commission, 2019). As outlined in chapter 2.1.6, high industry fragmentation and low share of firms with 250 employees and more are barriers for extensive digitization. Italy’s construction industry is even more fragmented than the German one and low numbers of firms with 250 employees and more (Staffa & Daniels, 2018b; Stern et al., 2018). As previously discussed in regard to Germany, this very high degree of fragmentation constitutes a considerable barrier for digitization and productivity gains because it adds layers of complexity and due to the fact that in small firms the lack of resources, financial and human, poses significant challenges to develop the necessary expertise (Stern et al., 2018). Furthermore, many regulatory aspects are overseen by the EU, rendering them virtually identical for Italy and Germany; including BIM’s increasing importance (European Commission, 2019; Schober & Hoff, 2016). Due to very similar conditions underlying industry digitization in Germany and Italy, the reader is advised to refer to chapter 2.1.6 for a discussion of Italy’s AEC digitization.

2.2.8 Labor and skills shortage
Currently, “the industry is facing a shortage of different skills mainly due to the high decrease of labor force after the crisis and strong emigration flow from young Italian construction professionals” (European Commission, 2019, p. 19). However, the situation is not as clear as that. A surplus of low skill occupation, i.e. painters building structure cleaners and related trade workers is anticipated (European Commission, 2019). Despite a significant increase in tertiary education in engineering, manufacturing, and construction between 2010 and 2016 and increasing participation of adult education and training, a shortage of high skill occupation
construction managers, architects, and professional with technical and management skills persists (European Commission, 2019). Three key causes can be identified for this: (1) a strong decrease in labor force, i.e. emigration of young Italian professionals following the crisis, (2) a skill gap, stemming from a lack of communication between higher education institutions and companies, (3) regionally varying quality of vocational education and training due to federalist responsibilities (European Commission, 2019).

Furthermore, the substitution of the declining Italian workforce by a growing share of foreign workers can be observed (European Commission, 2019). These foreign workers are usually hired for unskilled labor, despite their skill level being equivalent of local workers (European Commission, 2019). The result in “suboptimal use of human capital” (European Commission, 2019, p. 19).

Lastly, changing requirements of the construction industry following increasing digitization and the usage of new materials and techniques are likely to necessitate altered skill profiles of industry workers in the future. Since low-skilled labor is prevalent in the construction industry, this change in requirements is likely to cause the skill gap and skilled labor shortage to widen (McKinsey Global Institute, 2017). The skill gap and shortage of skilled labor on the other hand is likely to pose barriers for the necessary speed of digitization to realize productivity gains.

2.2.9 Industry structure

The comparison of German and Italian AEC industry measured by yearly investment and revenue yields a clear result. In terms of output, Italy was half of Germany; Italian planning firms generated less than half of German ones in terms of revenues. Considering the number of firms however, Italy boasted 40% more construction firms and 57% more planning firms in 2015 (Staffa & Daniels, 2018a; Staffa & Daniels, 2018b). Noteworthy, there are fewer employees by both construction and planning firms than in Germany. In 2016, the 511,405 Italian construction firms employed 1.42 million persons, averaging 2.8 workers per firm. Regarding planning firms, this number becomes even smaller; 193,176 firms exhibited total personnel of 255,400 persons which computes to an average of 1.32 person per firm. The
implication is that the scope of many, if not the vast majority of, firms in the Italian AEC industry is very minor. Consequently, the industry is extremely fragmented.

However, the number of construction firms in Italy has decreased significantly since 2010. Since then the number has dropped by almost 100,000 firms until 2017 (European Commission, 2019). The reason being that overall volume has also decreased by more than 30% between 2010 and 2017 (European Commission, 2019). Company births in the construction sector dropped by 24% from 50,255 in 2010 to 38,208 in 2015; company deaths increased by 14.3% from 51,368 to 58,736 (European Commission, 2019). However, the trend of decreasing number of construction firms has stopped as volumes have stabilized (European Commission, 2019). Regarding the architecture and engineering field, company births increased by 41.7 from 13,200 in 2010 to 15,562 to 38,208 in 2015; company deaths increased by 91.2% from 10,201 to 23,675 (European Commission, 2019).

3 Strategic planning in theory
The outlined market dynamics and their interconnectedness illustrate a high degree of complexity which is accompanied by ambiguity and volatility. In order to develop strategies in these changing conditions, strategic planning must account for uncertainty (Schwenker & Wulf, 2013, p. 22; Wulf et al., 2010, p. 7). The following chapter explains the strategic challenge of uncertainty and how to deal with it.

3.1 Strategy in times of uncertainty
Uncertainty “can be understood as an individual’s inability to predict something future accurately” (Milliken, 1987, p. 136). Colloquially, uncertainty is often used synonymously with risk and insecurity (Schwenker & Dauner-Lieb, 2017, p. 23). However, all three terms describe entirely different conditions (Schwenker & Dauner-Lieb, 2017, p. 23).

Risk describes conditions in which one knows all potential occurrences and their probabilities of occurrence (Schwenker & Dauner-Lieb, 2017, p. 23). Hence the difficulty lies in deciding between alternatives, but the best outcome can be derived analytically (Schwenker & Dauner-Lieb, 2017, pp. 23-24).
Insecurity refers to conditions in which one knows all potential occurrences but not their probabilities of occurrence (Schwenker & Dauner-Lieb, 2017, p. 24). Here analytical deduction of the best outcome is not possible, but potential occurrences can be envisioned (Schwenker & Dauner-Lieb, 2017, p. 24).

Uncertainty characterize conditions in which one can neither know all potential occurrences, nor their direction, nor their speed (Schwenker & Dauner-Lieb, 2017, p. 24). Thus, true uncertainty constitutes a fundamental challenge for strategic decision making (Schwenker & Dauner-Lieb, 2017, p. 24). Disregarding or underestimating true uncertainty poses a substantial threat to companies’ success by leaving them unprotected against environmental change or ignorant of potential opportunities (Schwenker & Wulf, 2013, p. 22). To incorporate uncertainty into strategic planning, it is therefore crucial to understand uncertainty and its three core dimensions volatility, complexity, and ambiguity (Schwenker & Wulf, 2013, p. 24).

(1) Volatility is of twofold but linked nature. Firm level volatility refers to volatility of a company’s workforce, earnings, capital expenditures, and the price of raw materials, which through unforeseeable and rapid change can hinder reliable and efficient long-term decisions (Schwenker & Wulf, 2013, p. 24).

Aggregate volatility, “refers to fast, large-scale changes in macro-indicators such as GDP growth”, that can arise from “strongly interconnected sectors” (Schwenker & Wulf, 2013, p. 25). It has the potential to dramatically alter policy and economic situation, and therefore has a substantial, albeit unpredictable influence on entire industries (Schwenker & Wulf, 2013, p. 25).

(2) Complexity results from a growing number of interrelated factors that need to be considered when developing strategies (Schwenker & Wulf, 2013, pp. 26-27). Complexity is particularly prevalent in the presence of network effects and change on different levels (Schwenker & Wulf, 2013, p. 27). Based on Snowden and Boone (2007), Schwenker & Wulf (2013) identified five features of complex systems: (1) connected and interacting elements, (2) disproportionately major consequences caused from minor impact, (3), the whole being “greater than the sum of its inputs and assets”, (4) due to constant external change hindsight not leading to the
deduction of helpful future implications, and (5) agents and system being in mutual constraint (pp. 26-27). In practice complexity is exhibited by changes in everyday business (Schwenker & Wulf, 2013, p. 27).

(3) Ambiguity emerges due to the combination of unprecedented complexity and novelty (Schwenker & Wulf, 2013, p. 29). It refers to the lack of clarity, i.e. how decisions will impact the short, mid, and long-term (Schrader, Riggs, & Smith, 1993; Schwenker & Wulf, 2013, p. 29). As such it involves (1) uncertainty about outcome probabilities, (2) uncertainty of causal relationships and thus decreases decision accuracy while increasing outcome risk (Schwenker & Wulf, 2013, p. 29).

The resulting true uncertainty constitutes a substantial challenge for strategists who are beginning to question the soundness of traditional strategic planning approaches that “fail to provide adequate answers” (Schwenker & Dauner-Lieb, 2017, p. 306; Schwenker & Wulf, 2013, p. 12). To cope with uncertainty, today’s strategic approaches should be holistically oriented towards the future and be able to model multiple potential futures (Kosow & Gaßner, 2008, p. 6; Schwenker & Dauner-Lieb, 2017, p. 307). Thinking in scenarios offers such an approach (Schwenker & Dauner-Lieb, 2017, p. 309).

### 3.2 Scenario planning

The analysis of existing market dynamics in the German and Italian AEC industry uncovered the challenge of dealing with uncertainty. Scenario-based strategic planning is a tool which helps to deal with these challenges. Before strengths and weaknesses of strategic planning follows, a definition is offered: Scenarios are the depiction of a potential future situation, including the paths leading to this future situation (Kosow & Gaßner, 2008, p. 9). Scenario planning therefore provides a “basis for generating strategies that deal with different contingencies” and “enable managers to be better prepared for strategic decisions, especially in times of increased volatility and uncertainty” (Schwenker & Wulf, 2013, pp. 46, 102). Per Schwenker & Dauner-Lieb (2017), scenario planning deals with uncertainty by:

(1) Creating awareness for uncertain developments by analyzing how the world could potentially look like (p. 30).
(2) Providing internal and external orientation by enabling fact-based discussions on how the future could look like (p. 30).

(3) Providing a mental framework in which strategic details can be further developed by preserving the notion of future conditions (p. 30).

The incorporation of internal and external perspectives “can foster cognitive change in the ‘mental models’ of decision makers – it challenges their assumptions and broadens their perception of possible developments” (Schwenker & Wulf, 2013, p. 46). Confronting those long-held internal beliefs can help alter corporate culture (Mietzner & Reger, 2005, p. 235). Thus, scenario planning result in the reduction of cognitive biases, i.e. framing bias, and the increase in decision quality (Meißner & Wulf, 2012, p. 803). This significance becomes even more evident when noting that scenario planning’s “aim is not to accurately predict the future, but rather to better understand the logical paths that lead to different scenarios and to help develop more comprehensive strategies” (Schwenker & Wulf, 2013, p. 46). In this context, scenarios can be used to obtain a number of different ends: Scenarios are internally coherent pictures of possible futures. (…) they can dramatize trends and alternatives, explore the impacts and implications of decisions, choices, strategies, and provide insights into cause-and-effect sequences (Mietzner & Reger, 2005, p. 223).

Additionally, scenarios can improve communication by creating “a common language for dealing with strategic issues by opening a strategic conversation within an organisation” (Mietzner & Reger, 2005, p. 235). Scenarios also allow the identification of weak signals, that are further discussed in chapter 3.3. Finally, scenarios offer flexibility over traditional strategic approaches (Mietzner & Reger, 2005, p. 235). In summary, scenario planning “provides a sound basis for comprehensive planning” and “… gives firms a holistic understanding of potential future changes” (Schwenker & Wulf, 2013, p. 45). Thus, scenarios help to promote the ability to “avoid the unavoidable” and to “shape the unavoidable” (Schwenker & Dauner-Lieb, 2017, p. 33). These characteristics renders scenarios planning more appropriate than traditional strategic approaches for today’s dynamic environments.
laden with uncertainty (Mietzner & Reger, 2005, p. 221; Schwenker & Dauner-Lieb, 2017, p. 308). However, disadvantages exist:

(1) Generally, scenario planning is highly complex and therefore slow (Schwenker & Wulf, 2013, p. 45). Data gathering from different sources, their analysis, and the subsequent description of scenarios demands the allocation of substantial time (Mietzner & Reger, 2005, p. 236). It is therefore not uncommon for scenario planning to last between five months to one year (Schwenker & Wulf, 2013, p. 48).

(2) The selection of appropriate stakeholders to prevent group bias can prove a difficult task (Mietzner & Reger, 2005, p. 236; Schwenker & Wulf, 2013, p. 87).

(3) Scenarios can become “wishful thinking” instead of “plausible futures”, which should be avoided (Mietzner & Reger, 2005, pp. 226, 236).

(4) The time-horizons of strategic planning and traditional scenario planning are not aligned; strategic planning looks at three to five year, while scenario planning is usually done for five years and more (Schwenker & Wulf, 2013, p. 49).

(5) There exists a lack of standardization and unwillingness of authors to disclose their method, hindering extensive replication (Schwenker & Wulf, 2013, p. 48).

Consequently, traditional scenario planning methods need to be adapted to address weaknesses while conserving advantageous characteristics. Hence, Roland Berger and HHL Leipzig Graduate School of Management jointly developed an approach to scenario-based strategic planning (Schwenker & Wulf, 2013, p. 14). This strategic tool is outlined in the next chapter.

3.3 HHL-Roland Berger approach to scenario-based strategic planning

The HHL-Roland Berger approach to scenario-based strategic planning, depicted in Figure 12, incorporates the six steps found in traditional scenario planning into one comprehensive process (Schwenker & Wulf, 2013, p. 50).
Standardization by the use of six tools helps structuring each step of the process and thereby reducing complexity inherent to scenario planning (Wulf et al., 2010, p. 14). Consequently, this approach to scenario-based strategic planning is easier and much quicker than traditional scenario planning (Wulf et al., 2010, p. 13). Drawbacks of traditional scenario planning are addressed effectively, while strengths are maintained. Thus, the HHL-Roland Berger approach to scenario-based strategic planning “meets the challenges of increasing volatility, rapid change and complexity of the environment” (Schwenker & Wulf, 2013, p. 50). It results in four distinct scenarios and “… in a comprehensive set of strategic options rather than a single option” (Schwenker & Wulf, 2013, p. 50). The description of the six steps follows.

(1) The definition of scopes is crucial as it “sets the scope of the entire analysis (Schwenker & Wulf, 2013, p. 51). Its tool, the framing checklist, summarizes the goal
of the scenario project, the strategic level of analysis, participants, stakeholders, and the time horizon (Schwenker & Wulf, 2013, p. 52).

(2) The perception analysis integrates the perspectives of internal and external stakeholders through a tool called 360° stakeholder feedback which consists of a two-part questionnaire (Schwenker & Wulf, 2013, p. 53). First, stakeholders defined in the definition of scope are asked a set of open questions about which factors in the six PESTLE dimensions political, economic, societal, technological, ecological, and legal will shape the present and future of the industry (Schwenker & Wulf, 2013, p. 53). Their answers are then clustered into approximately 40 factors (Schwenker & Wulf, 2013, p. 53). Second, in a closed questionnaire with the factors derived from the first questionnaire the same stakeholders are asked to assess all factors according to their potential impact on the company’s performance and their uncertainty (Schwenker & Wulf, 2013, p. 53). The outcome of the 360° stakeholder feedback is a list of rated influencing factors that can be used to identify blind spots and weak signals (Schwenker & Wulf, 2013, pp. 53, 80).

