INSTITUTIONAL DETERMINANTS OF THE EXTENT TO WHICH NEW TECHNOLOGIES DIFFUSE: A COMPARATIVE STUDY OF PREFABRICATED ELEMENTS 1945-1965

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ABSTRACT

We examine the extent of diffusion of a new technology in two countries, asking why the point of saturation, the onset of stabilization or decline, occurred at different times. This longitudinal study relies on a comparative inductive methodology and primary archival data spanning 20 years. The context is the spread of prefabrication in the French and Danish construction industries 1945-1965. We find that interactions between theorization and objectification explain diffusion, and that socio-political legitimacy determines the extent of diffusion when cognitive legitimacy is high and pragmatic legitimacy low. Three differentiating features of socio-political legitimacy are technological selection, resource allocation, and administrative support.

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How does legitimacy determine the extent to which a new technology diffuses? Previous neo-institutional research has illuminated the forces that drive diffusion (DiMaggio & Powell 1983), the pace of diffusion (Tolbert & Zucker 1983; Lawrence, Winn and Jennings 2001; Leblebici, Salancik, Copay and King 1991), and the channels through which diffusion occurs (Strang & Meyer 1993; Lounsbury 2001). However, a neglected topic is the extent to which a new technology diffuses within an organizational field. All new technologies encounter a saturation point, a moment in time when diffusion slows down and stability or decline set in (Christensen 1997; Fligstein 1991; Lawrence, Winn and Jennings 2001). Stabilization indicates that the technology has become institutionalized while decline indicates a lack thereof (ibid). Our goal in this paper is to explain the point of saturation, the moment when diffusion reaches its highest point prior to stabilizing or declining. For instance, are results from the first experiments with a new technology determinant for how widely it diffuses? Or is socio-political support or cognitive framing a better predictor of the extent of diffusion? We examine this question empirically in a comparative case study.

Research conducted within the neo-institutional traditions gives strong emphasis to the ideational realm and to the cultural-cognitive aspects of diffusion. Studies on *theorization* looks at how new technologies acquire their rationale prior to mass-scale diffusion (Hargadon & Douglas 2001; Greenwood et al. 2002). For instance, Edison theorized electrical light to pave the way for diffusion after this new technology had initially failed to diffuse (Hargadon and Douglas 2001). Studies on *translation* examine the sense-making that actors engage in when they interpret and implement a new technology (Zilber 2006; Hargadon & Douglas

2001). For instance, Zilber (2006) demonstrated how ideational structures shaped the Israeli translation of high tech over time. While her study addressed the ideational realm only, she proposed that future research investigates the relationship between the cognitive realm and the material realm, the latter referring to the tangible and concrete dimension of reality.

Neo-institutional theory takes the material realm into account in objectification, the process through which ideas gain tangible form (Charniawska & Joerges 1996). Hasselbladh and Kallinikos (2000: 709) define objectification as the collection of social practices that give material existence to new ideas. Objectification is widely regarded as one of the later stages in institutionalization processes, one that follows the stage of theorization (Greenwood, Suddaby & Hinings 2002). The analytical separation of these two stages into subsequent steps has been called into question (Zilber 2006) but good empirical studies on objectification are still lacking (Hasselbladh & Kallinikos 2000). Our study attempts to fill the gap in the literature by investigating how theorization and objectification, as they interact over time, explain the point of saturation, the onset of stabilization or decline.

To explore this topic empirically, we turn to the notion of legitimacy. A long-standing insight of institutional theory is that new elements diffuse more easily when they are endowed with high legitimacy (Rogers 1983, Hargadon & Douglas 2001; Djelic, 1998). Legitimacy refers to "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" (Suchman 1995: 574). A new technology is thus legitimate to the extent that it reflects dominant ideas. Accordingly, many studies examine legitimacy as a feature that flows from field characteristics, e.g., a dominant institutional logic (e.g., Dobbin 1994; Ocasio and Thornton 1999) or competing institutional logics (Lounsbury 2007; Seo & Creed 2002). An alternative perspective is to regard legitimacy as a factor that can be mobilized actively through rhetorical strategies (Suddaby & Greenwood 2005) or through organizational

networks (Lounsbury 2001). We depart from these previous studies by looking at how legitimacy evolves over time. Suchman (1995) proposed more than a decade ago that it would be fruitful to investigate if "the sequencing of legitimation efforts affects the ultimate success of a legitimation project?" (pp. 602-3).

New technologies are not born with legitimacy; they acquire it (Zucker, 1986; Scott, 1987; Rao, 1994; Suchman, 1995). Edison experienced this phenomenon when he first introduced electrical lighting and was met with indifference to his new technology. Potential consumers could not make sense of electrical lighting and so they discarded it (Hargadon & Douglas, 2001). After Edison reformulated his invention in familiar concepts and embedded it in working routines for gas lamps, electrical light rapidly acquired legitimacy and diffused widely. A similar pattern faced Kodak's roll-film camera, which had to be actively embedded in mainstream discourse and existing practices before it was recognized as a relevant and useful aspect of social life (Munir & Phillips, 2005: 1672). Both are examples of cognitive legitimacy.

Cognitive legitimacy occurs when a new technology is framed as desirable, proper, and appropriate within a widely shared system of beliefs, norms and values (Rao 1994; Suchman 1995; Aldrich & Fiol 1994). It is thus closely aligned with theorization. Two other types of legitimacy relate to objectification: *pragmatic legitimacy* derives from the concrete and tangible benefits associated with a new technology (Suchman 1995) while *sociopolitical legitimacy* results from a formal endorsement by legal authorities, governmental bodies, and other powerful organizations (Rao 1994; Aldrich & Fiol 1994). We explore the presence of these types of legitimacy during the diffusion of a new technology.

The new technology in question is the prefabrication of concrete elements in the construction industry. Prefabrication refers to the factory production of concrete building blocks that are then transported to the construction site and assembled into apartment blocks.

This technology diffused worldwide in the postwar period. France and Denmark, two of the largest producers of concrete in Europe, pioneered the diffusion of prefabricated elements.

The comparative case study reveals a diverging diffusion pattern in the two countries: Prefabrication continued to diffuse in Denmark throughout the period of study while it reached a point of saturation in France around 1958 before declining. We first found that prefabrication lost its cognitive legitimacy in France, but not in Denmark, in the late 1950s. Our data indicate that pragmatic legitimacy played no explanatory role in, as much it remained low in both countries throughout the period of study. However, sociopolitical legitimacy was a strong explanatory variable. High and enduring sociopolitical legitimacy supported the prior theorization of prefabrication as a superior technology and reinforced its diffusion in Denmark. In contrast, its sociopolitical legitimacy was feeble and discontinuous in France, which, in combination with low pragmatic legitimacy, eroded the theorized advantages of prefabrication and brought diffusion to a halt in 1958. Our inductive study points to technological selection, resource allocation, and administrative support as three distinguishing features of sociopolitical legitimacy. These findings rely on a comparative inductive analysis of how perceptions of the new technology evolved over time. The findings ultimately illuminate how theorization and objectification interacted over time and in combination determined the point of saturation.

The presentation of our empirical study is divided into four sections. The first section introduces the postwar construction industry in Denmark and France and the new technology of prefabrication. The subsequent section presents our methodological procedures, while the third section is devoted to a presentation of our empirical results. We subsequently, in the fourth and final section, sharpen the theoretical contribution of our study in light of its limitations and of previous research on institutionalization, diffusion and legitimacy.

THE CONSTRUCTION INDUSTRY

Construction is an extraordinarily complex activity in which many professional groups interact with one another. One template is that architects draw the blueprint for a building in response to the needs of a private developer or a public authority. Contractors then coordinate the manual workers, such as masons, carpenters, painters, electricians and other trained craftsmen while engineers employed either by contractors or by consultancies select the appropriate building materials and technical processes.

Construction of collective dwellings

The construction industry encompasses a large field of activities that range from the construction of new housing and public infrastructures to the renovation and destruction of them. Our analytical focus is new collective housing, more precisely the building of concrete apartment blocks in the post-war period. This subsection of the construction industry expanded very rapidly in the 1950s and 1960s Europe in response to post-war reconstruction, population growth, and increasing urbanization. This sudden increase in the construction of collective dwellings created a unique experimental field for the emergence of new thoughts in construction.

Modernism and Functionalism in Architecture

The French and the Danish construction industry were both guided by the institutional logic of modernism/ functionalism in the mid 20th century. The core principle of modernism/ functionalism is that form should follow function advocating a minimalist style of architecture that avoids purely decorative elements. Le Corbusier pioneered this movement in French architecture in the 1920s. A classical example is *Villa Savoye* that he completed in the late 1920s (see Figure 1). The diffusion of the modernist/functionalist principles reached Scandinavian architects at a conference in Stockholm in 1930 (Danish Ministry of Foreign

Affairs, 2003). Within a few years, Arne Jacobsen, a young Danish architect, applied these ideas to build the residential complex of *Bellavista*, which later became internationally recognized (see Figure 1).

Insert Figure 1

During the 1930s and 1940s, modernist/ functionalist architecture gained wide recognition in both France and Denmark. Few construction projects were initiated during this period, however, because of economic conditions during the depression and the Second World War. The major breakthrough came after WWII when the economy improved and many new construction projects were initiated. Modernism/ functionalism gained dominance in the Danish and French construction industry in this period (see Figure 2).

Insert Figure 2

In the late 1960s, critique of modernist/functionalist architecture started to mount in both countries, eventually to become replaced by postmodernism. The shift to postmodernism meant that particularism and contextualism replaced the universalism and rationalism of the functionalist-modernist logic. Institutional logic of functionalism/ modernism had thus a similar life cycle in France and Denmark, reflecting a general trend in the western countries at the time. The logic emerged and became popular at about the same time, and it manifested in similar architecture, in the two countries.

Technological systems and concrete

The rational principles of functionalism/ modernism inspired not only architects but also engineers. The postwar period was a bustling period of experiments in the European construction industry. The construction process was organized in a more rational and efficient

manner that corresponded to the ideas of scientific management. New construction technologies emerged and new building materials became popular.

Concrete became an exciting new alternative to bricks and stones in the construction of apartment blocks. Figure 3 shows a sharp increase of the use of concrete in the construction industry from 1945 to 1973. Concrete is a liquid substance made of gravel, sand, water and cement. All techniques for building with concrete involve some variation of casting. Casting refers to the pouring of concrete into forms that are made of wood, metal or plastic.

Insert Figure 3

New construction materials gave rise to new construction techniques. One technique was to cast concrete on the actual building site, using a concrete substance that was either mixed in a factory (ready-mix) or on-site. An expression of this technique is cast-in-place concrete walls (CIPCW), which refers to the pouring of concrete between frames on the construction site (shuttered concrete). Prefabrication represents another construction technique, one that was inspired by recent successes in the automobile industry where industrialization had rendered building processes significantly more rational and efficient. Prefabrication, the essence of industrialization, consists in pouring concrete into standardized, reusable forms in a factory and curing the concrete elements in a controlled environment. The output is concrete building blocks such as walls, floors and staircases. These prefabricated elements are then transported to the construction site, where they are lifted into place and assembled into buildings.

The graphic illustration of the market for prefabricated elements in Denmark and France (Figure 4) reveals more than a divergence around 1960. It also shows that there were long-term institutional effects of this divergence. After the market for prefabricated elements had formed, which it did during the 1950s and 1960s, it then stabilized at a certain level in the 1970s. Prefabricated elements stabilized around 40-45 percent of the market for concrete in

Denmark, one of the highest in Europe, while it in France only reached 15-20 percent of that market, which is slightly below the European average.