_Blind spots_ “are developments that a company knowingly or unknowingly overlooks” (Schwenker & Wulf, 2013, p. 79). Specifically, they are factors that are rated substantially higher by external stakeholders than internal stakeholders (Schwenker & Wulf, 2013, p. 54). They can be identified by aid visualization in spider diagrams (Schwenker & Wulf, 2013, p. 84).

_Weak signals_ are “initial indicators of future change in the environment” often resulting from “technological discontinuities or disruptive events” (Mietzner & Reger, 2005, p. 235; Schwenker & Wulf, 2013, p. 79). They can be identified by benchmarking: weak signals are factors mentioned by only a small number of participants in the first round questionnaire that score high in either impact, uncertainty in the second round (Schwenker & Wulf, 2013, p. 54).

The results of the perception analysis constitute the basis for the trend and uncertainty analysis and are valuable for opening a discussion about the underlying assumptions and mental modes of internal stakeholders, i.e. the top management and strategy decision-makers (Schwenker & Wulf, 2013, pp. 52, 53, 55).
(3) In the trend and uncertainty analysis, factors previously identified in the perception analysis are classified according to their respective rating in impact and uncertainty (Schwenker & Wulf, 2013, p. 56). The goal for this process step is the identification of two scenario dimensions along which scenarios are described in the fourth step (Schwenker & Wulf, 2013, p. 55). The tool at hand is the impact/uncertainty grid which positions influence factors according to their average stakeholder rating regarding uncertainty and impact on the x-axis and y-axis respectively (Schwenker & Wulf, 2013, pp. 56, 98). By doing so, factors can be divided in three distinct categories:

Secondary elements, which have a weak impact and either low or high uncertainty, are located at the bottom section, and, due to their lack in impact, can be disregarded in the further process (Schwenker & Wulf, 2013, pp. 56, 99).

Trends, that exhibit a strong impact, low to medium uncertainty, are located at the upper left-hand section, and serve for the detailed description of the scenarios in Step 4 (Schwenker & Wulf, 2013, pp. 56, 100).

Critical uncertainties exhibit strong impact and high uncertainty and are located in the upper right-hand corner (Schwenker & Wulf, 2013, pp. 56, 100). Due to their high degree of uncertainty, their development is unknown, but simultaneously, they will have a strong impact on the company (Schwenker & Wulf, 2013, p. 100). Consequently, they are the most important factors on the grid and need to be reflected in the scenario dimensions (Schwenker & Wulf, 2013, p. 100). In practice three to seven critical uncertainties are identified which are consolidated into two meta-factors based on similarity and the sharing of common themes (Schwenker & Wulf, 2013, pp. 56, 100). These key uncertainties then constitute the two scenario dimensions (Schwenker & Wulf, 2013, p. 106).

(4) Scenario building is the development of four distinct, plausible, logical, and qualitative scenarios (Schwenker & Wulf, 2013, pp. 57, 100, 101, 103). Therefore, the process step utilizes the Scenario matrix as framework. Four sub-steps exist:

First, “Identify the scenarios”, which is done by projecting the two meta-factors identified in Step 3 to their positive and negative extremes, whereby four distinct
scenarios emerge (Schwenker & Wulf, 2013, pp. 105, 106). These scenarios are then given names that should capture their cause-effect relationships and can be loosely based on historical events (Schwenker & Wulf, 2013, p. 106).

Second, “Create an influence diagram”, which serves to build the story behind the scenarios and the paths “along which the world will arrive at the four alternative scenarios” (Schwenker & Wulf, 2013, p. 107). The influence diagram outlines the cause-effect relationships of trends and critical uncertainties, thus capturing how they led to the end states described by the scenario (Schwenker & Wulf, 2013, p. 107). This is accomplished by selecting the most important factors previously identified and linking them according to their relationship (Schwenker & Wulf, 2013, p. 107). An important aspect is to ensure unambiguity and plausibility how factors impact each other to facilitate coherence between the different scenarios (Schwenker & Wulf, 2013, pp. 107-108). It is advised to conduct the development of the scenario dimensions and influence diagram in a workshop to ensure plausibility and consistency (Schwenker & Wulf, 2013, p. 108).

Third, “Describe the scenarios”, which is the “narrative prose based on the influence diagram or the systematic description of why developments happen and how they influence each other (Schwenker & Wulf, 2013, p. 108). Once scenarios are described they should be detailed with a concise headline and sub-header (Schwenker & Wulf, 2013, p. 108).

Fourth, “Create a fact sheet”, which includes a brief description, relevant numbers and key indicators of the scenarios that should enable readers to quickly gather the key points of the scenario in question (Schwenker & Wulf, 2013, p. 109).

Finally, the scenarios are checked regarding their ability to provide readers with understanding and anticipation of uncertainty and risks, as well as their ability to reveal previously unknown strategic opportunities (Schwenker & Wulf, 2013, pp. 109-110).

(5) Strategy definition has the goal of creating a core strategy applicable for all scenarios and scenario-specific options (Schwenker & Wulf, 2013, p. 61). It does so by utilizing the strategy manual which is complemented by the strategy corridor
This tool is based on the two meta-factors identified in the trend and uncertainty analysis which function as y-axis and x-axis and show the trajectory towards the most positive scenario (Schwenker & Wulf, 2013, p. 134). Generally, it is assumed that companies strive towards this best possible scenario (Schwenker & Wulf, 2013, p. 134). By examining both axes individually and considering how the company can “benefit from a positive” and “avoid or manage any negative development along” each axis, specific strategic actions can be derived (Schwenker & Wulf, 2013, p. 135). Pondering the same questions for factors and critical uncertainties that influence the development towards the most positive scenario and analyzing their cause-effect relationships depicted in the influence diagram from Step 4, allows the development of strategic recommendations. (Schwenker & Wulf, 2013, pp. 135-137). The above then form the core strategy (Schwenker & Wulf, 2013, p. 137). To develop complementary scenario-specific options, factors which develop negatively are considered (Schwenker & Wulf, 2013, p. 137). By assessing how to mitigate the consequences of their negative developments, strategic options are then derived (Schwenker & Wulf, 2013, p. 137).

(6) Monitoring is the final process step. It’s aim is to facilitate the strategy implementation by identifying which strategic option developed the preceding step should be utilized (Schwenker & Wulf, 2013, pp. 62, 138). This is accomplished by monitoring external developments through its framework, the scenario cockpit (Schwenker & Wulf, 2013, p. 139). The scenario cockpit is a strategic controlling system which formalizes the monitoring of external development (Schwenker & Wulf, 2013, p. 139). This is done by monitoring non-overlapping quantitative KPIs with a traffic light system (Schwenker & Wulf, 2013, pp. 139-141).

The outlined steps demonstrate the high degree of standardization and speed of the HHL-Roland Berger approach to scenario-based strategic planning. Jointly with the discussed advantages of scenario planning, this approach was deemed suitable to develop scenarios and strategies for the German and Italian AEC industry in 2025.
4 Practical application of the HHL-Roland Berger approach to scenario-based strategic planning

Chapter 2 outlined the market dynamics of the German and Italian AEC industry. The analyses showed the prevalence of high degrees of uncertainty in both markets. Then, Chapter 3 elaborated how true uncertainty poses severe challenges for strategic planning and how the HHL-Roland Berger approach to scenario-based strategic planning constitutes a suitable approach to cope with this true uncertainty. This practical application of the approach to the German and Italian AEC industry follows. Following the separation of the analysis of the German and Italian AEC industry, the practical application proceeds accordingly: while the first step of the process, the definition of scope, was conducted jointly for the German and Italian subsidiaries, subsequent steps were performed separately. The identical methodology was used for both Germany and Italy. Hence, to satisfy the page limit of this thesis, process steps are described detailed for the first application, i.e. Germany, and kept brief for the second application, i.e. Italy. Due to the limited scope, the sixth step, monitoring, will not conducted.

4.1 Germany

First, the practical application of the HHL-Roland Berger approach to scenario-based strategic planning was conducted for Germany in respect to seecon Ingenieure GmbH and Spiekermann GmbH.

4.1.1 Definition of scope

To define the scope of this scenario exercise, a first skype meeting of the primary participants was conducted on 18th January 2019. Subsequent communication regarding the definition of scope was facilitated via Skype and Email. By addressing the five central questions of the framing checklist, the scope was delineated:

(1) The goal of the scenario project was defined as the development of plausible scenarios for the German and Italian AEC industry by 2025, followed by the subsequent derivation of suitable strategies.

(2) The approach was focused on the business level. In regard to Germany, strategies for seecon Ingenieure GmbH and Spiekermann GmbH were to be
developed. In regard to Italy, strategies for NET Engineering SpA were to be derived. Other corporate activities of NET Engineering International Group, including NET EOOD and engiNET in Bulgaria were out of the scope.

(3) The HHL-Roland Berger approach to scenario-based strategic planning was conducted by an M.Sc. student of HHL, namely Kristian Reimar Kersting. Liaisons at NET were Stefano Susani (Industrial CEO) and Jeffrey Seeck (Group Chief of Strategy). Prof. Dr. Torsten Wulf (holder of the chair for Strategic and International Management at the Philipps University of Marburg and adjunct professor at the Dr. Ing. h.c. F. Porsche AG Chair of Strategic Management and Digital Entrepreneurship at HHL Leipzig Graduate School of Management) acted as the academic supervisor.

(4) The selection of internal and external stakeholders was overseen by Stefano Susani and Jeff Seeck who, through their insights and years of business experience, were able to select and contact the relevant stakeholders. Prior to the selection ten stakeholder categories were predefined based on (Schwenker & Wulf, 2013, p. 82): private sector customers, communal sector customers, regulatory bodies, software(-providing) companies, construction companies, sub-contractors, competitors, engineering associations, banks, and financial institutions.

For Germany 43 internal and 70 external stakeholders were identified. Internally their roles included COO, CFO, chief of strategy, business unit manager, unit leader, project leader, project manager, and controller. External participants held the following roles: CEO, board member, area manager, project developer, project manager, project engineer, (technical) team leader, head position, company owner, programmer, tax consultant, financial consultant, marketing manager, sales manager, and mayor. Regarding Italy, 12 internal and 38 external stakeholders were selected. Their respective internal roles were company president, CEO, CFO, strategy director, marketing manager, technical director, and R&D manager. The 38 external stakeholders held to following titles: CEO, managing director, marketing manager, procurement director, technical director, senior consultant, and risk director. This final list of internal and external stakeholders satisfied the requirement of broad variety not only in stakeholder categories, but also in functions.
Furthermore, the large number of stakeholders were deemed able to reliably identify the most important influencing factors (Schwenker & Wulf, 2013, p. 82).

(5) Usually it is recommended to set the time horizon to five years to match planning cycles and external developments (Schwenker & Wulf, 2013, p. 77). However, after a discussion among the participants, the time horizon was set to 2025 or six years to reflect the planning cycle at hand.

4.1.2 Perception analysis
As outlined in chapter 3.3, the perception analysis integrates internal and external stakeholder perspectives. Following the first step, definition of scope, 40 key factors pertaining the development of the German and Italian AEC industry until 2025 were obtained. Then these factors were rated regarding their impact and uncertainty. The objective of this step was twofold: first, gain an understanding about the importance of individual factors, and second, identify blind spots and weak signals.

4.1.2.1 360° Stakeholder Feedback
The 360° stakeholder feedback for the German AEC industry was conducted with all 43 internal and 70 external stakeholders identified in the framing checklist.

First, all 113 stakeholders received an e-mail with a link to an online survey. This survey method was used to accommodate for the large number of stakeholders. Six open questions depicted in Appendix 1 covering all PESTLE-dimensions were asked. 27 internal and 22 external stakeholders provided answers in the first round of the 360° stakeholder feedback. Unfortunately, the format underlying the tool for collecting the answers did not support the counting of entries. However, an estimation of entry numbers yielded approximately 1500 single entries made by the 49 respondents. Based on congruence these entries were clustered to a total of 40 factors, which corresponds with the recommendation for the ideal number of factors (Schwenker & Wulf, 2013, p. 53).

Many of the factors named in this first round of the survey, depicted in Appendix 2, displayed considerable overlap with trends discussed in chapter 2.1. However, respondents also named various factors that go beyond what was outlined in the literature. In this context, the value of the 360° stakeholder feedback becomes
apparent: on one hand, answers given by the respondents provide deeper context for the trends discussed in chapter 2.1, on the other hand, developments disregarded in the available literature are unearthed by respondents.

Second, the consolidated 40 factors were sent to all 113 participating stakeholders via a second online survey. All stakeholders were asked to assess the potential impact and uncertainty of each factor on a scale of one to ten. 24 internal and 20 external participants provided answers. The arithmetic mean of all stakeholders’ rating for each individual factor regarding its impact and uncertainty was computed, which are shown in Appendix 3.

4.1.2.2 Result analysis – blind spots and weak signals

After the 360° stakeholder feedback, the results analysis followed. To identify blind posts, external stakeholders’ assessment was contrasted against internal stakeholders’ assessment. To do so, the arithmetic means for both the impact and uncertainty dimensions regarding each factor were computed separately for internal and external stakeholders. Then the results were mapped on a spider diagram to visualize blind spots. The value range for the impact dimensions was 3.9, while the uncertainty range was 2.8. Occasions in which the external ratings were larger by 1.0 and more were deemed to indicate blind spots, as these differences would be equal to more than 25% in the impact dimension and more than 35% in the uncertainty dimension. Figure 13 shows five blind spots in the impact dimension, while Figure 14 illustrates five blind spots of the uncertainty dimension.
Figure 13: Blind spot analysis of the impact dimensions in Germany
Source: Own illustration based on Schwenker & Wulf (2013), p. 85.

Figure 14: Blind spot analysis of the uncertainty dimension in Germany
Source: Own illustration based on Schwenker & Wulf (2013), p. 85.
Comparing the blind spots of both dimensions reveals overlap regarding the factor protections and trade wars. By controlling for that overlap, nine distinct blind spots in Germany emerged, namely:

1. Protectionism and trade wars (political)
2. BREXIT (political)
3. Interest rate policy and interest rates (economic)
4. Rent, property, and real estate cost (economic)
5. Urbanization (social)
6. Project acceptance (social)
7. Accelerating innovation and disruption speed, as well as complexity (technological)
8. Digitalized business models and E-commerce (technological)
9. Expansion of broadband connection (technological)

The identified blind spots are distributed over the core PEST dimensions. Due to the thematic variety of topics covered it seems plausible that these blind spots, rather than being of specific nature, generally indicate differences in mental modes between external and internal stakeholders. Another explanation could be that internal stakeholders who deal with these topics frequently might deem these blind spots as trivial. While this does not necessarily mean that these factors are being disregarded in planning activities, it could mean that they are being considered as of secondary nature.

Finally, weak signals were identified. These are factors which have been named only a few times in the first survey but scored high in either the impact or uncertainty dimension in the second survey. In Germany two weak signals were identified:

1. Planning and permission processing time
2. Project acceptance

The first was mentioned nine times out of approximately 1500 entries in the first survey but scored a 7.9 in impact which constituted the second highest impact score of all factors. The second was project acceptance, which scored 6.6 in uncertainty, the second highest uncertainty rating of all factors. Both weak signals are addressing the realization potential of projects. That is, they pose potential
bottlenecks and are largely uninfluenceable. Therefore, their importance cannot be overstressed and should be reflected in the following scenario descriptions. Blind spots and weak signals revealed in this process step were considered in the scenario development and derivation of strategies.

4.1.3 Trend and uncertainty analysis

Next, the trend and uncertainty analysis followed. In this process step, factors were mapped to the impact/uncertainty grid and ultimately key uncertainties were distilled.

4.1.3.1 Impact/uncertainty grid

The overarching goal of the third step is the identification of two scenario axes (Schwenker & Wulf, 2013, p. 55). The third step of the approach starts with the graphical analysis of factors assessed in the 360° stakeholder feedback. As outlined in chapter 3.3 factors are mapped to the impact/uncertainty grid, a scatter plot with uncertainty as x-axis and impact as y-axis. The impact/uncertainty grid is divided into three areas, which results in the classification of factors according to their importance. Appendix 4 provides a comprehensive categorization of all factors.

Before discussing the findings of impact/uncertainty analysis, it should be noted that the overall range of the dimensions was quite small. While the impact range was 3.9 points between 4.4 and 8.3, the uncertainty range was even smaller with merely 2.8 points between 4 and 6.8. Therefore, the axes had to be adjusted accordingly to account for the small ranges and for distinct factor categories to emerge.

Figure 15 shows the impact/uncertainty grid for the German AEC industry until 2025, visualizing the findings of the 360° stakeholder analysis.
It shows nine distinct factors in the bottom half of the grid as secondary elements. These factors were disregarded in the further process (Schwenker & Wulf, 2013, pp. 56, 99). In the top left-hand area, 24 trends emerged that later on served for the detailed description of the scenarios (Schwenker & Wulf, 2013, p. 56). Most importantly, in the top right-hand corner, seven critical uncertainties revealed themselves, namely:

1. Remuneration development (economic)
2. Project acceptance (social)
3. Degree and complexity of regulation (legal)
4. Degree of digitization (technological)
5. Economic stability (economic)
6. Development of key technologies (technological)
7. Political stability and elections (political)

The number of critical uncertainties in this scenario exercise concurred with the number of critical uncertainties usually found (Schwenker & Wulf, 2013, p. 56). These critical uncertainties formed the basis for the scenario dimension, while identified trends served as basis for the scenario descriptions.
4.1.3.2 Key uncertainties

Following the process outlined in chapter 3.3, the seven critical uncertainties identified in the impact/uncertainty analysis were clustered into two key uncertainties. This was done according to similarities and the sharing of common themes. To ensure plausibility and to minimize potential subjectivity the following measure was undertaken: the suggestion regarding the clustering of critical uncertainties into two key uncertainties was reviewed by three sparring partners at NET during a workshop, namely Stefano Susani, Jeff Seeck, and Giovanni Acciaro (Mobility Technical Director & Strategic Development Manager at NET Engineering SpA). After a short discussion, the initial suggestion was unanimously approved.

There are several common themes shared among the critical uncertainties. Economic stability and remuneration development address economic conditions and industry economics. The former is of broad nature and summarizes many economic developments of a country. It can be seen as a driver of industry volumes cost, and price level. The latter one directly addresses the price and cost factor of projects but also the relative position of different industry participants. Both factors exhibit a stability component regarding the overall situation in the AEC industry. This element of stability is clearly shared by political stability and elections which is a driver for scope of regulation. These two factors are also important economic drivers because the construction industry, particularly infrastructure, is highly dependent on public sector spending, which again is influenced by the industry cost level and underlying economic conditions. The attitude of the public sector in turn is reflected in the project acceptance which can be not only of social but also of political nature. Combined these five factors constitute the socio-politico-economic conditions of the industry and thus determine the feasibility of projects.

Two critical uncertainties stand out from these first five. The degree of digitization and key technology developments are clearly technology related and constitute a different aspect of the macroenvironmental conditions than the first five critical uncertainties. Both share the sentiment of technological progress as well as scope of technological availability and its adoption. Therefore, they were consolidated into speed of industry digitization.
4.1.4  Scenario building

The two identified key uncertainties constitute the foundation for the following fourth process step in which scenarios are constructed and described according to cause-effect relationships.

4.1.4.1  Scenario identification

In this first step, scenarios were identified by projecting the two key uncertainties to their positive and negative extremes. This was done by using “feasibility of projects” as the horizontal and “speed of industry digitization” as the vertical axis. Four scenarios emerged that corresponded to the specific combination of axes projections. The scenarios were based on the following assumptions:

The HOAI will be abolished until 2025 leading to a liberalization of remuneration regarding architecture and engineering services in Germany. This manifests itself two key aspects.

First, architecture and engineering services are becoming increasingly in-sourced by construction firms that vertically integrate these services to incorporate a larger segment of the value chain. Existing planning firms are faced with intensifying price pressure which forces them to increase their project volumes and engage in cost-cutting activities. These developments are dependent on the cost-pressure and therefore upon the socio-politico-economic conditions. In advantageous conditions, there is little consolidation happening, while in disadvantageous conditions consolidation is shaping the market environment.

Second, and a consequence of the first point, architecture and engineering services are increasingly outsourced and offshored to low-cost countries to achieve arbitrage effects, i.e. exploiting the price differences between Germany and the low-cost country. These outsourcing and offshoring activities are primarily focused on services with a high degree of standardization, such as structural engineering and infrastructure design with low complexity. However, this commoditization trend of architectural and engineering services is further advancing as the standardization of services and the vertical integration of planning services progresses. The specific manifestation of these assumptions is detailed in the individual scenarios.
The assumptions stem from the discussion of HOAI in chapter 2.1, the fact that remuneration development was assessed with the highest uncertainty of all factors. Following these assumption four distinct scenarios were identified whose names were chosen to memorably describe the events leading to their outcome. The scenarios are depicted in Figure 16.

![Scenario matrix of the German AEC industry in 2025](source)

**4.1.4.2 Influence diagram**

In the second step, an influence diagram was created to illustrate the cause-effect relationships of the most relevant trends, critical uncertainties, and the two key uncertainties. The section of factors was based on an initial suggestion that was discussed during a workshop with the NET sparring partners Stefano Susani, Jeff Seeck, and Giovanni Acciari to ensure plausibility and consistency of all scenarios (Schwenker & Wulf, 2013, p. 108). Finally, a total of 25 factors was chosen and their complex links visualized as shown by Figure 17.
Trends are depicted in a blue box and critical uncertainties are depicted in green. The influence diagram reveals direct and indirect connections between the elements towards the two key uncertainties. A short discussion about the cause-effect relationships follows.

*Feasibility of projects* is mostly driven by mostly socio-politico-economic factors which constitute either advantageous or disadvantageous conditions for the AEC industry. Four out of five critical uncertainties corresponding to the key uncertainty feasibility of projects do so indirectly via other drivers such as *development of construction cost*, *consolidation trends*, as well as *planning and permissions speed*. The critical uncertainty *project acceptance* constitutes the exception as it directly influences *feasibility of projects*. Other socio-politico-economic factors that primarily drive *feasibility of projects* via an indirect route include *interest rates* and *availability of skilled labor*, both of which had been identified prior to the stakeholder analysis and were discussed in detail in chapter 2.1. Further factors relating to this first key uncertainty involve consequences of *climate change* influencing the *scarcity of materials* and *civic involvement* influencing *project acceptance* among others. Therefore, a high *feasibility of projects* describes a state in which the economic conditions are leading to high demand, while the political and social conditions allow
for the realization of projects. Vice versa, disadvantageous socio-politico-economic conditions are those that are unfavorable to the feasibility of projects.

*Speed of industry digitization* is primarily driven by technological factors, but to a lesser extent also by economic and political ones. Regarding this dimension *key technology developments* is located in the center as a necessary enabler. It is influenced by the politically driven *factors subsidies and supporting measures* as well as the *prevalence of startup culture*. *Key technology developments* in turn stimulates *digitalized business models* and the second technological critical uncertainty *degree of digitization*. This critical uncertainty is directly influencing *speed of industry digitization* but also has an indirect route via *innovation and disruption speed*. Considering the drivers behind speed of industry digitization illustrates that the central question behind this key uncertainty is not whether digitization happens but rather how fast it will materialize in the industry until 2025.

The influence diagram also reveals some lateral connections between the drivers of the key uncertainties. *Political stability* and *elections* as well as *scope of regulation* are indirect drivers for both key uncertainties due to their central nature; the AEC industry is highly dependent on the public sector and the conditions for technological development and its adoption can be rendered conducive or hindering by political influence. Other lateral links include *key technology developments* towards *energy transition* which in turn influences climate change. Thus, *key technology developments* not only indirectly drives *speed of industry digitization* but also *feasibility of projects*. Similar cause-effect relationships can be observed regarding degree of digitization towards planning and permission speed which again is a driver for feasibility of projects.

The influence diagram illustrates the complexity of cause-effect relationship in the German AEC industry. The following scenarios account for this interconnectedness.

### 4.1.4.3 Scenario descriptions and fact sheets

Conducting the 360° stakeholder analysis as well as the trend and uncertainty analysis whose results led into the influence diagram laid the foundation for the description of the scenarios. By using “narrative prose” the dynamics depicted in the
influence diagram and market analysis the scenarios were described in a systematic fashion (Schwenker & Wulf, 2013, p. 108). Additionally, fact sheets capturing the most important KPIs and summary of key developments are provided in Figures 18, 19, 20, and 21. Please note that any mentioning of political tendencies or actors is done so to provide detail rather than to disseminate a political agenda.

4.1.4.3.1 Scenario A – Digitized boom

Resulting from drastically growing environmental awareness, the agendas of most political parties have become considerably greener since 2019. Simultaneously, the fears driving the advent of nationalist tendencies have subsided following successful integration of migrants. This is reflected in the outcomes of the federal elections in 2021 and state elections until 2025 which have been dominated by political coalitions that manage to unite economic sense with environmental necessity and technological foresight. In this regard, extensive subsidies and support measures for education, digit(al)ization, and environmental projects are passed. Growth-conducive regulation and high political stability are driving stable economic growth of 3% which in turn cascades positively into the general socio-politico-economic conditions; e.g. the remuneration development has stabilized despite the abolishment of the HOAI. Simultaneously, the ECB is holding long-term interest rates at below 1% to boost the economies of the southern Europe. These low interest rates translate into long-term loans of under 2% that constitute necessary capital basis for AEC industry growth. Not compromising its commitment to making the future green, the government is able to provide the necessary construction land for the continuously rising construction demand of 8% annually.

Following the government’s enthusiastic attitude towards digitization and innovation, as well as the pronounced availability of capital, there is a surge in startups, which are setting a positive example regarding company culture for incumbent firms. As a result, and due to a future-enthusiastic attitude, key technology breakthroughs are achieved which in turn boost several key trends. Considerable progress has been made towards the full transition to renewable energy. This has not only been enabled by key technology developments but also by stricter environmental regulation from the eco-friendly government and civic
involvement, such as Fridays for future, following the high environmental awareness. Consequently, many coal plants are being replaced by renewable sources even before the planned phase-out in 2038.

Due to extensive governmental funding for digital matters, pervasive broadband coverage is provided which jointly with the aforementioned key technology breakthroughs propagate digitalized business models. Consequently, integrated mobility concepts and green mobility trends are increasingly common. These include sharing solutions, the increasingly seamless integration of public transports with individual transport, electric vehicles, and other alternatives to the combustion engine and an increase in bicycle-friendliness in German cities. Jointly with the stricter environmental regulation and the milestones achieved in the renewable energy transition, these mobility trends significantly reduce Germany’s share of climate change contributions.

The industry is rapidly digitizing resulting from several of the outlined developments including the high economic stability, the government’s enthusiastic attitude towards digit(al)ization manifested in conducive regulation and extensive supporting measures, as well as the prevalence of digitalized business models following key technology developments and pervasive broadband coverage.

Construction cost, which at the end of the second decade of the 2000s were increasing substantially, have, despite more stringent regulation, rising salaries, and increasing demand, only risen by 2% p.a., on par with the inflation rate. This is mainly due to the high degree of industry digitization including the pervasiveness of advanced BIM solutions, which is counteracting the once imminent shortage of skilled labor: rising industry productivity by 8% p.a. facilitates the realization of increasing demand by 8% p.a. without necessitating additional labor hours. At the same time, extensive education programs and the booming economy facilitate the necessary qualification of employees, while the high industry attractiveness and high salaries constitutes a pull factor in attracting foreign workers. Consequently, the high demand of construction projects can finally be realized by the firms without adding onto the years-long backorder logs. Other factors curbing the increase of construction cost are low interest, generous availability of construction land, stable
remuneration development, and low scarcity of materials. Following the high economic stability and limited cost pressure due the stable development of construction cost, consolidation trends are restrained despite the low interest rates and the abolishment of the HOAI.

Greatly increased planning and permission speed compared to 2019 is enabled by the pronounced degree of digitization and simplified regulation. Furthermore, a high degree of project acceptance is driven by civic acceptance towards designs necessitated by the public the environmental awareness and green mobility trends. Together with the extensive governmental subsidies this leads to the realization of broad infrastructure expansions. Lastly, the high prevalence of digitalized business models in conjunction with the high degree of digitization and pervasiveness of startup-culture is accelerating the innovation and disruption speed in the industry.

![Fact sheet Germany – Scenario A – Digitized boom](image)

**Figure 18**: Fact sheet Germany – Scenario A – Digitized boom  
Source: Own illustration based on Schwenker & Wulf (2013), p. 118.

### 4.1.4.3.2 Scenario B – The trap of complacency

While environmental awareness of the general public has been growing somewhat, it has not translated into drastically altered election outcomes federally in 2021 nor state-wise until 2025. The political landscape and government can be best described as stably retaining the status-quo of the second decade of the 2000s.
What is more, nationalist and far-left tendencies destabilizing the political landscape have been curbed following successful integration of migrants. Passed regulation as well as subsides and support programs installed by the government are of varied nature; conducive to economic growth and stability, moderate in regard to environmental regulation, and lacking in technological foresight. The economy is growing with around 3% p.a. and remuneration development is somewhat stable despite the abolishment of the HOAI. Concurrently, interest rates are held low by the ECB, which translates into long-term loan rates of 2% for industry players. Additionally, the government manages to provide necessary construction land necessitated for the realization of construction demand growing by 8% annually.