Insert Figure 4

METHODS

Research Design

The study was conducted as a comparative case study as it is indicated when the research objective is to identify new causal relationships (Yin 2003). The potential of comparative case studies for revealing causal relationships increases if the comparison involves a success case and a failure case (Ragin 1987). In our study, Denmark represents a success case and France a failure case in as much as the new technology diffused much more widely in Denmark than it did in France. This comparative design avoids one of the common shortcomings of retrospective studies, namely the tendency to sample on the dependent variable, neglecting cases of failure, which are much harder to detect in retrospect than are success cases (Aldrich & Fiol, 1994). While success cases provide insight into the conditions that are *conducive* for legitimation, it is through contrast with failure cases that we discover which of these conditions are *necessary* and *sufficient.* Failure cases are rarely reported in the literature, which leave us with poor insight into the key features of legitimation.

As is common for case studies, the analytical strategy builds initially on an inductive methodology, meaning that we made effort to derive generalizable knowledge from systematic comparison of empirical observations. Consistent with this ideal, we formed no stringent theoretical hypotheses prior to initiating data collection, relying instead on an initial research question to guide our early data collection. Induction is not fully feasible, however, because empirical data about the social world are inescapably mediated by human

interpretation (Eisenhardt 1989). Not only do we as researchers subconsciously bring our existing knowledge to bear upon the object of inquiry, but our informants or secondary sources also mediate our research findings. To minimize this weakness, we relied on multiple data sources and made significant efforts to locate primary sources. Many retrospective studies of diffusion rely on data sources that do not address how actors were thinking at the time they engaged in relevant activities. Without access to the ideas and actions of contemporary actors, research findings are more likely to remain stylized and speculative, reflecting *a priori* convictions about actors' ability to strategize in the institutional realm.

Data Collection and Data Analysis

Starting from the empirical observation that prefabrication was less common in France than in Denmark, we collected descriptive statistics of the European construction industry, which confirmed this empirical observation. Through constant comparisons of descriptive statistics, we identified the diffusion of prefabricated elements in the postwar period as our dependent variable. Through the same procedure, we identified Denmark as an early success case and France as an early failure case. From these clarification emerged our initial research question, which essentially inquired into why prefabrication had spread more widely in one pioneering country than in another one. Relying on *theoretical sampling,* we selected data sources that corresponded to our evolving insights and imagination of potential explanatory variables (Strauss and Corbin 1967).

Ruling out variables

In the process of theoretical sampling, we turned to secondary sources, particularly books about the construction industry and exploratory interviews with senior members of the construction industry. These sources offered many different perspectives on why

prefabrication diffused the way it did in either Denmark or France though none of them conveyed detailed knowledge about prefabrication in other countries. This initial exploration generated a list of hypotheses, most of them functionalist, which presented potentially salient explanations. Examples include weather conditions, aesthetic or technical considerations, demand and supply issues, national economic indicators, and demographic patterns. We systematically tested the empirical support for each of these variables, using archival data from government archives, national statistics, professional organizations, libraries, and online resource centers. No substantial empirical support was found for any single one of them though they may certainly be part of a larger web of causalities. Appendix A lists some of the empirical findings that rule out the explanatory power of some of the most plausible functionalist variables.

Having exhausted our supply of inductively derived variables, we turned to the literature on diffusion. Neo-institutional theory treats diffusion in some depth and proposes professional groups and institutional logics as potential explanatory factors (Dobbin 1994; Greenwood, Suddaby & Hinings 2002). To test the professional group hypothesis, we compared what engineers and architects wrote about prefabrication in their trade journals from 1945 to 1968. While there were many disagreements about the merits of prefabrication relative to alternative techniques, no significant difference could be detected between architects and engineers, nor for that matter between these two groups and contractors. Masons rarely expressed preference for concrete, understandable in light of their professional interests, but they were no less supportive of prefabrication than of other concrete technologies. To test the institutional logic hypothesis, we looked at the theorization of prefabrication in the decade following WWII. Prefabrication was theorized in a similar manner in Denmark and France: it drew on contemporary discourses of scientific management and modernist/ functionalist architecture. For instance, the American industrialization of car manufacturing was frequently evoked in

both countries as an example of what prefabrication could accomplish for housing. We thus rejected both hypotheses of professional groups and institutional logics.

Generating new variables

To generate new variables, we collected substantial amounts of primary data, including historical documents from the post-war period, including trade journals, government policies, and professional reports on prefabrication in Denmark and France. All the primary sources that we coded are listed in Appendix E. For analytical purposes, we initially selected primary sources so that they covered different professions, structural position within the industry, and access to relevant knowledge and decision-making processes. We also interviewed scholars in urban history and architecture with a specialty in postwar prefabrication and very senior informants, some of them a decade or two into retirement. Collection and analysis of primary data continued until we reached a point of saturation where new primary sources did not add significant new insights. One sign of saturation was an emerging correlation between the apparent legitimacy of prefabrication and the diffusion of prefabrication practices, suggesting that we had captured the essential data.

We captured how the theorization of prefabrication evolved over time by reading through all the documents to identify concepts that were discursively associated with prefabrication. For instance, if a sentence conveyed that prefabrication was the cheapest production form, then we coded the sentence as ‘costs’. We induced three codes from this procedure, namely costs (lower construction costs), aesthetics (architectural expression of the building), and pace (rapidity with which new housing could be built). Selected passages from this coding are reproduced in Appendices B-D. The corresponding text excerpts made it possible to compare how theorization evolved over time in Denmark and France.

To capture objectification, we examined primary data for concrete expressions of prefabrication, particularly passages that linked a concrete expression to the theorization of prefabrication. We first analyzed primary data that contained information about test results or commentaries on these results. We systematically compared these concrete analyses to the theorized advantages of prefabrication in the two countries (i.e., cost, aesthetics, pace), searching for national differences in the evaluation of prefabrication that could explain the pattern through which theorization evolved in the two countries. Secondly, we analyzed primary data that contained information about the extent to which the government and other formal bodies endorsed prefabrication. Priority was given to patterns that seemed to be continuous over time. For instance, if a text segment stated that the state supported a particular prefabrication technique from 1955 to 1960, then we coded it as 'selection of technology'. A careful comparison across cases revealed three potentially explanatory factors: selection of technology, resource allocation, and administrative support. Selection of technology refers to the consistent endorsement of a particular prefabrication technique over time, resource allocation to the government's direct or indirect allocation of financial resources to encourage the adoption of prefabrication, and administrative support to continuous efforts within the government and professional associations to favor prefabrication in long-term planning within the construction industry. To increase rigor, we systematically recoded those primary sources that were particularly informative and that covered the entire period of study (see Appendix E). The text excerpts were inserted in comparative tables, part of which is reproduced below.

FINDINGS

The Evolving Theorization of Prefabrication

Theorization unfolds purely in the cognitive realm and gives a new technology the cognitive legitimacy it requires to diffuse. Below we show how prefabrication was theorized similarly in the first decade of diffusion, which gave prefabrication high cognitive legitimacy in both Denmark and France. We subsequently show how the cognitive legitimacy declined in France while it remained intact in Denmark from 1955 to 1965. After demonstrating this divergence, which clearly impacted on the diffusion of prefabrication, we proceed to explain how objectification interacted with theorization to produce the observed diffusion pattern.

1945-1955: Similar theorization, similarly high cognitive legitimacy

In the decade after World War II, prefabrication became widely reputed in both countries as a way to obtain rationalization. Rationalization was at the time imbued with strong positive connotations of progress and prosperity. It was believed that prefabrication would revolutionize the construction sector just as rationalization had revolutionized American car manufacturing decades earlier, lowering cost and production time by means of a clear division of labor and efficient assembly lines. The explicit reference to the car industry was a common point of reference as shown here in a citation by Le Corbusier:

> **"**Houses will have to lump up in one piece, done with industrial plants in factory and built like Ford assembles the pieces of his cars on conveyor belts" (Le Corbusier, cited in Pilpoul, engineer, 1946: 8*)*

It was widely believed that the construction of homes, quintessentially associated with craftsmanship, would become much cheaper and faster if the construction process was rationalized in a manner similar to recent advances in the car industry. Accordingly, in France, prefabrication technologies were labeled "modern" as opposed to all other advances in construction technologies, which were simply considered "improved traditional" (Lods,

architect, 1946). A similar distinction between modern and traditional predominated in Denmark as expressed in the following citation:

> "Standardization of building parts is a prerequisite for the industrialization of the construction sector, and industrialization is, in a modern society, the most important means to make a product cheaper and to improve it. (The Committee for Rationalization of Building Activities, 1956: 1)

Hence, prefabrication was first and foremost theorized as a technology that favored rationalization and hence as a catalyst for the progression toward a modern society.

In more fine-grained detail, our data show that the advantages of prefabrication were theorized very similarly in both countries. As evidenced by our coding (See Appendix B), it was widely believed that prefabrication, as an industrialized construction process, would enable cheaper and faster building processes without compromising the key qualities of aesthetics and solidity. It was believed that the economic superiority of prefabrication would be demonstrated very rapidly. The expected savings would come from cheaper material, less qualified workforce, large standardized series, and higher building quality (See Appendix B). The pace of construction was seen as another important advantage. Prefabrication, heralded as the most efficient construction technology, would alleviate the exceptionally high demand for new homes faster than any alternative building method (See Appendix C). Finally, the aesthetics of prefabrication aligned with modernism, the architectural *zeitgeist* of the time, in which pure and simple forms, repeated manifold, fitted perfectly with the classical harmony that was in vogue at the time (see Appendix D).

This theorization was widely shared across the professions that influenced the institutional environment of the construction industry. Even if we noticed sporadic signs of dissidents, we can infer from our data that a very large cross-professional consensus did exist on the cognitive legitimacy of prefabrication in both countries in the decade after WWII. Architects, engineers and government officials alike celebrated prefabrication as a privileged path of transition toward an industrialized construction process. For instance, both states

privileged prefabrication in their financial support policies and actively promoted the use of prefabrication to construct new apartment buildings. Many of these features were brought about in Danish and French regulations in the early 1950s.This consensus on prefabrication as a cognitively legitimate technology did not remain unchallenged in the following decade.

1955-1965: Divergent cognitive legitimacy

In the mid 1950s, the diffusion of prefabrication slowed down in France and declined from 1958 to 1964. Meanwhile, cast-in-place concrete techniques became more popular and legitimate in France. Simultaneously, however, prefabrication continued to spread in Denmark at the same pace as previously (see Figure 4). This divergent diffusion pattern reflected the cognitive legitimacy of prefabrication in the two countries. France largely gave up on the belief that prefabrication would lower construction costs, increase the speed of production, and assure the aesthetic aspect of buildings. This discouragement did not manifest in the Danish construction industry, where the cognitive legitimacy of prefabrication remained almost intact.

In France, central actors in the construction sector started to question whether prefabrication was in fact more rational than the evolved traditional or the cast-in-place concrete techniques. The costs advantage of prefabrication rapidly eroded in France as expressed in the following excerpt:

> "[This] explain why prefabrication, in the first construction projects, has not been able to deliver equal quality at a lower price than traditional techniques. Accordingly, the industrial cannot offer an attractive price estimate in response to the hesitation, little short of hostility, of architects, traditional entrepreneurs, and even clients. This does not attract the customers that could open up for serial production of prefabricated elements. The arbitrariness, or the uncertainty if you will, that characterize the calculation of this price factor (the fixed costs) is so that, in our opinion, it is absolutely dangerous, even hazardous and vain, to offer revenue estimates and, from this point of view, compare prefabricated systems with the improved traditional" (Simon, engineer, 1962, p 88).