Despite the low interest rates, a start-up boom is still afar. This is because the government is not aiding startups through supporting measures, and regulation in place constitutes a barrier for founding. Consequently, there is a lack of startup-culture for incumbent firms to take as an example. Following the varied supporting measures and lack of a startup-culture, technological developments are progressing but are lacking substantial breakthroughs. Because of this and the moderate pressure from limited civic involvement, no significant milestones regarding the energy transition towards renewable energy have been reached. Instead, the energy mix has become gradually more renewable, however many coal plants are still in use and planned to be phased-out by 2038. Other causes for this step-wise development involve the lack of progressiveness in environmental attitude of the government reflected in the moderate environmental regulation.

The aforementioned lack in technological foresight in government regulation and their status-quo retaining policies have caused the broadband expansion to stagnate. While most urban areas are connected, the situation in rural areas is problematic. Consequently, the pervasiveness of digitalized business is lacking. While the government is supporting new mobility trends somewhat, the landscape is mostly similar to 2019 because of the lack of digital business models, no key technology breakthroughs, and moderate environmental regulation. This and the slow development of the renewable energy transition causes Germany’s share of
environmental impact to increase on a relative level. Nevertheless, construction materials are still abundant due to global developments.

Despite high economic stability and growth, the speed of digitization is slow. While BIM has become mandatory for most public projects, there are little additional advancements in the industry. This is because of the unfavorable regulatory framework which constitutes a significant barrier for the pervasive dissemination of digitization while supporting measures are virtually non-existent. Simultaneously, technological developments in this area are still amiss, broadband coverage is lacking, and digitalized business models are few in number. Therefore, productivity of the AEC industry is rising by just 2% annually. Concurrently, construction demand is increasing by 8% p.a. due to domestically advantageous economic conditions and foreign investors, who aim to partake of the “concrete gold”-rush. Due to the ongoing boom, the industry is at full employment. Despite subsidized training programs and rising salaries, luring some foreign workers to Germany, industry players have difficulties increasing their capacities to keep up with the rising demand. Jointly with the low productivity, year-long backorder logs are materializing. Consequently, construction cost are rising by approximately 8% annually since 2019. Further increase of construction cost are only prevented by cheap capital, the abundance of materials and construction land, and mostly stable remuneration. To cope with rising construction cost and demand, AE firms are exploring alternatives; highly standardized service segments, such as structural engineering and low-complexity infrastructure designs are increasingly sub-contracted to players in low-cost countries. This is done to exploit the high demand and order situation by essentially offering more capacity than they possess on their own. This strategy yields economic benefits by leveraging arbitrage effects, i.e. exploiting the differences in price levels between Germany and low-cost countries.

Enabled by the abolishment of the HOAI and as a consequence of increasing cost-pressure and low interest rates, some consolidation is occurring. Large construction firms are acquiring smaller AE firms to capture more segments of the AEC value chain. However, due to beneficial economic situation, these consolidation trends are not very pronounced. The industry remains highly fragmented.
Due to the low degree of digitization, but generally conducive regulation, the planning and permissions speed has increased over 2019 levels. Politicians and the general public are sympathetic towards construction projects, which is why, despite stagnant mobility trends, their realization potential is high. This and the governmental subsidies and supporting measures cause the expansion of physical infrastructure to progress swiftly. However, digital infrastructure is left behind, as reflected by the limited broadband expansion. Due to the lack of digitalized business models and the low degree of digitization, the innovation and disruption speed can be characterized as low as well.

While it seems as if the status-quo is conserved and future industry prospects are looking positive, a threat lingers. This becomes evident in the fact that the German AEC industry is being outpaced by foreign countries in terms of digitization. Due to the liberalization after the abolishment of the HOAI, highly digitized foreign players could replace domestic players who possess a low degree of digitization. This threat is veiled by the positive socio-politico-economic conditions and has not yet manifested as of 2025. German AEC players consider themselves safe due to the current order situation but are essentially unprepared for a sudden economic downshift. In this case, highly-digitized foreign competitors could possibly outcompete the German ones.
4.1.4.3.3 Scenario C – After boom comes bust

Nationalist tendencies and EU-skepticism of the second decade of the 2000s have fragmented the political landscape in Germany. On the federal level, a minority government is in power, while the governments of individual states consist of all political currents. Therefore, a high political instability persists with a government which is unable to effectively draft and pass legislation. Consequently, regulation can be most aptly described as utterly complex and unfavorable for the AEC industry, digitization, and environmental issues. The disastrous political and regulatory situation is reflected in negative economic growth of up to 2% annually. Private sector demand is affected adversely, and the ensuing austerity programs cause public sector spending to decrease. Overall, construction demand is dropping by 5% annually. To stimulate the economy, the ECB is holding interest rates low. However, negative industry prospects render investors and lenders risk averse, thus increasing cost of long-term loans to 6%. The situation for industry players is becoming increasingly difficult. Decreasing annual construction demand is forcing mass-layoffs and cost-cutting upon firms. In the short-term this leads to an abundance of skilled labor and decreasing salaries. In combination with the...
abolishment of the HOAI this causes the remuneration of AE firms to deteriorate. Due to the regulatory disarray the availability of useful construction land limited.

High loan cost and political ineptitude, that manifests itself in adverse regulation and a complete lack in supporting measures, cause decreasing numbers of startups and innovative ventures. Consequently, technological development in virtually all areas has slowed considerably. No major breakthroughs or implementation thereof have been achieved until 2025. This is also reflected in the stagnant energy transition. In this regard, one other cause is the lack of environmental awareness from the public and politicians which causes a lack of civic involvement; Fridays for future and other environmental grass-root campaigns have come to a stop. Essentially Germany’s energy mix has stagnated at 2019 levels.

Another consequence of the outlined technological stagnation and political disinterest in technology, is the lack of broadband expansion. Many rural areas in Germany are simply left-behind and even urban areas coverage is often of porous nature. This has consequences on digitalized business models, of which there are very few. This is especially true in the AEC industry; no major players have digitalized their business. The mobility situation is stagnant as well and strongly resembles 2019. The lack of digitalization has hindered the seamless integration of public and private transport. Lenient environmental regulation and the absence of subsidies have incentivized citizens to rely on established mobility concepts, such as their beloved diesel-cars. Caused by the unchanged nature of mobility and stagnant energy mix, as well as lenient environmental regulation, Germany’s environmental impact has increased. This situation is similar in other countries, leading to a scarcity of construction materials.

Many of the outlined factors culminate in a slow digitization of Germany’s economy and AEC industry. In 2025, Germany is trailing behind most other developed countries in terms of technological progress. This development has clear consequences for productivity. In fact, the AEC industry’s productivity is stagnant and in 2025 on par with its productivity in 1991. Furthermore, low availability of construction land, high scarcity of construction materials, and the significantly deteriorating loaning conditions are driving cost up. This is somewhat counteracted
by widespread practice of unpaid overtime, generally decreasing salaries due to the abundance of skilled labor in the market, and decreasing demand which drive cost down. Therefore, construction cost rise by about 5% annually.

Due to decreased demand, firms are increasingly competing on price to secure customers. However, many smaller firms that have no substantial financial reserves cannot cope with the price war in conjunction with increasing cost pressure. To cope with the high cost-pressure firms are sub-contracting low-complexity design to low-cost countries. However, this practice is fairly widespread and therefore not achieving the desired success, as prices in Germany begin to reflect this method. Many small, but also larger firms which do not possess the necessary financial reserves to stand the ensuing price war are becoming insolvent. Despite the generally high cost of capital, large and financially strong industry players are deemed less risky by investors and thus are able to obtain loans for much more favorable conditions, which they use to go on extensive shopping sprees. Therefore, industry fragmentation is decreasing significantly.

Another barrier for the industry is the slow planning and permission speed resulting from diffuse regulation and low degree of digitization. Moreover, politicians and the public are opposed to big projects further exacerbating the dire situation of the industry. Consequently, infrastructure expansion is halted. Following the outlined digitization trends, innovation and disruption speed can be described as very low.
4.1.4.3.4 Scenario D – Digitized bust

Following the countermovement to nationalist tendencies prevalent in the end of the second decade of the 2000s, the political landscape in Germany has encountered change of direction. An alliance of socially, environmentally and technologically progressives constitute the federal government and most states are governed by like-minded allies. While these governments are socially progressive and support technology and environmental issues, they are enforcing economically disastrous regulation causing a deep recession upon Germany. Following the regulatory and political situation, its GDP is shrinking by up to 2% annually. To stimulate economic growth, the ECB is holding interest rates low. However, negative industry prospects render investors and lenders risk averse, thus increasing cost of long-term loans to 6%. Hence, there is a lack of cheap capital in the market. Consequently, construction demand has declined considerably by up to 5% annually. This forces firms to lay-off employees, leading to an abundance of skilled labor in the short-term. Concurrently, there is a lack of construction land.

A number startups emerge due to low interest rates and political support manifested in support programs and conducive regulation. This is reflected in the fact that some
technological breakthroughs are achieved and that the general trajectory of technological advancement is promising. Concurrently, civic involvement in favor of environmental issues exists. Accordingly, the energy transition is progressing swiftly towards renewable energy, involving the substitution of coal plants by renewable sources. Following provided state funding and technological advancement, broadband coverage has become extensive. Both rural and urban areas are almost completely covered. Hence, the usage of ubiquitous digitalized business models is facilitated almost everywhere. This has a positive effect on enabling the integration of private and public transport. Furthermore, stricter environmental regulation has led to a ban of certain vehicles, i.e. diesel, in some urban areas. This has incentivized the transition of mobility even further. As a consequence of these mobility trends and the progressing energy transition, Germany’s environmental impact is decreasing. Because of global climate change and increasing global demand for construction and raw material, they become scarcer.

Despite the economic instability, digitization has progressed considerably until 2025. This is because of the favorable developments outlined. Consequently, productivity is increasing by up to 6% annually since 2019. In combination with an abundance of skilled labor, construction cost have initially decreased by 5% and are now flattening out. This development is observable despite increased capital cost, a lack of construction land and increasing material scarcity. Following the abolishment of the HOAI, AEC players are competing on price to secure the shrinking project volume in the market. However, due to the cost-pressure not many firms are able to achieve to desired success. To decrease their cost, many AE firms have gone over to sub-contract low-complexity designs to low-cost countries. However, this strategy is pervasive and construction prices in Germany tend to reflect it. Consequently, firms without substantial financial reserves are becoming insolvent. These firms and others are being bought by large and highly competitive players that possess strong financial backing. Therefore, the industry is characterized by rampant consolidation and decreasing fragmentation.

Digitization is only slightly helping to increase planning and permission speed, as the regulatory clutter constitutes the biggest barrier. Additionally, a conundrum
reveals itself. On the one hand, politics and publics oppose large projects because of environmental concerns and not-in-my-backyard-attitude, but on the other hand expansion in infrastructure, particularly transportation is needed to enable future mobility trends. Therefore, the expansion of infrastructure is in limbo. Due to the high degree of digitization, technological advancement, and digitalized business models, there persists a high innovation and disruption speed.

Figure 21: Fact sheet Germany – Scenario D – Digitized bust
Source: Own illustration based on Schwenker & Wulf (2013), p. 118.

4.1.5 Strategy definition
The last chapter described four different scenarios of the German AEC industry based on the influence diagram and dynamics discussed in chapter 2. What follows is the strategy definition by help of the strategy manual and strategy corridor. As “the strategy manual rests on the belief that companies always strive towards the most positive scenario”, Scenario A - Digitized boom was considered (Schwenker & Wulf, 2013, p. 134). Compared to scenario B, its technological developments offer additional upside potential for firms. Scenario C and D exhibit negative socio-politico-economic conditions that constitute substantial barriers for growth that could threaten firms’ survival. Scenario A, however, is characterized by positive manifestation of the key uncertainties feasibility of projects and speed of industry
digitization which constitute the x- and y-axis of the strategy corridor. In this strategy corridor, depicted in Figure 22, the development directions of the underlying factors towards this most positive scenario are shown.

Figure 22: Strategy corridor for German AEC industry

The included factors are the same 25 factors also included in the influence diagram; however, the connections have been simplified. Hence, the outlined strategies are based on these 25 factors and dynamics discussed in chapter 2. Due to the limited scope of this thesis, no internal analysis of NET and its subsidiaries was performed. Consequently, strategies were derived for architecture and engineering firms in general without paying special regard to NET’s situation. Accordingly, some of these strategies might already been implemented to varying degree. Per the definition of scope, the business level was analyzed. Hence business strategies are elaborated while corporate strategies were outside the scope of this thesis.

4.1.5.1 Core strategy

The core strategy rests on the assumption that the strategy for the most positive scenario “can be implemented irrespective of developments in any of the scenarios” (Schwenker & Wulf, 2013, p. 61). It was derived by considering how the company can benefit from positive and manage negative development along the two scenario
dimensions. Positive and negative developments of each individual factor were taken into account. Weak signals and blind spots were addressed, but due to matters of brevity not always explicitly indicated.

4.1.5.1.1 Leverage high feasibility of projects by stimulating strong and sustainable growth

(1) Increase capacities and capture demand. This strategic recommendation is designed to benefit from the rising construction demand resulting from the positive socio-politico-economic conditions depicted in the strategy corridor in Figure 22.

First, productivity should be increased to benefit from rising demand and counteract the extremely low industry productivity. This would enable NET’s subsidiaries to realize more projects with the same or less man hours. A number of solutions including electronic tendering, 3D laser technologies, and BIM offer opportunities in this matter, as elaborated on in the sixth recommendation. Processes should be digitized and streamlined to foster productivity gains. This includes digital project planning with a single source of truth to reduce waste of time and resources. Not only would this boost internal and external coordination, but also coordination between office and field. Furthermore, incentive structures of contracts should foster performance and alignment on a project-outcome level. Here, the transition to best-practices should be facilitated by contracting models such as integrated project delivery (IPD) to help long-term collaboration.

Another way to boost productivity is the optimization of design and engineering processes. Here, repeatable design elements should be used in projects not necessitating bespoke solutions. These should be stored in a standard design library made available within NET’s subsidiaries. This way excess work could be mitigated, and the speed of design processes increased. In this regard, it should be assessed if a tighter collaboration with contractors, alike the automotive industry, could result in efficiency and productivity gains.

Second, skilled staff needs to be attracted and retained for NET’s subsidiaries to thrive. Apart from the normal recruiting and retaining activities, there exist advanced approaches, some of which are outlined in the following. Tighter cooperation with schools and universities could attract high potentials and young professionals. This
should be aided by open work days, where interested prospects could get a first-hand look into the job and the culture and NET’s subsidiaries. The use of headhunting and professional social media presence could complement this approach. In this regard, an attractive common culture based on shared values and beliefs should overarch business units and practices. This attractive culture could be further emphasized by supporting work trends such as remote and flextime. Attractive compensation packages could help when skilled becomes scarcer.

Third, to sustain growth and leverage the increasing demand, NET’s subsidiaries should expand in a number of ways. First, the existing products and services portfolio should be used to penetrate a larger part of the existing market. This approach should be accompanied by a suitable marketing and brand strategy, discussed in the third strategic recommendation. Second, the existing product and service portfolio should be used to expand to new markets. This should be aided through a geographical extension, particularly into the wealthy German south, i.e. Bavaria and Baden-Wuerttemberg. Third, a larger part of the existing market could be captured through new and innovative products and services. This should be supported by organizational ambidexterity, i.e. exploration of innovation and exploitation by means of its service portfolio, outlined in the seventh recommendation. Before engaging in one or more expansion strategies, a thorough analysis should be conducted, which is outlined in the fifth strategic recommendation.

Fourth, excess demand that is exceeding available capacities should be captured by sub-contracting to low-cost providers, particularly in low-cost countries. This outsourcing mostly regards low-complexity infrastructure and structural engineering designs. The upside potential of this strategic measure is to exploit the price differences between Germany and the country in question. The downside potential is that these sub-contractors could approach clients for subsequent projects. However, the tendering process and awarding of contracts is generally based on long-term relationships with local decision makers, rendering this risk manageable. In practice the costs and benefits of the approach should be evaluated on a case-by-case basis.
M&A activities’ potential to aid strategic goals should be evaluated on a group level. Following the definition of scope, only business-level strategic recommendations are outlined in this section. Hence, corporate strategy, such as M&A, will not be discussed.

(2) *Foster organizational excellence*. This strategic recommendation is designed to deal with true uncertainty prevalent in the AEC industry. In this environment, NET’s subsidiaries require organizational agility to innovatively respond to changing market demands. Therefore, NET’s subsidiaries should excel in six categories of organizational capabilities to differentiate themselves from competition in order to achieve and leverage a sustainable competitive advantage.

First, NET’s subsidiaries should be centered around a shared purpose which should penetrate all strategic decisions. This would help leaders to provide orientation in times of uncertainty and, by aligning individual and organizational goals, facilitate collaboration within the subsidiaries. Additionally, clear leadership principles should govern the subsidiaries. Here, other organizations, such as Amazon or Knorr could serve as best practice examples. Thus, leaders at NET would be enabled to instill direction and guidance into the subsidiaries while transferring a sense of urgency and action to employees. The purpose-oriented approach would promote the middle management inclination to embrace the strategies and translate them into NET’s subsidiaries. This should be aided through the setup of incentive structures that reinforce NET’s strategic goals. To ensure continuous success, the next generation of apt leaders should be groomed to ensure seamless successions.

Second, the organizational structure of NET’s subsidiaries should be designed to clearly reflect accountabilities and decisions rights of individuals and committees while fostering their collaboration. Assigned responsibilities should reflect individual capabilities and role requirements. Hierarchies should be kept flat and the number of layers between the top leadership and frontline kept small to facilitate two-way communication and transparency while fostering agility, expressed in fast response times and swift decision making. Agility should be further promoted by setting up shared objectives and metrics that track value-adding activities across the boundaries of functions and business units. The decision processes behind these
activities should be separated from the management hierarchy. Thus, organizational silos can be prevented effectively. Overall the structure and resource allocation should reflect strategic trade-offs made by NET´s subsidiaries.

Third, excellence regarding roles, collaboration, and transparency should be pursued. By instilling role clarity, a clear understanding of each individual´s role and their responsibility in NET should be provided. Moreover, collaboration across functions, business units, and subsidiaries should be promoted to ensure lateral coordination and ultimately achieve strategic goals. In this regard, informal and virtual networks should be used to provide an informal channel for reinforcing NET´s culture and communicating essential information. To align and motivate personnel with strategic goals of NET, milestones, opportunities, threats, and challenges should be communicated transparently. In this regard, potential reservations should be addressed and resolved to facilitate compliance and motivation.

Fourth, people and their engagement are of substantial importance as outlined in the first strategic recommendation. HR should be seen as a strategic partner driving NET´s success by attracting, retaining, and developing talent. The employer brand strategy should build on the shared purpose of the organizations. Employee performance management should be aligned to strategic goals. This could be achieved through the integration of feedback mechanisms providing transparency, and employee development. In this regard, personnel should be prepared for future needs of the changing market environment, i.e. digitization, through workshops and other training programs. Further, educational leaves could be offered or supported.

Fifth, building on the shared purpose, NET´s subsidiaries culture should be based on a common set of shared values and beliefs. In this regard the culture should embrace change and view it as an opportunity to reflect the high level of agility necessitated by uncertain market environment. This should positively influence change management capabilities to foster the organizations´ ability to adapt flexibly to external changes.

Sixth, process and tool optimization should drive organizational excellence. Processes at NET´s subsidiaries should be streamlined and digitized to achieve
quality, time, and cost efficiencies. Accordingly, project management needs to be evaluated to help minimize resources needed and therefore improve productivity and efficiency. This should be supported by institutionalized knowledge and skill management enabled by sharing services.

(3) *Increase brand recognition of NET’s subsidiaries.* This strategic recommendation is designed to develop unique brands for NET’s subsidiaries to ultimately achieve the organizations´ strategic goals. This is done with a multi-brand strategy, positioning NET’s subsidiaries laterally with complementary product and service portfolios within the smart infrastructure, sustainable logistics, and transportation segments.

First, each of NET’s subsidiaries should define a clear brand identity consisting of vision, values, and capabilities. Each brand identity should be communicated to customers through different touchpoints to create a positive and unique brand image leading to a perceived competitive advantage. To create a positive brand image, the brand identity must be consistent across all brand touchpoints. Therefore, it is important that the brand identity is based on the common culture, shared beliefs, and values outlined in the second strategic recommendation. Touchpoints between NET’s subsidiaries and customer include projects, events, sponsorships, workshops, public relations, and general promotion activities. In order to achieve a perceived competitive advantage, NET’s subsidiaries brand identities should differentiate themselves from competitors’ brand identities by addressing four criteria: (1) being an important buying criteria, (2) being perceivable, (3) being hard to imitate, and by (4) being efficient. Given the development of trends depicted in the strategy corridor, NET’s subsidiaries should focus on maintaining corporate images of sustainability and digital leadership characterized by high skill, innovation power, and being a thought leader. This should build on the shared purpose of the second recommendation and the outlined HR strategy. This way, NET’s subsidiaries would address important buying criteria that are perceivable by customers. By claiming thought and innovation leadership, NET’s product and service portfolios would remain hard to imitate. By leveraging organizational excellence outlined in the second strategic recommendation efficiency is ensured.
Thus, NET´s subsidiaries would achieve a perceived and sustainable competitive advantage and thus offer customers a unique selling proposition to ultimately support the defined strategic goals.

(4) *Exert political influence.* This strategic recommendation is designed to change the rules of the game in order to improve the underlying conditions in which the construction industry and its players operate. This action is of twofold nature.

First, political parties and organizations that ensure political, regulatory, and economic stability should be supported. Traditionally, these are the parties of the center, because radical shifts to the political left and right induce a high uncertainty and erode the trust of investors. These stability-inducing political parties should be supported through donations, political education campaigns that encourage voter participation, and active support of political organizations, naturally within the legal boundaries. Furthermore, other industry players should be encouraged engage in similar political participation.

Second, interests should be represented by lobbying political parties. The goal should be to promote beneficial regulation while preventing unfavorable. In this regard, the two weak signals planning and permission processing time as well as project acceptance should be addressed. The same is true for the conditions necessary for swift and extensive digitization, such as the blind spot expansion of broadband connection. Generally, subsidies that directly and indirectly relate to the industry digitization, as well as supporting measures further fueling the construction boom should be promoted. Here, political action could result in vastly better outcomes for the entire industry and thus NET´s subsidiaries.

(5) *Improve the competitive position of NET´s subsidiaries.* This strategic recommendation aims to further enhance competitiveness. While the positive development depicted in the strategy corridor mitigate potential threats and off-set weaknesses, NET´s subsidiaries should use these favorable conditions to strengthen their competitive position to prepare for uncertainty.

First, NET´s subsidiaries should analyze their existing product and service portfolios. That is by contrasting incurred costs with revenues, determining the profit
of each individual business unit and service segment. Furthermore, growth rates of individual business units and service segments should be considered. This trend analysis should be done for the last three to five years to assess trend developments. In this regard, market forecast should be taken into account to determine probable future developments and to identify the lifecycle position of each individual segment, i.e. introduction, growth, maturity, decline. Ultimately this outlined analysis should help NET’s subsidiaries to decide where to invest and where to divest. Specifically, business units or service segments that show a downward trend in sales and profit combined with declining growth are areas of divestment and vice versa.

This method should also be used to identify promising new segments for which organizational know-how exists or could be acquired efficiently. While primary data won’t be available for areas in which NET’s subsidiaries have not been active, market data might be. By evaluating these data and conducting a cost-benefit analysis, potential profitability should be assessed prior investment. There might be fringe cases, in which seemingly unprofitable business units and service segments provide entry for key projects. Prior investment or divestment, cost and benefits for the entire organization should be assessed on a holistic case by case basis.

Second, collaboration and partnerships with other industry players could prove advantageous. By collaborating with competing architecture and engineering firms that possess complementary offerings, NET’s subsidiaries could broaden their reach. This, in conjunction with the first strategic measure would help to induce growth. Alternatively, collaboration with competitors of similar expertise is thinkable to deepen the bench in order to attract larger projects. However, the outlined collaboration exhibits threats. Collaboration could increase complexity, especially while NET’s subsidiaries are being integrated into NET. Furthermore, there is the risk that collaborating competitors could lure key accounts from NET. Therefore, this strategic action should be thoroughly evaluated.

Moreover, potential partnerships with service providers and startups to develop and implement value-adding services should be assessed. In this regard, these partners
could help with the innovation process further reinforcing the innovation leadership outlined in the third strategic recommendation.

Collaboration is also thinkable with players along the industry value chain. Tighter integration with construction companies could prove worthwhile by improving productivity and cost-efficiency through streamlining processes. In this regard, NET’s subsidiaries should offer supply-chain management for the involved parties of the construction project and thereby improving project planning and transparency to mitigate resource waste and leverage cost-efficiencies. As the analysis in chapter 2 showed, the extensive implementation of BIM will enable this strategic action by shifting responsibilities to stakeholders earlier in the process. This means that architecture and engineering firms will yield greater power over the entire project. Following the assumed abolishment of the HOAI, the lines between AE firms and construction companies will become blurred further, which enables more holistic project management. Furthermore, it puts NET’s subsidiaries in a position to influence the choice of materials towards greener construction, thus further differentiating themselves from other competitors and achieving cost-efficiencies. Hence, NET’s subsidiaries should embrace this change rather than trying to adhere to the status-quo; the name of the game is to adapt or to perish.

Third, NET’s subsidiaries should aim to reduce product complexity and transparency. As shown in the analysis of chapter 2 and the associated trend in the strategy corridor, industry fragmentation causes high project complexity which could deter investors and customers. This manifests itself in a hostile contract framework with misaligned incentives, multiple sources of truths for project planning, and opaqueness regarding cost and performance.

Complexity reduction can be achieved through a higher degree of integration between players in the value chain, i.e. collaboration, and facilitated by digitization, which is outlined in the sixth strategic recommendation.
4.1.5.1.2 Embrace progressive speed of industry digitization to become an industry leader

(6) *Embrace digit(al)ization as a first mover.* This strategic recommendation is designed to not only prepare NET’s subsidiaries for the changes associated with the progressing digitization, but also to claim an industry leadership role. It aims to enable NET’s subsidiaries to increase productivity and resource-efficiency, thus facilitating higher project volumes and profitability. Furthermore, higher degrees of integration are promoted which promote collaboration and help to render the value chain more transparent for internal and external stakeholders. Ultimately, digit(al)ization should lead to the creation of new revenue streams and business models as well as constituting a differentiation factor leading to a competitive advantage. Therefore, a digit(al)ization strategy should be developed, elements of which are outlined in the following.

On an organizational level, NET’s subsidiaries should develop a milestone plan to actively structure the digit(al)ization process. This includes the clear assignment of responsibilities within the organizations, involving the creation of new roles or responsibilities, such as data or BIM manager on an operational and CTO on a strategic level. Furthermore, hiring and training should reflect the changed requirements of the digitization in order to prepare NET’s subsidiaries for its challenges and opportunities. Given the progressive digitization development captured in the strategy corridor, it should be avoided to disregard the importance of the digitization. Instead it should be anchored as a strategic core topic for NET’s subsidiaries. In order to foster commitment and compliance within the subsidiaries, decisions should be communicated transparently, and reservations addressed.

Next, the internal IT-infrastructure should be brought up to speed. This should be done by centralizing and modernizing the IT department. Software and hardware should facilitate digit(al)ization and not act as a bottleneck. Common software solutions for all employees should be installed, including office suites, cloud sharing services, BIM, and plan grid to foster collaboration. Moreover, shared database solutions, such as the seecon datahub, should become the internal standard to enable collaboration across functions, business units and even subsidiaries. By
digitizing project planning, a single source of truth should be established to promote more efficient operations including better coordination with construction firms. In this regard, processes in general should be digitized to promote transparent and efficient documentation, allowing re-evaluating decisions and information when needed. Construction management should be digitized and connected to all parties involved on the construction site to improve collaboration, boost efficiency, and provide customers with transparency regarding project progress. This facilitates risk assessment, quality control, and ultimately better outcomes. In this regard, design management, scheduling, quality control, contract management and document management should be digitized.

NET’s subsidiaries should also build up their digital competencies to differentiate themselves from competitors. Here, next-generation BIM, including additional functional characteristics such as time and budget, should become the go-to platform to facilitate collaboration, boost efficiencies, and reduce cost. Because of BIM’s potential to disrupt existing business models, mere adoption is not enough. Rather, NET’s subsidiaries should shape BIM’s development, e.g. the combination with AR and VR technology, and dissemination to explore new business models and to realize its opportunities. BIM’s adoption and standardization should be pushed by collaborating with industry leaders and by exerting political influence. Further, workshops and information events with industry players should be conducted to promote BIM’s role in overcoming low productivity and improving collaboration.