French proponents of prefabrication almost abandoned the cost argument for prefabrication. Prefabrication, they maintained, should not be compared to improved traditional systems in terms of short term costs. Moreover, they abandoned the belief that prefabrication was not the only way of rationalizing the construction process. The "improved traditional" system, as the actors called it, based on "cast-in-place" technologies became a viable alternative to prefabrication. Pace, the other technical advantages of prefabrication, almost disappeared as well from the French discussions about prefabrication. And on the aesthetics side, primary data clearly show that a large proportion of architects or developers no longer had a preference for prefabrication (see Appendix C). Hence, prefabrication lost cognitive legitimacy and its initial theorization became a myth.

On the Danish side, in contrast, the theorization and cognitive legitimacy of prefabrication remained intact. It was believed, throughout the period of study, that prefabrication would lower the costs and the pace of construction even if this belief had not yet materialized by the late 1950s. Despite some heated debate about the superiority of prefabrication relative to other construction technologies, a consensus persisted around prefabrication as the most rational construction technique, one that carried high potential for cost and time savings. As late as 1964, we still see manifestations of cognitive legitimacy, i.e. of a valid theorization:

> "By increasing the rational construction and minimizing labor, it will undoubtedly become possible to lower the cost of constructing new dwellings. The available experiences, e.g., the most recently initiated project with prefabricated construction, confirm this perception. One should not, however, exaggerate the expectations to the results that prefabrication can attain in the short term. Expenses related to the construction process are only a part of the overall costs of acquiring a new building. Savings on production costs can be countered by increases in the cost of land, the costs of financing, and other elements in the cost of acquisition. Finally, the gain from rationalization will probably not fully impact on the overall cost of construction until the conditions for a more efficient competition in the construction industry have been established." (Ministry of Housing, 1964, 6)

Not only cost, but also pace supported the cognitive legitimacy of prefabrication. The Danish government wanted to build new city housing as fast as possible, and prefabrication was promoted as the fastest way to do so. This technique was believed to be faster not only because the building process was more efficient, but also because prefabrication could integrate unskilled labor into the construction industry. Such integration of unskilled labor seemed to be almost impossible otherwise because of quasi-monopolies that skilled labor groups had acquired for most acts of construction (Arbejdsmarkedskommissionen 1952). Prefabrication, being a new technology, had no acquired monopolies. Hence, support for prefabrication facilitated the integration of unskilled labor, which in turn increased the labor supply in the construction industry, which ultimately would alleviate faster the urgent housing shortage in Danish cities. By means of this argument, and a continued belief in its rationalization potential, prefabrication did maintain a high cognitive legitimacy in Denmark (see Appendix C).

In regard to aesthetics, the simple design of prefabrication had general appeal in Denmark (see Appendix C). However, this aspect of theorization received less attention in the national debates in Denmark than it did in France. Danish architects were also less outspoken than French architects, perhaps as a consequence of French architects having obtained formal status as a profession in contrast to Danish architects.

Proposition 1: cognitive legitimacy, obtained through theorization, is required for a new technology to diffuse widely. Once if disappears, a new technology will stop diffusing and its prevalence will decline.

The next question we address is how objectification impacted on how theorization evolved in France and Denmark. In other words, we now turn to the material realm.

Diverging Processes of Objectification

Objectification refers to the concrete parameters for prefabrication, those parameters that enable (or restrict) the way that prefabrication was implemented in construction practice. Naturally, prefabrication was not objectified in the exact same way in France and Denmark. Not only were there different prefabrication techniques, i.e., different sizes of standardized elements and different mechanisms for how to assemble them, but different support and regulation mechanisms were also put into place in Denmark and France. These parameters, of which we have identified four, build pragmatic legitimacy and sociopolitical legitimacy.

Similarly low pragmatic legitimacy

One working hypothesis relates to pragmatic legitimacy. We hypothesized that the concrete expression of prefabrication produced better results in Denmark than in France when it was implemented. By better results we mean evidence to the effect that prefabrication was cheaper or faster than any alternative construction technique. If so, prefabrication would have had higher pragmatic legitimacy in Denmark than in France, which could have explained the diverging cognitive legitimacy from 1955 to 1965. Although plausible, this hypothesis was not supported by our data. The results of experiments with prefabrication were, in fact, as inconclusive and neutral in Denmark as they were in France (see Appendix B). Despite countless debates and evaluations in the 1950s, no evidence showed that prefabrication actually lowered the costs relative to competing technologies, nor that it increased the pace of production.

For instance, the French state organized several contests to promote prefabrication and industrialization in the construction industries in the 1950s[1]. The results of these experiments were closely monitored and several technical reports[2] were published to account for the comparative advantages of prefabricated elements, all of which show inconclusive or disappointing results. Contemporary scholars have, in analyzing the technical reports from this period, produced very interesting secondary data[3]. Their work shows that prefabrication performed poorly on a number of indicators: cost per square meter, time delays, users' perceived utility, organization of the construction site.

In Denmark, data were compiled on prefabrication experiments in the 1950s and the results were finally published in 1962 (Appendix E, Nielsen 1962). The results show no advantage in price or cost between the use of traditional brick technology and modern concrete prefabrication technology, no matter how the data was split (city versus countryside; high rises versus low rises; early 1950s versus mid 1950s). The results of these experiments were published at a time when policies and laws had already been adopted, which made for a low impact in practice.

An interesting finding here is that Denmark, in spite of equally disappointing experimental results, continued to uphold the view that prefabrication was more rational than other techniques. In contrast, France, facing a largely identical situation, abandoned the very same belief. In other words, the cognitive legitimacy declined in France, but not in Denmark, although prefabrication had low pragmatic legitimacy in both settings. The lack of pragmatic legitimacy can probably explain why the diffusion of prefabrication came to a halt in France

[1] Well-known experiments led by CSTB (Centre Scientifique et Technique du Bâtiment) are: Orléans, (1946, 200 dwellings), Villeneuve-Saint-George (1949, 200 dwellings), Strasbourg (1951, 800 dwellings), Les 4000 (1952, 4000 dwellings).
[2] Some primary data are in Cahiers du CSTB, N°116-130, 1951-1953.
[3] The works by Treutel (1993) and Croizé (2005) are informative secondary data that deeply study the technical archival data of these experiments.

in the late 1950s and then declined in the early 1960s. We summarize this finding in the following hypothesis:

Proposition 2: Initial cognitive legitimacy is insufficient to ensure diffusion in the long run.

Different levels of sociopolitical legitimacy

How can we explain the divergence in cognitive legitimacy that arose in Denmark and France in the late 1950s, and which powerfully affected the diffusion? Our comparative inductive analysis points to sociopolitical legitimacy as the best explanation. The data shows that prefabrication maintained sociopolitical legitimacy in Denmark throughout the period of study. In contrast, it lost sociopolitical legitimacy in France around 1958, the year that diffusion stagnated and began to decline. By sociopolitical legitimacy we refer to the formal endorsement of prefabrication in public policy and law.

Proposition 3: Sociopolitical legitimacy assures that a new technology will continue to diffuse even without having pragmatic legitimacy.

Our comparative data analysis suggests three particular factors that belong to this category. They are the selection of prefabrication technology, resource allocation, and administrative support, all of which evolved very differently in France and Denmark during the period of study.

Different degrees of technological selection

In France as well in Denmark, prefabrication became tangible in the 1940s and 1950s when new technological expressions emerged. Both countries developed formal mechanisms

to encourage and channel these technological innovations, but their specific initiatives differed. Denmark continuously worked on the selection of new technologies, while France made more effort in generating them. Hence, after the initial years of experimentation with a variety of prefabrication technologies, France endorsed free choice among an increasing array of accredited technical expressions. Denmark, in contrast, promoted a single technical expression of prefabrication from the mid 1950s. The resulting technical continuity made it possible for prefabrication to diffuse further in Denmark while the technical discontinuity effectively blocked diffusion in France.

As apparent in Table 1, the emergence of prefabrication led to a bustling period of local innovations in France. In the early 1950s, the French state implemented a quality control system in an effort to reduce the increasing number of technical expressions of prefabrication. The Centre Scientifique et Technique du Bâtiment (CSTB) accredited and patented new prefabrication technologies, thereby making them eligible for publicly financed architectural contests. Within a few years, more than 650 technical systems had been accredited and patented. What at first was considered as a landmark of the French national genius soon became a real obstacle for standardization and mass production. Another mechanism also sought to reduce technical diversity: standardized blueprints would increase the uniformity of construction. But here again, the policy produced unexpected results. More than 2000 standardized blueprints competed on the market, allowing very diverse architectural expressions. Thus technical discontinuity impeded the use of prefabrication in France as expressed in the following citation:

> ”Technical continuity is born from a decrease in the variety of works and buildings: elementary continuity through respect of norms, adoption of type specifications, use of standardized elements, complete continuity for each project type. This continuity is at the disposal of all those who accept to subject themselves to a certain discipline. However, until now, too many architects, research units and companies have made an honor of inventing a system that is different from that of their neighbor. Technical continuity presupposes a limitation of this system multiplication.” (Rapport du groupe de travail sur l’industrialisation, 1958, Annexe: 3). For other citations, please refer to Table 1.

In France, construction professionals did not support the policy of reducing technical diversity in order to facilitate mass production at the expense of individual autonomy.

The data in Table 1 shows the opposite pattern in Denmark. Standard measurements were adopted progressively throughout the 1950s, starting with a standard floor height of 2.80 meters, required from 1951 in all apartment buildings that were constructed with state loans. In 1956, a governmental policy advocated an open system of prefabrication to make all prefabrication elements compatible with one another. The standard measure, the module, was set to 10 cm. The rationales for adopting modules and an open system were the following:

> "If each construction project has the required size and a homogeneous design, then prefabrication becomes economic…/ This lead directly to considerations about the use of a *module* and other forms of standardization in the construction of homes, which may lead to a replacement of many different elements of different sizes with fewer types of elements that can be applied in many different contexts. The standard measure for ceiling height was a first step in this direction, the module policy is the next." (Simonsen & Munch-Petersen, engineers involved in State committees, 1957: 8)

As explained in this citation, an open system with fixed modularity made it possible to obtain economies of scale, primarily because different prefabrication technologies did not compete with one another. Standardization may also have reduced some of the uncertainty that resulted from less convincing test results. A similar system had been proposed in France in 1952, but it did not take effect until 1964. The earlier adoption of standard measures in Denmark facilitated the diffusion of prefabrication in this country, while the French reliance on accreditations and patents, in contrast, increased the technical diversity and effectively blocked the diffusion of prefabrication (see Table 1).

Proposition 4: The formal selection of one tangible expression of a new technology, reinforced through time, enhances the sociopolitical legitimacy of the new technology and eventually the extent to which this technology will diffuse.

Different visibility on resource allocation

Another way in which prefabrication acquired sociopolitical legitimacy is through the allocation of financial resources (e.g., fiscal deduction, protected markets, and public purchase). The analysis of primary data revealed a different allocation of financial resources in the two countries. In Denmark, resources were allocated on a more continual basis to prefabrication throughout the period of study, notably by providing attractive state loans to contractors who used prefabrication. Resource continuity refers to whether public finances were allocated to prefabrication over continuous periods of time.

Table 2 reveals a lack of continuity in the financial resources allocated to prefabrication in France. In the initial decade, some contests were exclusively opened to prefabrication technologies, reflecting the French government's strong support of prefabrication at this time. However, these mechanisms slowly disappeared during the 1950's when other criteria, not explicitly linked to prefabrication, replaced them as the key parameters for public financing. At the end of the1950s, no allocation of resources was devoted specifically to prefabrication in public tenders. All technologies competed on an equal footing in open competition for resources, which made it very difficult to obtain economies of scale for prefabrication. Citations in Table 2 illustrate the difficulties for contractors to secure financial resources and to do engage in long term planning. The following excerpt summarizes why resource allocation was essential for prefabrication to diffuse:

> "We were wrong to make an analogy between cars and prefabricated dwellings. For dwellings, there is no open market for series. Repetition can only happen in few cases. Not until we create an artificial market will we create the opportunities for mass production that will foster good conditions for prefabrication. It requires that the market is less episodic, meaning that it provides continuous opportunities over time and a sufficient annual volume." (Simon, Engineer, 1962: 87)

In Denmark, throughout the 1950s, significant resources were accorded to construction projects that employed unskilled labor and used new construction techniques. In practice, these criteria were equivalent to prefabrication. The resources consisted in state loans with interest rates far below the market price. This type of support gave prefabrication a financial advantage over other technologies and access to a large pool of unskilled labor to work in factories and on construction sites.

> "In certain periods, non-traditional construction has been privileged. This has been the case in periods with high employment where there has been a labor shortage, particularly skilled masons. In order to increase construction capacity under this condition, state loans have been made available for construction projects that used skilled masons to only a modest degree, a privileged position relative to ordinary brick construction. To give this privilege, it has been a condition that the use of skilled masons represented no more than 15 percent of what is common in brick construction." (Danish Ministry of Housing, 1957: 32)

In addition, the Danish state commissioned four large construction projects to be built entirely with prefabrication technology in the period 1962-1965. This commission was made several years in advance so as to enable the creation of factories that could deliver the prefabricated elements. The timing in 1959 coincided with the passing of a new construction law that explicitly gave privilege to prefabrication and other new construction technologies (Table 2). Hence, the allocation of financial support to prefabrication was made visible many years into the future, which certainly contributed to further diffuse prefabrication in Denmark.

Proposition 5: Allocation of financial support to a new technology, given over longer periods of time into the future, increases its sociopolitical legitimacy and eventually the extent to which this new technology diffuses.

Different continuity in administrative support

Lastly, our inductive analysis revealed that the process of administrative support for prefabrication was much more continuous in Denmark than in France. We examine here the

collective administrative mechanisms that enhanced the diffusion of prefabrication (e.g., work group, report by experts, laws, decrees, and public policies). Administrative continuity refers to the ongoing governmental activities that encouraged the widespread adoption of prefabrication.

In France some working groups on industrialization had met during the entire period and we can trace recurrent names of famous architects and engineers like Lods, Camus or Bonnome throughout the decade. However this continuous work had no direct impact on regulation. We can infer from Table 3 that there was a very high administrative instability in France at that time. Some people were worried about the brutality of administrative measures, the instability of technical norms, or the impossibility of making long-term plans in such an unstable situation. Government changed *22 times* during the period of study, and from 1958 on, regulations in the construction industry paid little attention to prefabrication. The following quote is a good example of how actors perceived the situation:

> "The display of relatively brutal administrative decisions may affect cost variation…/ We have to underline that continuity, through administrative and financial means, can only be attained if it is possible to commit for several years, which is only feasible if the context is stable."(Rapport du groupe de travail sur l'industrialisation, 1958, Annexe: 2)

Denmark, in contrast, demonstrated a very high level of administrative continuity in the support of prefabrication. A work group on industrialization of construction was operating throughout the 1950s and it strongly influenced the legal measures that were taken to regulate the construction industry. Although the government changed several times during the period in question, the commitment to develop the construction sector remained intact. Constant efforts were made throughout the 1950s to plan the next steps of development, to formulate explicit rules and to enforce them by decree. For instance, to obtain a state loan, contractors had to submit a time plan, divided into four hour blocks, that outlined which steps would be executed a year into the future. They also had to respect a maximum cost per square meter

that was set so low that there was almost no flexibility for architectural design and building materials (primary data, interview). Moreover, they were bound by a fixed ceiling height of 2.80 meters and a module norm of 10 cm. These explicit rules encouraged contractors in large numbers to adopt prefabrication. The announcement of these rules a year or more in advance of the date they took effect encouraged the construction of new and larger prefabrication factories. This careful stimulation of both supply and demand had a direct effect on the spread of prefabrication in Denmark in the late 1950s and early 1960s. The primary data show that it was with deliberation that key construction professionals and state representatives provided administrative support for the widespread diffusion of prefabrication.

Proposition 6: Continuous administrative support that determines and makes visible the market conditions for a new technology enhance the sociopolitical legitimacy of this technology and eventually the extent to which it will diffuse.

In summary, we found three dimensions of sociopolitical legitimacy that differed radically in the two cases throughout the last decade of study (1955-1965), namely selection of technology, resource allocation and administrative support. Their continuity over time seems to have imbued prefabrication with sociopolitical legitimacy. It seems that these three dimensions of sociopolitical legitimacy, present in Denmark but absent in France, explain why the diffusion of prefabrication diverged so dramatically after 1958. The findings suggest that the acquisition of sociopolitical legitimacy gave additional momentum to the diffusion of prefabrication in Denmark while the absence of sociopolitical legitimacy eroded the cognitive legitimacy that prefabrication had attained in France during the first decade of study.

Proposition 7: Sociopolitical legitimacy is necessary for the maintenance of a high level of cognitive legitimacy when the level of pragmatic legitimacy is low.

In concluding this section, we observe that objectification strongly affected the extent to which prefabrication diffused in Denmark and France. Its impact on diffusion became very apparent in the late 1950s and early 1960s when ambiguous and weak test results cast a shadow of doubt on the initial theorization of prefabrication. In the absence of pragmatic legitimacy, sociopolitical legitimacy proved crucial in assuring the continuous diffusion of prefabrication and, not the least, in avoiding a rapid decline. As such, objectification influenced the initial theorization in a feedback loop that collectively explains the extent to which the new technology of prefabrication diffused in Denmark and France.

DISCUSSION

In this section we discuss in greater depth what we consider our study to contribute theoretically to three lines of inquiry within institutional theory. They are a) the role of respectively theorization and objectification in processes of institutionalization, b) the influence of legitimacy on diffusion and institutionalization, and c) the role of political action in processes of institutionalization.

Theorization and Objectification

This comparative case study contributes to the stream of research on theorization and objectification as the two core processes involved in the diffusion of a new technology (Hasselbladh & Kallinikos 2000; Greenwood et al 2002). Our contribution consists in illuminating the relationship between objectification and diffusion, a relationship that despite its widely recognized importance has received remarkably little attention in the institutional

literatures on diffusion, legitimacy, and institutionalization (Zilber 2006). A particularly neglected aspect, the one that we have attempted to illuminate in this paper, is the question of how objectification interacts over time with theorization to determine the extent of diffusion, understood as the point of saturation that occurs prior to either stabilization or decline of the diffusing entity. Our study showed that theorization, while being an important force in the early stages of diffusion, was insufficient to explain the different points of saturation in Denmark and France. The explanation that emerged from our inductive analysis is that objectification, i.e. the material form that prefabrication technology took in each country, had an important impact. Objectification affected the initial theorization, and it was *this* feedback loop, and not the theorization or the objectification themselves, that seemed to determine if the new technology continued to diffuse or if it stabilized and declined. Most importantly, we found objectification to be a crucial factor at later stages of diffusion: it either reinforced the momentum of theorization, increasing the extent of diffusion (as we saw in Denmark), or it acted as a stick in the wheel that brought diffusion to a halt and provoked a point of saturation and a subsequent decline (as we saw in France). In combination with theorization, objectification thus determined the point of saturation (the extent of diffusion) and the subsequent stabilization or decline (the extent of institutionalization). The implication of this finding is that the two processes of theorization and objectification cannot be conceptualized as two consecutive steps in the institutionalization process as previously suggested (Greenwood et al. 2002). We propose instead another model (see Figure 5). Since it seems unfounded to study theorization in isolation, we encourage future research on institutionalization processes to pursue this line of inquiry. A worthwhile goal would be to clarify how the two processes of theorization and objectification co-evolve over time with which institutional effects.

-------- Insert Figure 5 ----------

In terms of studying objectification, we identified three discriminant factors of objectification that made a remarkable difference in our empirical study: selection of technology, resource allocation, and administrative support. The former refers to the reinforcement of one particular material expression of a new technology, the middle one to a particular allocation of resources to reinforce the widespread adoption of the new technology, and the latter to progressive efforts to make this new technology central to future industrial developments. The continuous presence of these three factors over a longer period of time explained the divergent pattern of diffusion that we observed in Denmark and France. While other factors may be more important in other empirical situations, we nevertheless offer these three factors as potential determinants of the extent to which a new technology will diffuse after the initial momentum of theorization wears off. These factors prolong the diffusion phase and postpone the saturation point beyond what theorization can accomplish alone.

We were surprised to discover that evidence of the new technology's superior performance did not explain the different points of saturation in the two countries. No such evidence was available in either country at the time that France experienced the point of saturation. In contrast, by the time Denmark reached this point more than a decade later, evidence of superior performance had been produced. This difference may explain why France, in contrast to Denmark, experienced a decline rather than a stabilization after the point of saturation had been reached. However, because our study is limited to only two cases, we cannot substantiate this proposition. Instead, we encourage future research to investigate if evidence of superior performance predicts a stabilization after the saturation point or if other factors better explain whether a new technology stabilizes or declines after reaching its point of saturation.

Legitimacy

Seen from another angle, our study illuminates some interesting dynamics of legitimacy. Building on previous studies that defined different types of legitimacy (Suchman 1995) and examined the institutional effects of legitimacy (Rao 1994), we investigated the evolution of three types of legitimacy over time. We traced how cognitive legitimacy, pragmatic legitimacy and socio-political legitimacy of a new technology evolved in two countries over a period of 20 years. Cognitive legitimacy referred in our empirical study to the rationalization of prefabrication, i.e. to the arguments for why it was superior to alternative construction technologies (cheaper, faster, and aesthetic). Pragmatic legitimacy occurs if prefabrication, as expected, produced new aesthetic dwellings cheaper and faster than alternative technologies. Finally, sociopolitical legitimacy pertains to whether the government formally endorsed prefabrication as superior or more appropriate than alternative construction technologies. A comparison of how these three types of legitimacy evolved in Denmark and France revealed some theoretically interesting patterns that we captured in seven propositions.

One interesting pattern is that pragmatic legitimacy did not matter for diffusion. We found no evidence in either country for the claims conveyed by the theorization of prefabrication. These claims initially produced high cognitive legitimacy, but since they were not confirmed, the pragmatic legitimacy remained low in both countries during the entire period of study. Since the new technology diffused nevertheless, we suggest that pragmatic legitimacy, contrary to common wisdom, is not required for diffusion. This suggestion counters functionalist approaches to diffusion (e.g., Boland, Lyytinen & Yoo 2007).