The emerging BIM ecosystem would allow NET’s subsidiaries to carve out profitable business segments for themselves, such as BIM data analysis that would complement the already existing seecon datahub. Another thinkable business case is the combination with existing consulting service and as such to offer BIM consulting services to firms along the construction industry value chain. Thus, NET’s subsidiaries should jump on next-generation BIM and shape their future rather than risk being disrupted.

Connected to BIM a number of promising technologies exist whose potential should be explored. Data generated from LIDAR technology could be fed into BIM, thus promising added value, particularly in the conception, project planning, and later on
monitoring of infrastructure. This technology could be combined with UAVs, commonly referred to as drones, to leverage its impact.

Visual asset management could integrate traditional asset management into BIM solutions, thus compounding on its advantages and offering added value. NET’s approach of considering the public into project decisions through virtual environment is a promising move, particularly to boost public and social project acceptance.

NET’s subsidiaries should also explore the potential of digitalizing their sales channels. This could involve the support of offline channel through a mobile app giving customers a comprehensive overview regarding projects, including the most important documents and status-quo. Thus, perceived complexity could be reduced and transparency achieved. Further it could help to generate customer profile data that can be analyzed and help to improve future products and services. Ultimately, the creation of new revenue models through digitalization of offers constitutes a tremendous potential.

(7) Foster a startup culture. This strategic recommendation is designed to keep NET’s subsidiaries adaptive to change and innovative while growing in size and volume. This is particularly important since the industry analysis revealed high degrees of uncertainty that include rapid change.

NET’s subsidiaries should reinvigorate their R&D efforts to promote innovation. NET should boost their ability to explore innovative solutions by stronger integrating their NETLab and actively searching for collaboration opportunities with academic and non-academic researchers, industry thought-leaders, and startups.

By building on the organizational excellence prescribed in the second recommendation, NET’s subsidiaries should foster a culture of progressive thinkers who embrace the opportunities of change. In this regard, it is important to establish agile processes that are adaptive and proactive regarding external developments and focus on the collaboration and interaction of individuals. The measures nurturing such an interdisciplinary and agile mindset are described in the second recommendation. By taking a holistic view of the entire organization and its value stream, lean processes should be established. This includes ways of identifying
resource waste, limiting work queues, and a pull approach to work-streams. Regarding processes, design thinking offers a solution-centric approach to foster innovation and agility.

(8) Develop a matchmaking platform. This strategic recommendation builds on the progression of the industry digitization. Essentially, it is the digitalization of the face-to-face business model currently used in the industry which is associated with high degrees of complexity and opaqueness.

NET’s subsidiaries should explore the idea of developing a matchmaking platform connecting different players in the industry. By aggregating global tender information and company profiles, efficient matchmaking and sales between industry parties could be facilitated. The platform should focus on the B2B segment and could include architecture firms, engineering firms, construction companies, and their suppliers. The goal should be to decrease the high complexity of the industry by providing transparency regarding specifications of tenders, capabilities of firms, and prices of projects.

NET’s subsidiaries would profit from this venture by being able to analyze the gathered data to help shape their service offers to the needs of customers, and by monetizing the platform. Here, commission fees or annual fees are thinkable.

A potential downside could be reduced volume of NET’s subsidiaries in favor of other competitors active on the platform. However, this downside could also be leveraged to identify service weaknesses that could be improved. Furthermore, in a highly digitized world other industry players are likely to start such a platform eventually. Therefore, it is better to shape the future instead of risking being shaped.

While online platforms such as GlobalTenders.com already exist, their comprehensiveness is limited and user experience poor. Thus, the goal of complexity reduction and the provision of transparency is not fulfilled. A better practice example can be drawn from another industry with Klöckner’s platforms.
4.1.5.2 Scenario-specific options

4.1.5.2.1 Scenario B

(9) Expedite industry digitization. In this scenario, there are advantageous socio-politico-economic conditions that drive a high demand of construction projects. This is met by low speed of industry digitization, causing low productivity. Therefore, a demand surplus persists. Hence, industry players, including NET’s subsidiaries, would be unable to fully realize the positive feasibility of projects. Thus, their best option would be to accelerate the technological progress on industry and firm basis in order to increase productivity and therefore boost growth.

The strategic measures for that are already outlined in the core strategy, specifically in the first, second, fourth, and sixth recommendation. As the slow speed of industry digitization is of systemic nature in this scenario, exerting political influence including lobbying as well as cooperation with other industry players should be focused to expedite the industry digitization.

4.1.5.2.2 Scenario C and Scenario D

(10) Trim the fat and build meaningful relationships. Scenarios C and D are characterized by disastrous socio-politico-economic conditions causing low construction demand and mounting cost pressure. If NET’s subsidiaries found themselves in this situation, they should aim to increase their productivity, decrease their cost, and capture a higher share of the decreasing demand to offset the downswing.

The essential strategy to increase productivity has already been outlined in the first, second, and sixth recommendation which addresses organizational and technological efficiency levers. These productivity gains would be essential by allowing NET’s subsidiaries to generate the same output with less man hours. Hence, increased productivity enables laying-off personnel and therefore cutting cost. Labor cost could be further reduced by unpaid overtime and the cutting of benefits. Furthermore, NET’s subsidiaries should focus on profitable business segments as described in the first part of the fifth strategic recommendation. This step should be aided by sub-contracting low-complexity designs to low-cost countries to increase profit margins and thus counteracting price pressure, as
outlined in the last part of the first strategic recommendation. To capture a higher market share of the decreasing industry demand, the marketing strategy outlined in the third recommendation should be executed. By building on the meaningful long-term connections with customers, the brands of NET’s subsidiaries should be leveraged to differentiate themselves in these adverse conditions. This would further aid the increase of productivity and cost-cutting need in this environment. These strategies would promote NET’s financial position and therefore help to fend off consolidation by larger players. Thus, its survival would be ensured in disadvantageous conditions.

(11) *Perform stress tests.* NET’s subsidiaries should develop different worst-case revenue and cost projections to illustrate different situations. From there, it could be derived which combination of project volumes and headcount can keep the business running for a given period of time. In conjunction with focusing the most profitable business segments, as outlined in the fifth recommendation, customers and employees necessary for survival should be identified. This provides insights into which customers should be developed for NET’s subsidiaries to be able to endure in unfavorable conditions. Ultimately, NET’s subsidiaries should use these projections to prepare contingency options before the worst-case manifests.

4.2 Italy
The practical application of the HHL-Roland Berger approach to scenario-based strategic planning was conducted for Italy with regard to NET Engineering SpA.

4.2.1 Definition of scope
As the definition of scope was conducted jointly for Germany Italy, please refer to chapter 4.1.1 for detailed information regarding the definition of scope.

4.2.2 Perception analysis
After the definition of scope, the perception analysis was conducted.

4.2.2.1 360° Stakeholder Feedback
The 360° stakeholder feedback for the Italian AEC industry was conducted with all 12 internal and 38 external stakeholders identified in the framing checklist.
First, eight internal and 26 external participants answered the questions of the first online-survey, depicted in Appendix 5. An estimated 800 single answers were provided. These were clustered into 40 factors, depicted in Appendix 6, which were reflected in the trends discussed in according chapter 2.2.

Second, five internal and 20 external stakeholders rated the 40 factors according to their impact and uncertainty. The aggregated ratings of each factor are shown in Appendix 7.

4.2.2.2 Result analysis – blind spots and weak signals

First blind spots were identified. The value range for the impact and uncertainty dimensions were 3.6 and 3.3 respectively. Hence, external value with 1.0, equal to more than 27% and more than 30% respectively, larger than the internal value were deemed to indicate blind spots, that are depicted in Figure 23 and Figure 24.

Figure 23: Blind spot analysis of the impact dimension in Italy
Source: Own illustration based on Schwenker & Wulf (2013), p. 85.
Figure 24: Blind spot analysis of the uncertainty dimension in Italy
Source: Own illustration based on Schwenker & Wulf (2013), p. 85.

Considering both the impact and uncertainty dimensions while controlling for overlap showed seven blind spots, namely:

1. Political stability & elections (political)
2. Availability of subsidies and funding measures (political)
3. Availability of financing options (economic)
4. Wealth of firms and households (economic)
5. Project acceptance (social)
6. Sustainability awareness (social)
7. Strength of university research (technological)

The identified blind spots comprised the core PEST dimensions. Their encompassing characteristic could indicate a difference in mental mode between internal and external stakeholders. The factors political stability & elections and availability of subsidies and funding measures stand out. The former does so because its uncertainty was deemed 2.2 higher from external than from internal stakeholders. This could either indicate that internal stakeholders are already preparing for the worst or that they are lacking sensibility regarding the
developments of the political landscape. Indicated by the 2.5 points higher score in impact, external stakeholders compared to internal ones think that availability of funding measures will have a larger impact.

Second, three weak signals were identified, namely:

1. **Degree of economic integration of EU states** (political)
2. **Speed of bureaucratic and administrative processes** (political)
3. **Wealth of firms and households** (economic)

All three factors were only mentioned once in the first survey but scored high rating in the second survey. Noteworthy, the two latter ones are among the critical uncertainties that will be discussed in the following. Generally, blind spots and weak signals were considered in the following steps.

### 4.2.3 Trend and uncertainty analysis

#### 4.2.3.1 Impact/uncertainty grid

Appendix 8 provides a list of all 40 factors according to category that were mapped on the impact/uncertainty grid. Due to the small range of 3.6 regarding impact and 3.3 regarding uncertainty, the axes had to be adjusted so that three factor categories emerged. Figure 25 shows impact/uncertainty grid of the Italian AEC industry.

![Impact/uncertainty grid for the Italian AEC industry in 2025](Source: Own illustration based on Schwenker & Wulf (2013), p. 99.)
Nine secondary elements were located in the bottom of the figure, 25 trends in the upper left-hand area, and finally six critical uncertainties in the top right-hand corner:

1. Speed of bureaucratic and administrative processes (economic)
2. Degree of digitization (technological)
3. Development and availability of key technologies (technological)
4. Wealth of firms and households (economic)
5. Project acceptance (social)
6. Market attractiveness for investors (economic)

4.2.3.2 Key uncertainties

The six identified critical uncertainties were clustered into two key uncertainties according to similarities. To minimize potential subjectivity the consolidation was discussed with the three sparring partners at NET who agreed on the following reasoning:

Wealth of firms and households can be seen as a manifestation of the economic conditions of a country. It is therefore influenced by economic performance which is related to the market attractiveness of the industry. This factor encompasses not only the economic performance of the industry, but also the underlying social and political conditions. That is because enforced regulation, but also the public’s opinion and action determine the attractiveness. The latter is reflected in the project acceptance from the public and politicians which can constitute a bottleneck for the realization of projects and thus is an industry attractiveness driver. Similarly, speed of administrative processes governs the realization potential of projects. In summary these four factors reflect the overall socio-politico-economic conditions which drive the feasibility of projects.

Two critical uncertainties stand out from these first four. The degree of digitization and key technology development are clearly technology related and constitute a different aspect of the macroenvironmental conditions than the first five critical uncertainties. Both share the sentiment of technological progress as well as scope of technological availability and its adoption. Therefore, they were consolidated into speed of industry digitization.
4.2.4 Scenario building
The two identified key uncertainties were then used to construct four scenarios.

4.2.4.1 Scenario identification
By using feasibility of projects as horizontal and speed of industry digitization as vertical axis, four scenarios emerged. These were based on the following assumptions:

The remuneration regulation regarding architecture and engineering firms has been liberalized approximately ten years ago. Consequences are as follows:

Engineering services have been bought normal procurement services of prior clients, thus leading to price and cost pressure for existing AE firms. To respond to the price and cost pressure, the existing AE firms increase their project volumes and engage in cost-cutting activities.

Second, and a consequence of the first point, architecture and engineering services are increasingly outsourced and offshored to low-cost in low cost-countries to achieve arbitrage effects, i.e. exploiting the price differences between Italy and the low-cost country. These outsourcing and offshoring activities are primarily focused on services with a high degree of standardization, such as structural engineering and infrastructure design with low complexity. However, this commoditization trend of architectural and engineering services is further advancing as the standardization of services and the vertical integration of planning services progresses.

Third, the high dependence on public sector clients renders the cash-flow. This is particularly pronounced by the fact that the Italian government is practicing payment terms of 120 days. Consequently, a development of payment terms and the availability of inexpensive financing are key factors for the healthiness of the Italian AEC industry.

Following these assumptions, four scenarios, shown in Figure 26, were identified whose names were chosen to be indicative of the events leading to the outcomes.
4.2.4.2 Influence diagram

An influence diagram comprising 21 factors was created. These factors were picked based on their ratings in the perception analysis and a discussion with the internal partners at NET. The cause-effect relationships are depicted in Figure 27.

Feasibility of projects reflects socio-politico-economic factors that are either favorable or unfavorable for the AEC industry. All four critical uncertainties relating to this key uncertainty do so directly. Hence, they are stimulated by other factors.
These indirect drivers of feasibility of projects include political and economic stability, interest rates and taxation, as well as regulation and level of employment. All of which are basic macroeconomic drivers.

Speed of industry digitization is essentially driven by technological factors, like the critical uncertainties key technology developments and degree of digitization. However, other stimulating factors are also of environmental, social, and political nature such as sustainability awareness, mobility trends, and expansion of infrastructure.

Furthermore, lateral connections exist: economic stability stimulates the degree of digitization and project acceptance drives not only the feasibility of projects but also through expansion of infrastructure the speed of industry digitization.

Hence, the influence diagram illustrates the complexity of cause-effect relationships and their interdependencies in the Italian AEC industry. The following scenarios detail the complex connections in their respective manifestation.

4.2.4.3 Scenario descriptions and fact sheets
What follows are the systematic descriptions of the four distinct scenarios done in narrative prose. Additionally, a fact sheet summarizing the key facts and KPIs is provided in Figures 28, 29, 30, and 31 following each respective scenarios.

4.2.4.3.1 Scenario A – A new hope
After a period of nationalist tendencies, a landslide has occurred in Italy’s political landscape. The public elected a new government in 2023 that has initiated a period of stability and prosperity. This pro-EU government has passed regulation not only conducive for technological and environmental progress but also for the country’s economic and financial stability. Its fiscal policy incentivizes economic activity: the ensuing GDP growth of up to 3% annually facilitates gradual debt reduction and provides stability. Consequently, unemployment levels decrease, and wealth of households and firms increase. The latter are progressively investing.

The ECB is keeping interest rates at under 2%, thus easing access to inexpensive capital for the AEC industry. Additionally, other financing methods have become popular, e.g. mini-bonds, further fueling the capital needs of the industry. Due to the
significantly lowered public debt, payment morale has drastically improved; the average days waited for payments from public customers has decreased from on average 156 days to 60 days. This has drastically improved the cashflow situation of industry players. The outlined developments render the AEC industry highly attractive and drive demand, which is increasing by 8% annually.