Another interesting pattern is that cognitive legitimacy and socio-political legitimacy co-evolved, meaning that they followed a similar pattern of evolution within each country. Their co-evolution is interesting because it testifies to a close relationship between collective cognition and socio-political institutions, one of the core tenets of neo-institutional theory. It

also confirms our previous suggestion that theorization (cognitive legitimacy) co-evolves with objectification (socio-political legitimacy) during the later stages of diffusion. An interesting avenue for future research is to investigate if these two types of legitimacy always evolve as closely as we found in this study. Do they diverge in the presence of high pragmatic legitimacy, or does one of them determine the other at different stages of diffusion?

A third pattern of interest is the correlation between diffusion on the one hand and the evolution of cognitive legitimacy and socio-political legitimacy on the other hand. Both types of legitimacy remained high in Denmark while cognitive legitimacy and socio-political legitimacy declined from a high position to a low position in France during the same period of study (see Figures 6 and 7). Diffusion apparently continued as long as cognitive legitimacy and socio-political legitimacy were high and declined when they decreased. This finding points to cognitive legitimacy and socio-political legitimacy as strong and interrelated predictors of diffusion. We propose that new technologies may continue to diffuse as long as the cognitive legitimacy and socio-political legitimacy are high. Since our findings are based on only two studies, we encourage future research to pursue this line of inquiry. It would be fruitful to compare how different constellations of legitimacy evolve over time and to identify the constellations that increase diffusion, respectively bring it to a halt or reverse it. Such studies would add considerable value to the literature on legitimacy, particularly if they illuminate the black-boxed dynamics that underpin the core institutional claim that legitimacy drives diffusion and produces institutional effects.

---------Insert Figures 6 and 7----------

A final pattern that we find interesting is the importance of sociopolitical legitimacy for diffusion. Sociopolitical legitimacy effectively circumvented the negative effect of low

pragmatic legitimacy in Denmark. In France, the withdrawal of sociopolitical legitimacy while pragmatic legitimacy was still low negatively impacted on cognitive legitimacy. Hence we propose that low pragmatic legitimacy, combined with the withdrawal of sociopolitical legitimacy, can undermine cognitive legitimacy and bring diffusion to a halt. In other words, sociopolitical legitimacy seems to determine diffusion under conditions of low pragmatic legitimacy and high cognitive legitimacy. Future research should investigate if sociopolitical legitimacy predicts diffusion under all circumstances or whether it primarily mitigates the negative effects of low pragmatic legitimacy.

Political Action in Institutional Theory

A final contribution that arises from our study relates to the political arena of institutionalization. A current debate within institutional theory revolves around the question of whether political action represents a fruitful or a futile avenue for understanding the dynamics of institutional change (Lawrence & Suddaby 2006). A growing body of works within neo-institutional theory suggests that individual actors and organizational actors do indeed engage in political action that effectively shapes institutionalization processes (Lawrence and Suddaby 2006; Lounsbury 2001; Holm 1995; Rao 1998). Our study adds to this line of inquiry with a comparison between a failure case and a success case.

We identified three consequences of political action that determine the sociopolitical legitimacy of the new practice, i.e., technological selection, resource allocation and administrative support. We found that centrally positioned actors, notably construction professionals on government committees for public policy on housing, engaged in political activity to further diffuse prefabrication in both countries. However, only the Danish actors succeeded in this political undertaking. Our data are not fine-grained enough to determine the reason. More details on the interaction between construction professionals and state officials

would be required to compare the failure case with the success case, not easy from the distance of five decades. Hence, we propose that future studies on the topic of political action rely on a similar research design but select more recent empirical phenomena for study.

CONCLUSION

Our comparative case study contributes with better insights into how theorization and objectification interact with one another and how they in collaboration determine the point of saturation in a diffusion process. We showed how this interaction manifested in the co-evolution of three types of legitimacy. The legitimacy dynamics that we identified, and which we formulated as propositions, bring more clarity to the point of saturation and to the subsequent stabilization or decline. Not only do they explain the variance between the diffusion patterns in our empirical study, but they also make legitimacy and diffusion amenable to political action. To the extent that our findings can be generalized to other diffusion progressions of new technologies, they show how strategic actors may proceed to prolong the diffusion phase to support institutionalization, respectively shorten it to provoke a point of saturation and abort an institutionalization project. This capacity positions actors as political agents that can sustain or undermine institutionalization by either reinforcing or dismantling a particular type of legitimacy at an opportune moment.

The study has a number of practical implications for market formation of new technologies. The study indicates how markets for new technologies can be created and expanded, including how actors may proceed to avoid a sudden contraction in the market for a new technology. Much more research is required on this topic. Our hope is that this comparative, longitudinal study has succeeded in opening up an exciting new line of inquiry with multiple implications for current theory and practice development.

FIGURE 1
Pioneering modernist/ functionalist architecture

Villa Savoye by Le Corbusier, France, 1929-1930.

Bellavista by Arne Jacobsen, Denmark, 1933-1934

FIGURE 2
Modernist/functionalist architecture in France and Denmark, 1950-1965

La Duchère, collective work, Lyon, France, 1958.

Høje Gladsaxe, by Hoff and Windinge, Denmark, 1964.

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FIGURE 3
The Rise of concrete in Denmark and France, 1920-2001 (Source: CEMBUREAU)

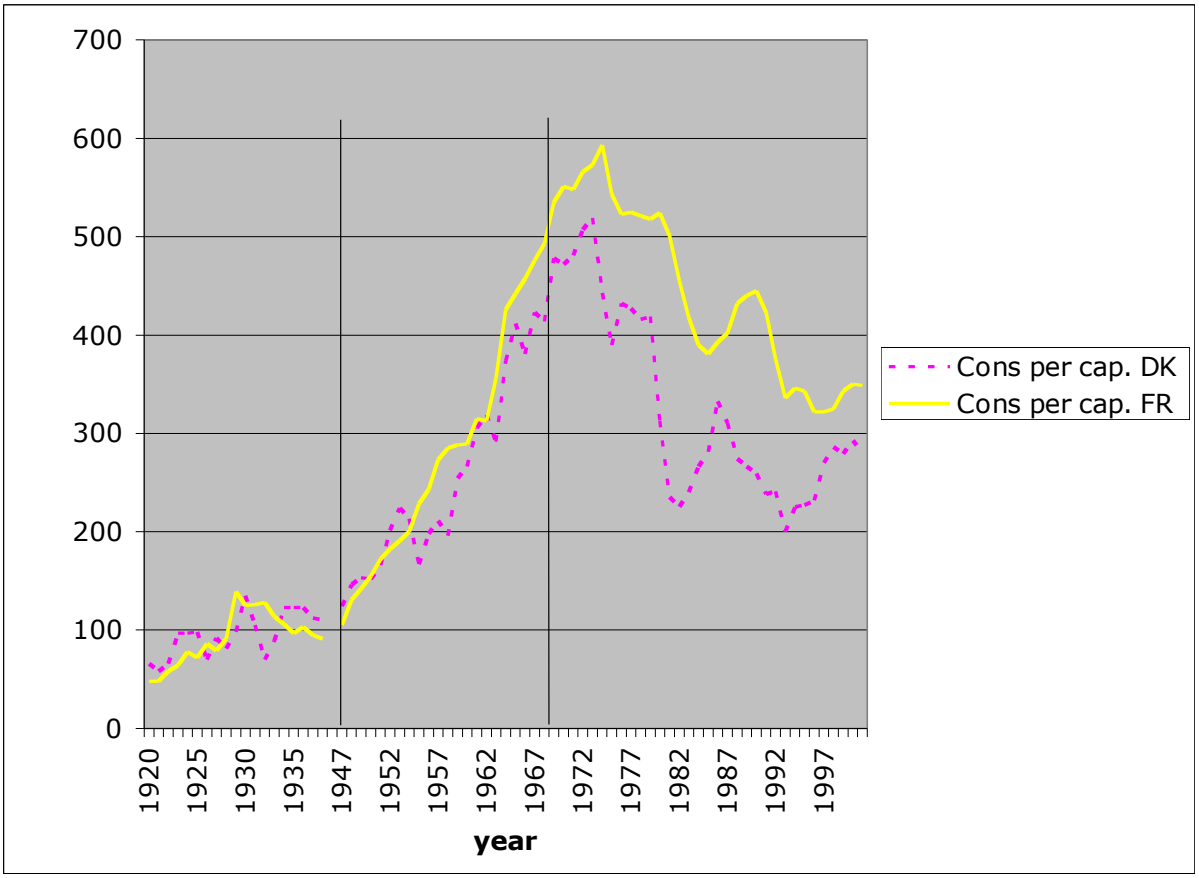


FIGURE 4

Frequency of using pre-fabricated elements relative to other concrete technologies in Denmark and France, 1952-2000 (Source: CEMBUREAU, UNICEM)

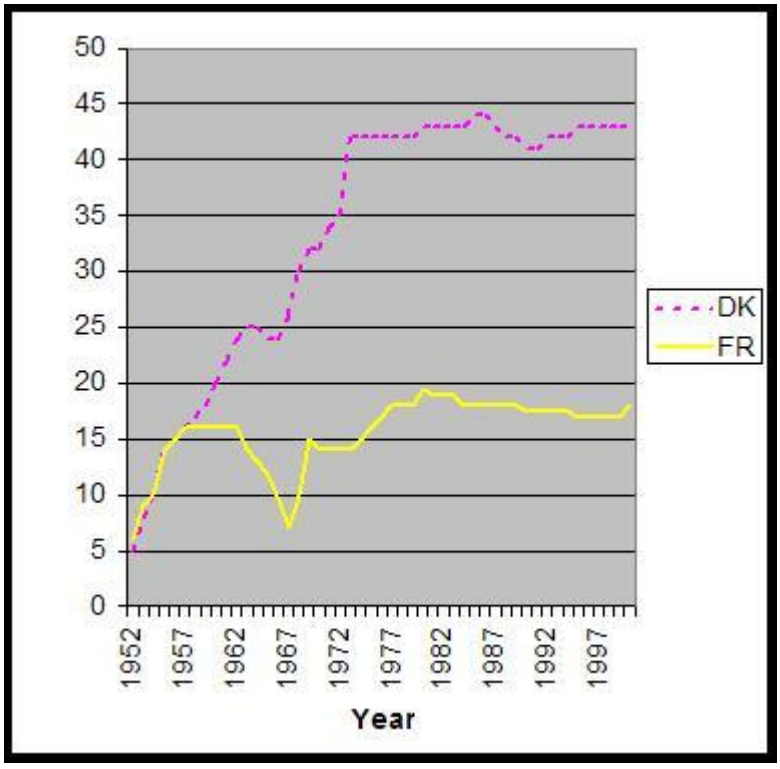


FIGURE 5
A model of institutional determinants to diffusion

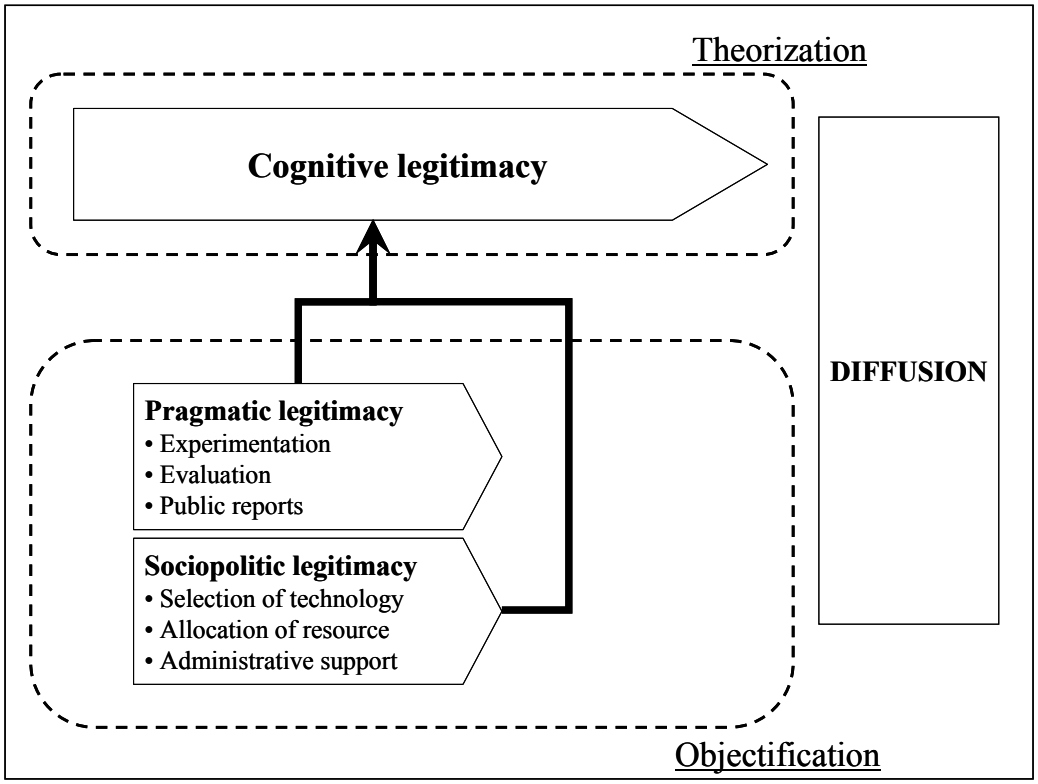


FIGURE 6
Evolution of legitimacy in Denmark

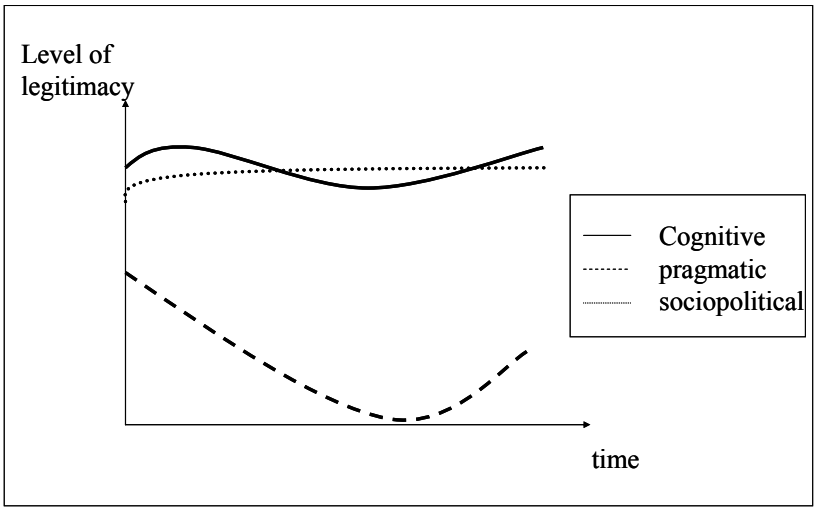


FIGURE 7
Evolution of legitimacy in France

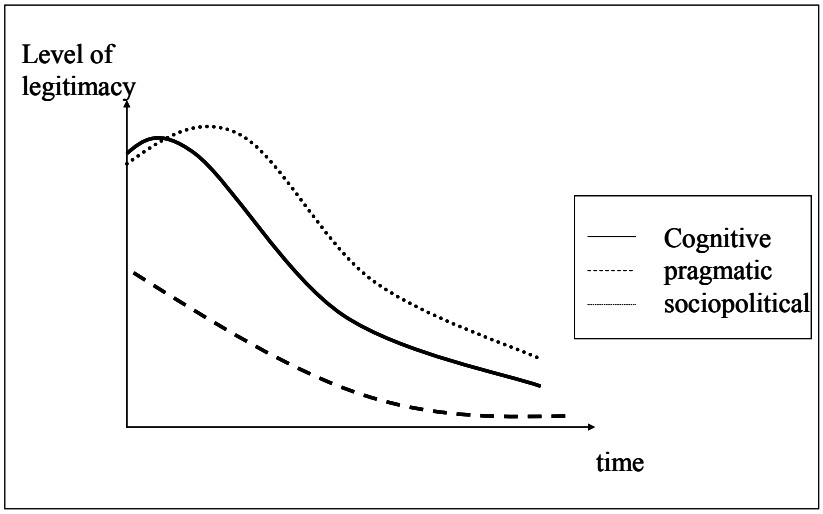


TABLE 1
Technological selection

France	**Denmark**
”Technical continuity is born from a decrease in the variety of works and buildings. This continuity is at the disposal of all those who accept to subject themselves to a certain discipline. However, until now, too many architects, research units and companies have made an honor of inventing a system that is different from that of their neighbor. Technical continuity presupposes a limitation of this system multiplication.” (MRU, governmental research unit, Report, 1958, Annexe: 3).	“It is obviously of little interest to standardize different building parts (…from bricks to kitchen cupboard units) without making sure that all these elements fit together in the final building. It has therefore been suggested to adopt a common measure, a module, that is set to be large enough to reduce the potential standard measures to a reasonable number, and yet so small that the design can be flexible. Most European countries and the US have adopted a 10 cm or 4” module: it is therefore natural that we also in this country choose a basic module of 1 dm [10 cm]…” (The Committee for Rationalization of Building Activities, 1956: 1)
“[France] is primarily to be distinguished by a wide diversity of more or less first hands methods. It is of some interest to know that the *Centre scientifique et technique du bâtiment* [The Scientific and Technical Centre for Buildings], a body which considers approval of methods recognized as valid has to date approved nearly 650.” (Bonnome, State officer, 1955: 4)	“If each construction project has the required size and a homogeneous design, then prefabrication becomes economic…/ This lead directly to considerations about the use of a *module* and other forms of standardization in the construction of homes, which may lead to a replacement of many different elements of different sizes with fewer types of elements that can be applied in many different contexts. The standard measure for ceiling height was a first step in this direction, the module policy is the next.” (Simonsen & Munch-Petersen, engineers working in State committees, 1957: 8)
“A real industrial unit whose primary preoccupation will be to pursue continuous output constitutes the central concern for modern industry. I am well aware that the application of the term series to construction is frightening… Golden eras have always obeyed relatively severe discipline. In construction, we can divide by 100 or even by 1000 the number of models without even noticing it. (Balency Bearn, engineer, 1957: 121)	“Based on the previously adopted standard sheet, *‘Heights of floors in buildings’,* efforts are made to establish standard sizes for window heights, window openings and door openings. This work, which seeks to determine some preferred standard measures, will be integrated into a vertical module system and consider market standards for windows and doors. The selection of window heights will consider the question of standardized dimensions for radiators.“ (Ministry of Housing, 1957: 53)
“Prefabrication in a factory requires prior study of the function of the chosen prefabrication system. The architect cannot develop the project unless he is familiar with the chosen system. The current panoply of methods does not bring about this conjunction.” (Barets, engineer, 1957: 85)	“The *result* [of a module policy] must be cheaper dwellings, resulting from the benefits of mass production. The quality of the executed work will also improve when all building parts can be produced in a factory or in good conditions back at the workshop.” (The Committee for Rationalization of the Building Activities, 1956: 8)

TABLE 2
Resource allocation

France	Denmark
"We were wrong to make an analogy between cars and prefabricated dwellings. For dwellings, there is no open market for series. Repetition can only happen in few cases. Not until we create an artificial market will we create the opportunities for mass production that will foster good conditions for prefabrication. It requires that the market is less episodic." (Simon, engineer, 1962: 87)	"[F]inancial conditions must be made conducive to carry out fundamental planning and projection activities. It is not feasible to accumulate new experience without first investing both capital and extraordinary projection effort to this accumulation. Not that it should result in uniformity, but that the possibilities for long-term planning should be created. If the financing should still rely on laws of construction support, then these laws must be valid beyond the four years that are currently stipulated by law." (Simonsen & Munch-Petersen, 1957: 8)
"Finally, and most importantly, mass production and continuous production are difficult to develop, not least when it comes to collective housing. Developers are rarely able to guarantee continuity by means of market repetition. The individualism of contractors continues to pose an important obstacle." (Simon, engineer, 1962: 15)	"In considering how to specify the parameters for state-supported and non-supported prefabrication projects and other forms of rational construction with low labor consumption, the question arises as to which requirements should be fulfilled as a condition for placing the individual project within the parameters. The argument for assigning priority would be most solid if demands were made to provide documentation for the fact that the labor consumption for each apartment will not exceed a particular number of labor hours. (Ministry of Housing, 1964: 15)
"One definite obstacle to commercial continuity is the taste for diversity that developers and their architects express, disregarding the opinion of final users ... who are much less concerned with originality than with the core qualities and the price of dwellings." (Governmental Report, 1958, Annexe: 4)	"In certain periods, non-traditional construction has been privileged. This has been the case in periods with high employment where there has been a labor shortage, particularly skilled masons. In order to increase construction capacity under this condition, state loans have been made available for construction projects that used skilled masons to only a modest degree, a privileged position relative to ordinary brick construction. To give this privilege, it has been a condition that the use of skilled masons represented no more than 15 percent of what is common in brick construction." (Ministry of Housing, 1957: 32)
"It is necessary to create a market for the industrial production of dwellings. All new industries require investment to open a market, and this can only happen if a dedicated financing plan is made. The state should create the market for labor intensive processes." (Governmental report, 1958: 8)	