Key technology breakthroughs stimulate several developments. Due to enabling regulation, various work trends have emerged, including working remotely. Italy’s impact on the environment is greatly reduced because of stricter environmental regulation and the aforementioned technological developments. The industry is highly digitized following economic growth, supportive regulation and technological breakthroughs. This manifests itself in markedly increased industry productivity, which is growing by 8% annually.

Despite increasing demand, construction cost are growing less than 2% annually due to improved funding situation, increased productivity, as well as an improved labor market situation: following an increasing industry attractivity and rising salaries, more young professionals are lured into the AEC industry and many Italians who had emigrated in an economic recession are returning. Through highly digitized processes and simplified regulation, the speed of administrative processes is greatly improved; average permission time has been halved to 115 days compared to 2019, which is faster than the OECD average.

Driven by the general awareness for sustainability, stricter regulation, and the global effect on climate change, Italy’s mobility landscape has changed. In 2025, public and private transport is more seamlessly connected than ever, while alternative transportation modes, such as e-scooters, are being utilized. The demand for these progressive mobility trends as well as political will and favorable regulation manifests itself in strong acceptance towards projects. Some infrastructure expansion ensures.
4.2.4.3.2 Scenario B – A false sense of security

The newly elected Italian government has marked a shift in politics by crushing the EU-opposition and providing a stable foundation for economic prosperity. Regulation passed is generally conducive for economic growth, moderate in terms of environmental regulation, and uninspired regarding technological progress. GDP is growing up to 3% annually, which is translating into greatly improved levels of employment; unemployment is at 6%. The fiscal policy in place stimulates economic activity and gradually decreases public debt. Concurrently, the wealth of households and firms is increasing, the latter of which are investing their new found resources.

Because the ECB is keeping interest rates at under 2% the access and cost of capital is facilitated for AEC industry growth. This is further reflected in the increasing availability of cheap financing options beyond just bank loans. Improved capital, particularly cash-flow, conditions are also driven by lowered public debt that boosts payment morale; waiting time for payment from public sector customers has decreased drastically from on average 156 days to 60 days. As a consequence of the outlined developments, the Italian AEC industry is highly attractive and demand is rising by 8% annually.
In contrast to the improved economic situation, technological progress and its adoption is slow. This is reflected in the state of industry digitization, which, despite the economic prosperity, is poor. Causes include regulatory barriers and sluggish technological progress. Consequently, industry productivity is almost stagnant at 2019 levels, only slightly improved by basic-level BIM adoption. Concurrently, the increasing industry attractiveness lures young professionals and Italians, who in previous economic recessions had emigrated, into the AEC industry. Therefore, skilled labor slowly becomes more abundant. Concurrently, the capital becomes cheaper due to the low interest rates. Nevertheless, the increased demand is considerable and therefore construction cost rise by 8% annually. Due to the low levels of digitization, administrative process and permission speed is not drastically improved. However, by streamlining the underlying regulation, speed increases are achieved; average permission time has decreased somewhat compared to 2019 and now takes 175 days, which is slightly above the OECD average.

Following high demand and low productivity gains, demand surplus occurs. Some areas, i.e. low-complexity designs in infrastructure and structural engineering, are sub-contracted to low-cost countries in order to achieve arbitrage effects.

Awareness of the environmental is low in Italian society. This has negative consequences on the country’s impact of climate change, that is increasing. Furthermore, the country’s mobility landscape in 2025 strongly resembles 2019. This is because the government has failed to implement stricter environmental policies and awareness of sustainability has not yet become pronounced enough to incentivize citizens to drastically alter their behavior. The lack of digit(al)ization is another barrier in this regard. What follows is a mixed acceptance towards projects from the public and politics; the value of digital infrastructure is underrated, while traditional projects are supported. Consequently, the expansion of infrastructure is progressing swiftly in some areas, but slowly in regard to digitization.
4.2.4.3.3 Scenario C – The depths of despair

Prevalent nationalist trends and EU-criticism have fragmented Italy’s political landscape; after the 2023 election a minority government is in power. This government’s governing expertise is limited, which manifests itself in chaotic regulation. This unstable environment breeds economic and financial volatility accompanied by negative GDP growth of 2% annually. The economic downturn is also reflected in increasing unemployment up to 20%. Resulting from negative economic growth and due to disadvantageous fiscal policy, Italy’s public debt is rising substantially. Concurrently, wealth of firms and households decrease greatly, causing private investments to drop. Following austerity program, public spending decreases substantially. Overall, construction demand is shrinking by up to 5% annually. To stimulate economic growth, the ECB is keeping interest rates low. However, capital for industry players remains expensive, because these unfavorable conditions render investors and lenders highly risk-averse; long-term loans for AEC players rise to 6%. The outlined developments result in ever-deteriorating payment morale. In the case of public sector customers, AEC firms
have to wait more than 200 days for payment. Thus, cash-flow has become a substantial challenge and is driving industry insolvencies.

Technological development is progressing slowly because the economic downturn and the regulatory mess are causing digitization inhibition. Consequently, productivity is entirely stagnant at 2019 levels. Construction cost are affected adversely, because of the heavy reliance on skilled manual labor, of which there is a shortage due to previous emigration trends following economic recessions. Therefore, and because of drastically increased cost of capital, as well as decreased demand, construction cost are increasing by 5% annually. Following regulatory chaos and low productivity, the speed of administrative process and permissions is very slow. In fact, permission times have increase from 227 days in 2019 to over 300 days in 2025.

Due to decreasing project volumes, AEC firms are competing on price, leading to a price war. To increase their competitiveness, firms are sub-contracting low-complexity designs to low-cost countries in the hope to leverage price-level differences. However, this strategy is so common, that it does not result in a competitive advantage. Due to the increased cost pressure and the low payment moral, many firms cannot cope with the price wars. These less funded companies are bought by larger firms with stronger financial backing. The result is drastic consolidation of the Italian AEC industry.

Due to low environmental awareness and lenient regulation, Italy’s impact on the environment is worsening. Because of the low environmental awareness, poor digitization, and unfavorable regulation, the Italian mobility landscape is stagnant. In fact, there has been little to no progress since 2019. This lack in demand for new mobility solution is also reflected in the low project acceptance. The Italian public and politicians show a not-in-my-backyard-attitude, opposing virtually all medium- and large-scale projects. Hence, expansion of infrastructure is progressing slowly at best and halting at worst.
4.2.4.3.4 Scenario D – Digitized recession

After the fragmentation of the Italian political landscape in the second decade of the 2000s, a coalition of social, environmental, and technological progressives was elected in the 2023 elections. They are passing economically disastrous regulation while supporting environmental and technological progressiveness. The result is economic instability with up to 2% negative annual GDP growth. Industry demand is shrinking by 5% annually. Due to the ill-advised fiscal policy and the economic recession, Italy’s public debt is rising substantially. The deteriorating economy is translating into increasing unemployment up to 20%. Consequently, wealth of firms and households is decreasing, and private investment shrink. So does public spending following austerity programs. To counteract negative economic growth, the ECB is keeping interest rates low. However, the poor industry prospect induce risk-aversity in investors and lenders. There is long-term loans to increase to 6%. The access to financing is therefore strongly limited, causing deteriorating payment morale that is also evident in public sector payment waiting time; on average AEC firms are waiting 200 days. Cash-flow issues are further exacerbated by the poor availability of capital for industry players.
Despite the economic recession, the government and firms have identified technology and digitization as a potential savior from the economic downturn. Through extensive support technological breakthroughs are created. As a result, industry productivity gains of 8% annually are realized. This increase in productivity and the lowered industry demand drives construction cost down. On the other hand, the shortage of skilled labor, due to previous emigration caused by recessions, persists and capital is expensive. Therefore, construction cost rise at 2% annually.

Improved productivity means that less manpower is needed for the same output. In this shrinking market, further layoffs are happening. While digitization could improve the speed of administration and permissions, the regulatory mess is slowing it down; permissions time has increased to 250 days in 2025 compared to 227 days in 2019.

To secure their part of the pie in a shrinking market, AEC firms are trying to compete on price. The ensuing price wars catches firms with stretched finances and without access to cheap capital in the worst possible moment. AE firms’ attempts to leverage arbitrage effects by sub-contracting low-complexity designs to low-cost countries in order to stay competitive prove unsuccessful. Mass-scale insolvencies are ensuing that are exploited by larger firms with better funding and more digital expertise; consolidation is rampant and large one-stop-shops become prevalent.

Through technological advancements and tight environmental regulation, Italy’s impact on climate change is decreased. High environmental awareness, the aforementioned regulatory component and digitization are driving changes in the Italian mobility landscape. Public and private mobility are becoming seamlessly integrated. Alternative transportation modes become widely-available while citizens are being incentivized to refrain from using cars. Public awareness for mobility is driving project acceptance towards large infrastructure designs which can be expanded somewhat despite the economic recession.
4.2.5 Strategy definition

Comparing the German and Italian scenarios reveals that major similarities exist. This was somewhat expected as there was considerable overlap regarding the underlying factors. In fact, 27 of 40 individually determined factors were identical. These included most socio-politico-economic drivers and technological developments. Accordingly, the axes of German and Italian scenarios were identical, and the developments depicted in the strategy corridor in Figure 22 and Figure 32, were similar.

Hence, the majority of strategic recommendation for the German subsidiaries of NET should also be executed by NET Engineering SpA in Italy. However, some differences exist.

4.2.5.1 Core strategy

13 of 40 factors underlying the scenarios differed between Italy and Germany. Four of these 13 were not included in the influence diagram and strategy corridor, depicted by Figure 32.
Two additional factors were secondary elements and thus played no further role. The seven remaining factors share strategic commonalities. Market attractiveness for investors and availability of financing options can be improved by increasing competitiveness on firm level. In fact, the strategic recommendations outlined in chapter 4.1.5.1 are aimed to do exactly that. By executing these actions, Net Engineering SpA would become more attractive for investors and hence would open up more and better financing options. Nevertheless, these factors also possess a political component which they share with four other factors, namely public debt of Italy, degree of economic integration of EU states, level of employment, and prevalence of corruption. Beyond improving competitiveness, these are best addressed by exerting political influence so that Italy is governed by a stable government that would counteract negative developments regarding these factors and induce favorable conditions. This is outlined in chapter 4.1.5.1 in the fourth recommendation. Last, strength of university research should not only be addressed through political influence but also through NET Engineering SpA’s innovation approach. These are prescribed in the third, fifth, and seventh recommendation in chapter 4.1.5.1. It can be summarized that by enacting the core strategy outlined in
chapter 4.1.5.1, NET Engineering SpA would exploit the beneficial socio-politico-economic conditions while leveraging digitization opportunities.

4.2.5.2 Scenario-specific options

4.2.5.2.1 Scenario B

Comparing the strategy corridors and respective scenarios B Germany and Italy reveals strong similarities. Both scenarios are characterized by generally positive socio-politico-economic conditions, resulting in high demand. Following slow industry digitization, low productivity persists, causing a demand surplus. Thus, slow industry digitization constitutes the key barrier standing in the way of fully exploiting the pronounced feasibility of projects. To overcome this issue, the strategic measures for Germany and Italy concur: stabilize the advantageous socio-politico-economic conditions and accelerate the progression towards industry digitization and thus higher productivity. Hence, the same strategic recommendations as outlined in chapter 4.1.5.2.1 apply.

4.2.5.2.2 Scenario C and scenario D

Following the considerable overlap of factors, same scenarios dimensions, and highly similar development of the scenarios, the analytical basis for scenarios C and D in both Italy and Germany correspond. However, public debt in Italy is a key driver, as the construction industry is highly depended on public sector customers. In a deteriorating public debt situation, payment morale is becoming worse which exacerbates cash flows issues for industry players. NET Engineering SpA should anticipate and prepare by allocating sufficient funds to keep the business running despite payment tardiness of customers. Other actions could include to assign receivables to professional debt collectors. The EU has announced that the practice of withholding funds by public sector customers is infringing on EU law. Hence, NET Engineering SpA should explore its legal options. In regard to other strategic measures, scenarios C and D in Germany and Italy concur. Hence, the scenario-specific options outlined in chapter 4.1.5.2.2 should be executed.

5 Conclusion

This thesis’ introductory example of RIM and Apple illustrated how established incumbents face disruption in market environments characterized by accelerating
change and subsequently raised the question how NET’s subsidiaries can deal with increasing uncertainty, complexity, volatility, and ambiguity. By analyzing the market dynamics of the German and Italian AEC industry, it was shown that the industry is experiencing drastic changes driven by technological progress and socio-politico-economic developments. The strategic implications of dealing with uncertainty were elaborated which was followed by a discussion of scenario planning elaborating its strengths and weaknesses. The HHL-Roland Berger approach to scenario-based planning was identified as a tool overcoming the shortcomings of traditional scenario planning. Building on the industry analyses, this approach was used to develop four scenarios describing the German AEC industry by 2025 and four scenarios describing the Italian AEC industry by 2025 followed by corresponding strategic recommendations.

To accommodate for the differences between the German and Italian AEC industry, the approach was, except for the definition of scope, executed once for Germany and once for Italy. First, the scope of the scenario exercise was determined. Then internal and external stakeholders of the German and Italian subsidiaries were surveyed to identify the most relevant trends and critical uncertainties, whose cause-effect relationships were visualized by the influence diagram. Based on the latter, scenario dimensions were derived. Despite their separate execution, identical key uncertainties were determined for Germany and Italy:

1. **Feasibility of projects**
2. **Speed of industry digitization**

These meta-factors served as scenario axes, revealing four distinct scenarios for each Germany and Italy. By basing the developments towards these scenarios on the influence diagram, the scenarios were described in detail and summarized in individual fact sheets. In both cases the most advantageous scenario A served as basis for the core strategy. In both, Germany and Italy, scenario A was characterized by very positive socio-politico-economic conditions and a progressive speed of industry digitization. Here, the environmental conditions were such that through the right strategy NET’s subsidiaries could be positioned to exploit the increasing industry demand by leveraging productivity-enhancing digitization. Therefore,
strategic recommendations that maximize the benefit from positive and mitigate negative developments were derived. Additionally, strategic options were discussed to equip NET’s subsidiaries for disadvantageous environmental developments. Due to considerable overlap, the strategies for Germany and Italy were almost identical; minor adjustments were outlined for the NET Engineering SpA in Italy. In conclusion, the initial goal of this master thesis could be reached: plausible scenarios for the German and Italian AEC industry in 2025 with a particular regard on the industry digitization were developed and corresponding strategic recommendations derived. By executing and refining these strategic actions, NET’s subsidiaries are able to position themselves such that they take advantage of favorable developments while managing unfavorable ones.