TABLE 3
Administrative support

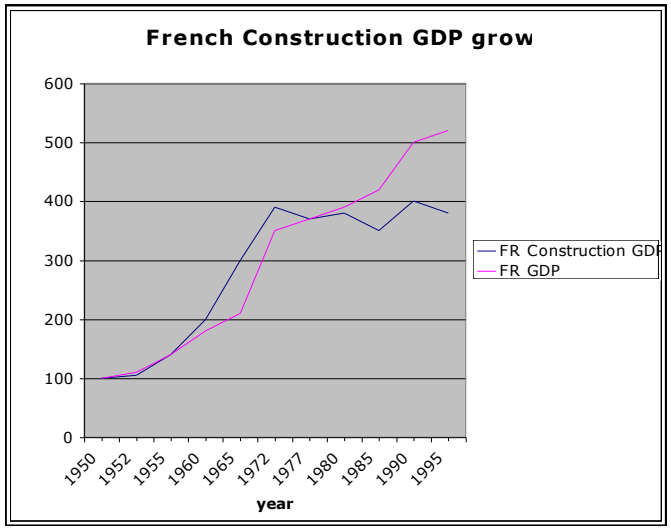
France	Denmark
"The display of relatively brutal administrative decisions may affect cost variation…/ We have to underline that continuity, through administrative and financial means, can only be attained if it is possible to commit for several years, which is only feasible if the context is stable."(Governmental report, 1958, Annexe: 2)	"The administrative practice adopted by the Ministry manifested itself in the law of construction support from 1955 in which it is underlined that efforts shall be made to extend the production of dwellings and to minimize related expenses. In correspondence, the very parameters of financing that are conveyed by the law have been changed in the 1955 revision so that they encourage contractors to carry out rational and inexpensive construction." (Ministry of Housing, 1957: 30).
"If we want to improve our technical effort and thereby reduce costs, then we have to create the necessary conditions for expanding this effort: To guarantee continuity in technical regulation, and to guarantee the continuity of markets by a policy of substantial and regular orders." (Wagner, State Officer, 1965: 14)	"If the production of dwellings is to keep up with industrial development, then it is hardly possible to avoid the use of industrial production methods. This orientation requires that contractors and government consciously alter their path in the direction of more collaboration and long term planning. Research must be supported and the financial conditions must be made conducive to carry out fundamental planning and projection activities." (Simonsen & Munch-Petersen, 1957: 7-8)
"Market continuity is only possible when we have continuity in financing". Public administration has to invest State funds in the creation of a plan that is coherent over time and space." (Governmental report, 1958: 2)	"As a continuation of the planning efforts that are required for each construction project, significant weight must be assigned to making an actual long-term plan for construction. One of the prerequisites will be to provide adequate financial support for this long-term planning of construction." (Ministry of Housing, 1957: 7-9).
"Are 40 000 distinct operations necessary for the French individualism to express itself freely? The effort to decrease variety is only possible with a stable regulation. It could come from developers and architects. It is clear that the State has to intervene to set aside a part of its financing to repeated operations." (MRU report, 1958: 3)	"Based on the perceived necessity of permanently increasing the capacity of the production facilities in the construction sector, the financial committee of the government adopted a particular program in March 1960 that contained at least 7500 apartments, to be built over a period of four financial years from 1960 to 1965. It was a very significant step that was taken here in that it was explicitly stipulated in the decree, which was issued simultaneously, that these buildings would be built no matter how the economic and labor situation would evolve." (Kjeldsen 1961: 6).

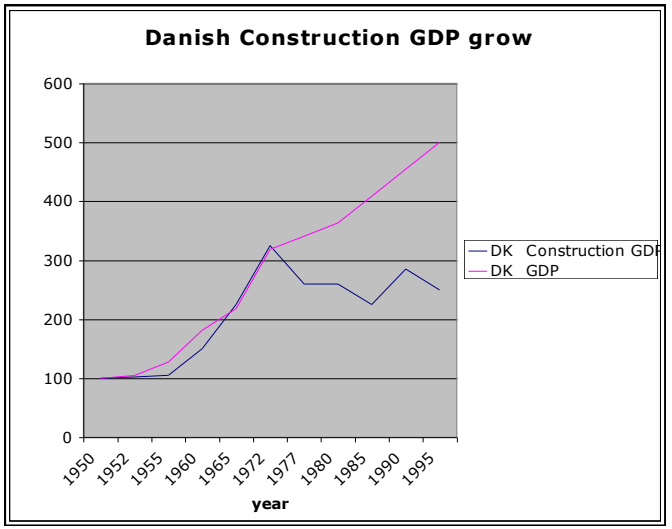
APPENDIX A
Test of functionalist variables

Local conditions as explanatory variables	Counter proposals
Weather	- The comparison of meteorological data over a 50-year period in Paris and Copenhagen don't show any significant difference in the quantity of rainfall. There is still a difference in average temperatures. - Some countries in northern Europe haven't diffused prefabrication as much as Denmark. Precast concrete accounts for only 27% of total concrete used in Sweden (Source: CEMBUREAU, 2007) and the UK has roughly the same figure as France (btw 15% and 20%). - There is no evidence of regional differences in the use of prefabrication in France despite sharp weather differences. - Weather is unapparent in the discourse of professions in the studied period
Urban Density	- Urban density is indeed higher in Denmark (Source: OECD, 2005). Nevertheless France has much bigger cities than Denmark. Paris with 10 millions of inhabitants should have been at the center of prefabrication diffusion. - Concerning transportation costs, many studies indicate that 30 km is a good approximation of the maximum distance for transportation of heavy materials. With such a small distance, difference in the size of the country has no influence on the phenomena. Besides, in France, the dominant alternative material to precast concrete is ready-mix concrete, that is also transported to the building site.
Lack of workforce	- Many primary documents report that in both countries, labor supply was a qualitative and quantitative problem all over the period. - Qualified masons were missing to supply the huge demand for dwellings - France and Denmark have a large rural exodus in the following years after WWII bringing non qualified people in the construction industry (source: Danish and French statistics) - Immigration to France was eased from 1945 but remained low until the end of the 50's. Then it speeded up due to concomitants events, not least the Rome Treaty and decolonization (agreement with Spain in 61, with Portugal in 63, end of the Algerian war in 1962…). But two evidences contradict the immigration argument. M. Campinos-Dubernet, one eminent French expert on post war construction workforce demonstrates that the massive hiring of immigrants in this industry on began around 1962 that is to say after prefabrication had declined. (Campinos-Dubernet, 1984: 208). She also relates that immigrants had no special competences in alternative technologies to prefabrication.
Difference in demand	- Both countries had to meet a very high demand btw. 1945 and 1968 due to reconstruction after WWII, rural exodus, and the baby boom. France has moreover to face the very bad shape of its real estate due to a former law that froze

rental increases between the two wars and thus discourage private investments in rehabilitation. From 1960, France has also to cope with a high immigration rate.

- The following graphs show very similar pattern in the evolution of construction GDP in both countries:





- Concerning the construction of new collective dwelling in particular, both countries raised dramatically their production in the 50's and 60's and reached a peak around 1972.

APPENDIX B
Theorization – Costs

1946-1951

FRANCE

"Work in a factory or a workshop is more economic than work on a construction site. The output is superior, it is possible to make products of higher quality and homogeneity with an unskilled workforce". (Anonymous entrepreneur, 1946: 32)

"The architect should organize the fabrication of construction elements so that also here, by means of rational prefabrication, he saves on labor costs and obtain a better output from workers who benefit from more comfortable working conditions, increased well-being, and healthiness that is far superior to the common standards on a construction site." (Hummel, Governmental architect, 1946: 31)

DENMARK

"As a second way to bring down construction costs, the Minister of Housing brought forward rationalization and industrialization of construction. It is my personal opinion, said the Minister, that rationalization and industrialization will lead to a revolution in construction. The new methods will eventually come to make construction cheaper." (Minister of Housing cited in Andreasen, architect, 1951: 210).

"The advisor asked for standard types so that projection costs could be reduced somewhat" (Olaf Sahl, architect, 1951: 207)

1958-1965

FRANCE

"At the current time, these two criteria: revenue and labor cost do not allow for a distinction between the evolved traditional techniques and the new techniques of prefabrication in a factory or on the construction site. In fact, the biggest progress in productivity that the industry has attained so far is essentially a result of studies on operations and organization of the construction site." (MRU (governmental research unit) Report, 1958: 8).

"Prefabrication, in the first construction projects, has not been able to deliver equal quality at a lower price than traditional techniques. Accordingly, the industrial cannot offer an attractive price estimate in response to the hesitation, almost hostility, of architects, traditional entrepreneurs, and even clients. The arbitrariness that characterizes the calculation of this price factor is so that, in our opinion, it is absolutely dangerous, even hazardous and vain, to compare prefabricated systems with the improved traditional" (Simon, engineer, 1962: 88).

DENMARK

"The comparison that SBI [the research unit of the Ministry of Housing] has conducted between brick and non-brick construction did not give any result in terms of one category being clearly superior to the other. That was not expected either – had this been the conclusion then many of the endless debates in recent years would have come to an end as solid proof would be presented by either of the two parties. (Nielsen, architect, 1962: 28)

"By increasing the rational construction and minimizing labor, it will undoubtedly become possible to lower the cost of constructing new dwellings. The available experiences, e.g., the most recently initiated project with prefabricated construction, confirm this perception. One should not, however, exaggerate the expectations to the results that prefabrication can attain in the short term. Expenses related to the construction process are only a part of the overall costs of acquiring a new building." (Ministry of Housing, 1964: 6).

"The construction [of *Bellahøj*, 1953-1956] was an experiment. There was, however, at no point in time, anything light-hearted or uncontrolled about this experiment, and the high price – which in this case simply refers to higher than usual, not unreasonable or shockingly high – came about primarily because of the particular character and form of the buildings." (Kjeldsen, 1961: 7)

APPENDIX C
Theorization – Aesthetics

1946-1951

FRANCE

"An architecture based on the use of standardized elements can reach the purity of antiquity" (...) "Here arises the possibility to coordinate architectural composition, industrial prefabrication and assembly on the construction site without financial pursuits becoming an obstacle to harmonious production." (Abraham, architect, 1946: 2; 14)

"There is no prefabrication without order, and order is a primary condition for architecture." (Perret, architect, 1946: 1)

"[The Strasbourg context] wanted to demonstrate that the importance of the construction site and the industrialization favor cost reduction without negative impact on quality and beauty." (Petit, Head of Minister of Housing, 1951: 4)

DENMARK

"The new construction methods will eventually make construction cheaper, particularly if we could come to prefer more simple building designs." (Minister of Housing, cited in Andreasen, architect, 1951: 210)

"In the subsequent discussion there was general consensus among the participants, after Vilh. Lauritzen had explained that the English 'standard schools' looked fine and that rationalization did not hinder good architecture." (Sahl, architect, 1951: 207)

1958-1965

FRANCE

"We cannot expect French customers to prefer high uniformity, which is contrary to its constitution. " (Bonnome, State Officer, 1959: 1498)

"The architect is compelled to feel and express a kind of reserve toward prefabrication" (Simon, engineer, 1962: 81)

"[I]t is not only necessary that the architect becomes accustomed to the constraint [of prefabrication], but he must also consider it as essential, or he will disappear. Are the imperatives of prefabrication preventing Art from expressing itself in the construction? We do not believe so." (Simon, engineer, 1962: 82)

"It is important to recognize that an industrial object generally, when it is first created, does not have a particular harmonious shape… In the case of the prefabricated house, more flexibility is generally accepted when architects are involved at the very beginning of the projection phase. However, the conception is often born from the brain of an engineer who thinks first and foremost about technique and is relatively indifferent toward this dimension." (Simon, engineer, 1962: 13)

DENMARK

"These projects may have contributed to an immediate expansion of housing availability, but they also substantially increased the opposition to this particular type of housing – on aesthetic as well as technical grounds – an opposition with which the technicians and constructors who saw the potential for a permanent improvement in construction capacity have had to deal for many years." (Kjeldsen 1961: 8)

"Often laymen are convinced that everything that is made of concrete is ugly – as opposed to tile, which always is beautiful – a conviction that is strongly supported by large segments of the press. It is unnecessary to say that it is not so simple, but it remains a fact that people in general are less tolerant of an unfortunate concrete facade than of a boring brick wall." (Kjeldsen, 1961: 11)

APPENDIX D
Theorization - Pace

1946-1951

FRANCE

"The prefabricated house is one that is made exclusively from elements that a) are entirely made in a factory by means of the most advanced technology, b) are selected based on the most precise and meticulous studies, c) require for their on-site assembly only the simplest of procedures that take an absolute minimum of time." (Lods, architect, 1946: 70)

"It is evident that more and more architects need to work in four dimensions. The factor of 'time' impacts importantly on the costs of operations. We have seen that prefabrication of blocks is a way to reduce time spent on the construction site and also a way to reduce time spent on reparations and maintenances relative to standard procedures." (Abraham, architect, 1946: 113)