However, some limitations exist. First, due to the page and temporal restraints underlying this thesis, the derived strategies are based entirely on external developments. No internal analysis, customer segmentation, or competitor analysis was conducted. Hence, the derived strategies are applicable for German and Italian architecture and engineering firms in general. They should, therefore, serve as a discussion basis to develop more customized strategies for NET’s subsidiaries. Connected, there is the question of whether all strategic recommendations can be implemented. Often resource restriction, e.g. temporal and financial, apply, preventing full implementation.

While the HHL-Roland Berger approach to scenario-based planning offers a high degree of standardization, subjectivity persists. This becomes evident when recalling that the key uncertainties, on which all scenarios were based on, were derived by clustering critical uncertainties according to similarity. While the outcome of this process step was reviewed by three participants at NET to reduce bias, another author could have chosen, and argued, different dimensions. In this case, the scenarios and strategies could have been vastly different. Further, it should be noted that the scenarios are neither complete nor exact representation of futures but rather provide plausible discussion bases. This becomes obvious when looking at the influence diagrams which exhibit high complexity despite only illustrating 25
and less factors. Reality is vastly more complex and capturing it in scenarios, if possible, requires excessively more resources.

By choosing online surveys as the method for the 360° perception analysis, a large number of stakeholders that provided various industry perspectives were involved which helped to reduce subjectivity. However, this method resulted in answers of different quality and analytical levels which rendered the subsequent clustering into 40 factors per country a task that required some interpretation and thus a source of subjectivity. In retro-perspective, interview-based survey format could have led to a higher quality or at least more accurate answers that would have mitigated subjectivity on part of the consolidator. However, this approach would have resulted in greater time-intensity, fewer participants, and smaller variety of answers.

Because the underlying format of the scenario exercise is a master thesis, the exercise was cut short regarding the sixth step. Therefore, the continuous monitoring including the scenario cockpit was not executed. However, to realize the full value of this approach, this step should be conducted at NET. In this regard, monitoring market developments and subsequent stakeholder analyses could prove valuable to determine the direction the industry is going and how to react on a business level. By establishing scenario planning as a continuing strategic exercise, NET could thus prepare for increasingly uncertain environments in the future.
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### Appendix

1. Please name important POLITICAL FACTORS that will have a crucial influence on the German Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

2. Please name important ECONOMIC FACTORS that will have a crucial influence on the German Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

3. Please name important SOCIETAL FACTORS that will have a crucial influence on the German Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

4. Please name important TECHNOLOGICAL FACTORS that will have a crucial influence on the German Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

5. Please name important ECOLOGICAL FACTORS that will have a crucial influence on the German Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

6. Please name important LEGAL FACTORS that will have a crucial influence on the German Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

Appendix 1: 360° stakeholder feedback, open questionnaire regarding German AEC industry
Source: Own illustration based on Schwenker & Wulf, (2013), p. 82.
<table>
<thead>
<tr>
<th>Dimension</th>
<th>Factor</th>
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<tbody>
<tr>
<td>P</td>
<td>Political stability and elections (global, EU, Germany)</td>
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<tr>
<td>P</td>
<td>Protectionism and trade wars</td>
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<td>P</td>
<td>BREXIT</td>
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<td>P</td>
<td>Planning and permission processing time</td>
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<td>P</td>
<td>Implementation of energy transition</td>
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<td>P</td>
<td>Subsidies and supporting measures</td>
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<td>Migration policy and integration</td>
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<td>Remuneration development</td>
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<td>Economic stability (global, EU, Germany)</td>
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<td>Interest rate policy and interest rates</td>
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<td>Startup- and beta culture as model for corporates</td>
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<td>Project acceptance (Political, societal)</td>
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<td>Development of key technologies</td>
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<td>Sustainability of processes, methods, and materials</td>
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<td>Effect of climate change</td>
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<td>Prevalance of circular economy</td>
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<td>L</td>
<td>Degree and complexity of regulation</td>
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Appendix 2: 360° stakeholder feedback, aggregated factor list regarding German AEC industry
Source: Own illustration based on Schwenker & Wulf, (2013), p. 83.
Appendix 3: 360° stakeholder feedback, aggregated impact and uncertainty ratings regarding German AEC industry
Source: Own illustration based on Schwenker & Wulf, (2013), p. 83.
### Dimension | Factor | Merged Impact | Uncertainty |
<table>
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<td>6.2</td>
</tr>
<tr>
<td><strong>P</strong></td>
<td>Protectionism and trade wars</td>
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<td>BREXIT</td>
<td>4.8</td>
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<td><strong>P</strong></td>
<td>Planning and permission processing time</td>
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<td><strong>P</strong></td>
<td>Implementation of energy transition</td>
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<td><strong>P</strong></td>
<td>Subsidies and supporting measures</td>
<td>6.8</td>
<td>5.1</td>
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<td><strong>P</strong></td>
<td>Civic involvement</td>
<td>6.1</td>
<td>4.8</td>
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<td>Expansion of infrastructure</td>
<td>6.7</td>
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<td>Migration policy and integration</td>
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<td>6.8</td>
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<td>6.3</td>
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<tr>
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<td>5.4</td>
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<tr>
<td><strong>Ec</strong></td>
<td>Rent, property, and real estate cost</td>
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<td>5.4</td>
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<td>Development of construction cost</td>
<td>7.4</td>
<td>5.2</td>
</tr>
<tr>
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<td>Scarcity of construction materials and raw materials</td>
<td>5.9</td>
<td>5.2</td>
</tr>
<tr>
<td><strong>Ec</strong></td>
<td>Availability of skilled labor</td>
<td>8.3</td>
<td>5.1</td>
</tr>
<tr>
<td><strong>Ec</strong></td>
<td>Availability of construction land and capacities</td>
<td>7.7</td>
<td>5</td>
</tr>
<tr>
<td><strong>Ec</strong></td>
<td>Socioeconomic inequality and health of middle class</td>
<td>5.6</td>
<td>5</td>
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<tr>
<td><strong>Ec</strong></td>
<td>Startup- and beta culture as model for corporates</td>
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<td>4.9</td>
</tr>
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<td>Foreign competitors</td>
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<td>4.8</td>
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<td>Wage and salary development</td>
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<td>Work trends</td>
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<td>4.5</td>
</tr>
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<td><strong>Ec</strong></td>
<td>Availability of affordable housing</td>
<td>6.2</td>
<td>4.3</td>
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<td><strong>S</strong></td>
<td>Environmental awareness and consumer behavior</td>
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<td>4.8</td>
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<td>4.2</td>
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<td>Demographic change</td>
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<td><strong>S</strong></td>
<td>Project acceptance (Political, societal)</td>
<td>7.2</td>
<td>6.6</td>
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<tr>
<td><strong>T</strong></td>
<td>Degree of digitization</td>
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<td>6.5</td>
</tr>
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<td><strong>T</strong></td>
<td>Development of key technologies</td>
<td>6.7</td>
<td>6.3</td>
</tr>
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<td><strong>T</strong></td>
<td>Accelerating Innovation and disruption speed, as well as complexity</td>
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<td>5.6</td>
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<td><strong>T</strong></td>
<td>Mobility trends</td>
<td>6.7</td>
<td>5.1</td>
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<td>Digitalized business models and E-commerce</td>
<td>5.3</td>
<td>5.1</td>
</tr>
<tr>
<td><strong>T</strong></td>
<td>Expansion of broadband connection</td>
<td>6.2</td>
<td>4.7</td>
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<td><strong>T</strong></td>
<td>Sustainability of processes, methods, and materials</td>
<td>6</td>
<td>4.4</td>
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<tr>
<td><strong>En</strong></td>
<td>Effect of climate change</td>
<td>6.8</td>
<td>4.7</td>
</tr>
<tr>
<td><strong>En</strong></td>
<td>Prevalence of circular economy</td>
<td>5.1</td>
<td>4.7</td>
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<tr>
<td><strong>L</strong></td>
<td>Degree and complexity of regulation</td>
<td>7.2</td>
<td>6.5</td>
</tr>
</tbody>
</table>

**Average Impact**: 6.3  
**Range**: 3.9 to 2.8

---

**Appendix 4**: 360° stakeholder feedback, categorization of factors regarding German AEC industry  
Source: Own illustration based on Schwenker & Wulf, (2013), p. 83.
1. Please name important **POLITICAL FACTORS** that will have a crucial influence on the Italian Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

2. Please name important **ECONOMIC FACTORS** that will have a crucial influence on the Italian Architecture-Engineering-Construction (AEC) industry within the next 6 year until 2025.

3. Please name important **SOCIETAL FACTORS** that will have a crucial influence on the Italian Architecture-Engineering-Construction (AEC) industry within the next 6 year until 2025.

4. Please name important **TECHNOLOGICAL FACTORS** that will have a crucial influence on the Italian Architecture-Engineering-Construction (AEC) industry within the next 6 year until 2025.

5. Please name important **ECOLOGICAL FACTORS** that will have a crucial influence on the Italian Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

6. Please name important **LEGAL FACTORS** that will have a crucial influence on the Italian Architecture-Engineering-Construction (AEC) industry within the next 6 years until 2025.

---

Appendix 5: 360° stakeholder feedback, open questionnaire regarding Italian AEC industry
Source: Own illustration based on Schwenker & Wulf, (2013), p. 82.
<table>
<thead>
<tr>
<th>Dimension</th>
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<td>Political Stability &amp; Elections</td>
</tr>
<tr>
<td>P</td>
<td>Availability of subsidies and funding measures</td>
</tr>
<tr>
<td>P</td>
<td>Leadership, clear vision, and strategy for the future</td>
</tr>
<tr>
<td>P</td>
<td>Energy policy</td>
</tr>
<tr>
<td>P</td>
<td>Taxation &amp; fiscal policy</td>
</tr>
<tr>
<td>P</td>
<td>Prevalence of corruption</td>
</tr>
<tr>
<td>P</td>
<td>Degree of economic integration of EU states</td>
</tr>
<tr>
<td>P</td>
<td>Speed of bureaucratic and administrative processes</td>
</tr>
<tr>
<td>Ec</td>
<td>Economic and financial stability</td>
</tr>
<tr>
<td>Ec</td>
<td>Availability and cost of skilled labor</td>
</tr>
<tr>
<td>Ec</td>
<td>Public debt of Italy</td>
</tr>
<tr>
<td>Ec</td>
<td>Work trends</td>
</tr>
<tr>
<td>Ec</td>
<td>Market attractiveness for investors</td>
</tr>
<tr>
<td>Ec</td>
<td>Availability of financing options</td>
</tr>
<tr>
<td>Ec</td>
<td>Level of employment &amp; unemployment</td>
</tr>
<tr>
<td>Ec</td>
<td>Interest rate and inflation</td>
</tr>
<tr>
<td>Ec</td>
<td>Foreign competitors</td>
</tr>
<tr>
<td>Ec</td>
<td>Lack of ownership</td>
</tr>
<tr>
<td>Ec</td>
<td>Payment morale</td>
</tr>
<tr>
<td>Ec</td>
<td>Construction trends</td>
</tr>
<tr>
<td>Ec</td>
<td>Collaboration &amp; integration of processes</td>
</tr>
<tr>
<td>Ec</td>
<td>Wealth of firms and households</td>
</tr>
<tr>
<td>S</td>
<td>Project acceptance</td>
</tr>
<tr>
<td>S</td>
<td>Sustainability awareness</td>
</tr>
<tr>
<td>S</td>
<td>Demographic change</td>
</tr>
<tr>
<td>S</td>
<td>Civic involvement</td>
</tr>
<tr>
<td>S</td>
<td>Migration and integration</td>
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<td>S</td>
<td>General culture and work culture</td>
</tr>
<tr>
<td>S</td>
<td>Urbanization</td>
</tr>
<tr>
<td>S</td>
<td>Social cohesion</td>
</tr>
<tr>
<td>T</td>
<td>Expansion of Infrastructure</td>
</tr>
<tr>
<td>T</td>
<td>Development and availability of key technologies</td>
</tr>
<tr>
<td>T</td>
<td>Degree of Digitization</td>
</tr>
<tr>
<td>T</td>
<td>Sustainability of processes, construction and materials</td>
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<td>T</td>
<td>Mobility trends</td>
</tr>
<tr>
<td>T</td>
<td>Strength of (university) research</td>
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<td>T</td>
<td>Broadband connectivity</td>
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<tr>
<td>En</td>
<td>Effect of climate change</td>
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<tr>
<td>En</td>
<td>Prevalence circular economy</td>
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<tr>
<td>L</td>
<td>Scope and complexity of regulation</td>
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</table>

Appendix 6: 360° stakeholder feedback, aggregated factor list regarding Italian AEC industry
Source: Own illustration based on Schwenker & Wulf, (2013), p. 83.
### Appendix 7: 360° stakeholder feedback, aggregated impact and uncertainty ratings regarding Italian AEC industry

Source: Own illustration based on Schwenker & Wulf, (2013), p. 83.
<table>
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</tr>
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<td>P</td>
<td>Availability of subsidies and funding measures</td>
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<td>P</td>
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<td>Energy policy</td>
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<td>P</td>
<td>Taxation &amp; fiscal policy</td>
<td>8</td>
<td>7</td>
</tr>
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<td>P</td>
<td>Prevalence of corruption</td>
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<td>P</td>
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<td>Speed of bureaucratic and administrative processes</td>
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<td>8</td>
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<td>Availability and cost of skilled labor</td>
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<td>Market attractiveness for investors</td>
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<td>Development and availability of key technologies</td>
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<td>Broadband connectivity</td>
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<td>Effect of climate change</td>
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Average: 7.2, Range: 3.6

Appendix 8: 360° stakeholder feedback, categorization of factors regarding Italian AEC industry
Source: Own illustration based on Schwenker & Wulf, (2013), p. 83.
Bibliography


Schober, K.-S., & Hoff, P. (2016). Digitization in the construction industry: Building Europe’s road to "Construction 4.0". Munich: Roland Berger GmbH.


Declaration of authorship

I hereby declare that I have written this thesis without any help from others and without the use of documents and aids other than those stated above.

Furthermore, I have mentioned all used sources and have cited them correctly according to the citation rules defined by the Dr. Ing. h.c. F. Porsche AG Chair of Strategic Management and Digital Entrepreneurship.

Moreover, I confirm that the paper at hand was not submitted in this or similar form at another examination office, nor has it been published before.

With my signature I explicitly approve that HHL will use an internet-based plagiarism detector which screens electronic text files and looks for similar pieces on open-access websites as well as similarities in work previously submitted.

Leipzig, 29th April 2019

Kristian Reimar Kersting