"Nothing can apparently be reproached the methods that permit the construction of buildings within time delays that are much shorter than those to which we have become accustomed". (Abraham, architect, 1946: 2)

DENMARK

""When it takes about twice the time to complete a construction as it did in 1939, it is beyond doubt that it has made construction more expensive, and if we can once again return to the normal pace, then we can build more dwellings for the same amount of money." (Minister of Housing, cited in Andreasen, architect, 1951: 210)

"Under these conditions [shortage of materials, skilled labor, and availability of loans, as well as rising construction costs] and the current housing shortage, the question has been raised about a rationalization of the construction industry. If it is possible, through new construction methods or reorganization of the construction process, to save on labor and materials or to shorten construction time, then a major contribution will have been made to upgrade the status of construction." (Danish Ass. of Engineers, 1951: 7)

1958-1965

FRANCE

"In the days following Liberation, it was obvious that prefabrication was the only solution that could alleviate the social problem of the housing crisis. At this time, that was considered essential." (Simon, engineer, 1962: 14)

DENMARK

"In an attempt to find a fast and efficient solution to the housing shortage, which seemed to be getting worse, a law was passed in March 1947 on the financing of construction projects using unusual construction methods. Through this law, the State provided large, inexpensive loans according to parameters that resembled those of the ordinary housing sector. The State thereby took on a significant part of the financial risk associated with constructions that used new and partially untested materials or construction forms. It was expected that the law would lead to saving on labor force and materials of which there were particular shortage, e.g., brick and wood, or which could shorten the time that it took to complete a building. Particular reference was made here to element houses, made of concrete or similar." (Ministry of Housing, 1957, p. 15)

"The fastest and simplest solution to the decree requirement was to replace bricks with concrete. [The decree stipulated that state loan could be issued only to projects that used a maximum of 15 percent of masons relative to traditional construction]. Thereby did concrete and untraditional construction become synonymous terms and in opposition hereto: tile and traditional construction." (Kjeldsen, 1961: 7)

"A division of constructions according to the number of floors and according to capital vs. province does not either show any significant difference between the two categories of construction [brick and prefabrication] in the amount of time it took to construct the buildings, and much variance occurred even within each subdivision. The data material shows – quite naturally – a tendency toward somewhat longer production time for high-rises than for the lower buildings."(Nielsen, architect, 1962: 27)

APPENDIX E
List of coded primary sources

List of coded primary data – France (by year of publication):

- ***Moniteur des Travaux Publics (Le)***.1946. L'industrialisation du bâtiment et de la reconstruction », numéro spécial, Paris, Novembre.
- Abraham P. 1946. ***Architecture préfabriquée***. Paris: Dunod.
- ***Architecture Française (L')***. 1951. Concours du M.R.U. Groupe de 800 logements - Strasbourg, 117-118: 1-82.
- Bonnome C. 1955. ***La préfabrication dans l'industrie de la construction***. Conférence faite par M. Bonnome devant la Section Danoise de la Société des Ingénieurs Civils de France. April.
- ***Techniques & Architecture***. 1957. Industrialisation du bâtiment. November-December. 17(5).
- Nouaille, R. 1957. ***La préfabrication***, Paris: Eyrolles
- ***Direction de la Construction***. 1958. Rapport du comité de productivité du bâtiment du Commissariat général à la productivité.
- Bonnome, C., Léonard, L. 1959. L'industrialisation du bâtiment (tome III), ***Encyclopédie pratique de la construction et du bâtiment***. Paris: Aristide Quillet.
- Simon, E. H. L. 1962. L'industrialisation de la construction, ***Moniteur des Travaux Publics (Le)***, Paris, 1962.
- Wagner, R. 1965. ***Le prix de la construction***. Congrès de Paris, October 20th.

List of coded primary sources – Denmark (by year of publication):

- Akademisk Arkitektforeningen (AA). 1951. ***Arkitekten*** (årsskrift). Copenhagen. Arkitektens Forlag.
- Boligministeriet. 1964. ***Betænkning vedrørende den mulige forøgelse af boligbyggeriet.*** Copenhagen: J. H. Schultz A/S. Universitets-bogtrykkeri.
- Boligministeriets produktivitetsfondsudvalg. 1957. ***Beretning om udvalgets virksomhed i tiden april 1953 – april 1957.*** Copenhagen: Statens trykningskontor.
- Dansk Ingeniørforening (byggerationaliseringsudvalget).1956. ***Modulordningen***. Copenhagen: Teknisk Forlag
- Kjeldsen, M. (red.) 1961. ***Halvtredsernes byggeri***. Copenhagen, Teknisk Forlag.
- Nielsen, F. 1962. En sammenligning mellem muret og ikke-muret byggeri in ***Tidsskriftet Tegl*** (3): 22-29. Copenhagen: Forlaget Tegl.
- Simonsen, W. R. and J. F. Munch-Petersen. 1957. ***Montagebyggeriet i dag.*** Copenhagen, Teknisk Forlag.

REFERENCES

Aldrich, H. E, & Fiol, C M. 1994. Fools rush in? The institutional context of industry creation. ***Academy of Management. The Academy of Management Review***. 9 (4) : 645-670.

Arbejdsmarkedskommissionen [committee within Danish Ministry of Work and Housing] 1952. *Bevægeligheden på arbejdsmarkedet.* Copenhagen: S. L. Møllers Bogtrykkeri.

Berger, P. L., & Luckmann, T. 1967. ***The social construction of reality.*** New York: Anchor Books.

Boland, R. J., Lyytinen, K, & Yoo, Y. 2007. Wakes of innovation is project networks : the case of digital 3-D representations in architecture, engineering and construction. ***Organization Science***, 18(4), p. 631-647.

Borum, F. 2004. Means-end frames and the politics and myths of organizational fields. ***Organization Studies,*** 25: 897–921.

Callon, M., & Caliskan, K. 2006. ***New directions in the social studies of markets: Towards and anthropology of economization***. Unpublished manuscript.

Campagnac E. 1987. ***Culture d'entreprise et méthodes d'organisation : l'histoire de Bouygues***, Noisy-le-Grand (Paris) : LATTS (presses de l'ENPC).

Campinos-Dubernet, M. 1984. ***Emploi et gestion de la main d'œuvre dans le BTP, Mutations de l'après-guerre à la crise***. Paris: centre d'études et de recherches sur les qualifications, dossier 34.

Christensen, C.M. 1997. ***The innovator's dilemma: When new technologies cause great firms to fail.*** Cambridge, MA: Harvard Business School Press.

Croizé J.C. 2005. ***Quand la France s'est tournée vers la préfabrication lourde en béton:le programme des "4000 logements de la Région parisienne***", Working Paper.

Czarniawska, B., & Joerges, B. 1996. The travel of ideas. In B. Czarniawska-Joerges & G. Sevon (Eds.), ***Translating organizational change:*** 13–48. Berlin: de Gruyter.

DiMaggio, P. 1988. Interest and agency in institutional theory. In L. G. Zucker (Ed.), ***Institutional patterns and organizations: Culture and environment:*** 3–21. Cambridge, MA: Ballinger.

DiMaggio, P. J., & Powell, W. W. 1983. The iron cage revisited: Institutional isomorphism and collective rationality in institutional fields. ***American Sociological Review***, 48: 147-160.

Djelic, M.-L. 1998. ***Exporting the American model: The postwar transformation of European business.*** Oxford University Press. 328 p.

Dobbin, F. 2004. ***The New Economic Sociology: A Reader.*** Princeton, NJ: Princeton University Press.

Dobbin, F., Sutton, J. R., Meyer, J. W., & Scott, W. R. 1993. Equal opportunity law and the construction of internal labor markets. ***The American Journal of Sociology***, 99(2): 396-427.

Dobbin, F. 1994. ***Forging industrial policy.*** Cambridge, U.K.: Cambridge University Press.

Eisenhart, K. 1989. Building theories from case studies. ***Academy of Management Review,*** 14: 532-550.

Fligstein, N. 2001. ***The architecture of markets: An economic sociology of twenty-first century capitalist societies.*** Princeton : Princeton University Press.

Fligstein, N. 1991. The structural transformation of American industry: An institutonal account of the causes of diversification in the largest firms, 1919-1979. In W.W. Powell & P. J. DiMaggio (Eds.): ***The new institutionalism in organizational analysis:*** 311-336. Chicago: University of Chicago Press.

Garud, R.; Rappa, M. A. 1994. A socio-cognitive model of technology evolution: The case of Cochlear implants. ***Organization Science***, 5 (3): 344-362

Glaser, B., & Strauss, A. 1967. ***The Discovery of Grounded Theory***. Chicago: Aldine.

Gomez P.-Y. Jones B. 2000. Conventions: an Interpretation of deep Structure in Organizations", ***Organization Science***, 11(6): 696-708

Greenwood, R., Suddaby, R., & Hinings, C. R. 2002. Theorizing change: The role of professional associations in the transformation of institutionalized fields.***Academy of Management Journal,*** 45: 58–80.

Hall, P. A., & Soskice, D. 2001. Varieties of capitalism: The institutional foundations of comparative advantage. Oxford: Oxford University Press.

Hargadon, A. B., & Douglas, Y. 2001. When innovations meet institutions: Edison and the design of the electric light. *Administrative Science Quarterly* 46: 476-501.

Hasselbladh, H., & Kallinikos, J. 2000. The project of rationalization: A critique and reappraisal of neoinstitutionalism in organization studies. ***Organization Studies,*** 21: 697–720.

Haveman, H. A., & Rao, H. 1997. Structuring a theory of moral sentiments: Institutional and organizational coevaluation in the early thrift industry. ***American Journal of Sociology,*** 102: 1606–1651.

Holm, P. 1995. The dynamics of institutionalization: Transformation processes in Norwegian fisheries. ***Administrative Science Quarterly,*** 40: 398–422.

Le Corbusier. 1977 (1923).***Vers une architecture***. Paris: Arthaud.

Leblebici, H., & G. H. Salancik, A. Copay, T. King. 1991. Institutional change and the transformation of interorganizational fields: An organizational history of the U.S. radio broadcasting industry. ***Administrative Science Quarterly***, 36: 333-363.

Lawrence, T. B., R. Suddaby. 2006. Institutions and institutional work. In S.R. Clegg, C. Hardy, T. B. Lawrence & W. R. Nord (Eds.), ***Handbook of Organization Studies*** [2.Ed]., 215-254. Thousand Oaks, CA: Sage.

Lawrence, T. B., Winn, M. & Jennings, P. D. 2001. The temporal dynamics of institutionalization. ***Academy of Management Review***, 26: 624-644

Lounsbury, M., & Pollack, S. 2001. Institutionalizing civic engagement: Shifting logics and the cultural repackaging of service-learning in US higher education. ***Organization,*** 8(2): 319–339.

Lounsbury, M. 2001. Institutional sources of practice variation: Staffing college and university recycling programs. ***Administrative Science Quarterly,*** 46(1): 29-56.

Lounsbury, M., Ventresca, M. J. & Hirsch, P. M. 2003. Social movements, field frames and industry emergence: a cultural-political perspective on US recycling. ***Socio-Economic Review***, 1: 71-104.

Mill, J. S. [1881] 1950. Of the four methods of experimental inquiry. In ***Philosophy of Scientific Method***. New York: Hafner. 211-233.

Munir K. A., & Phillips, N. 2005. The birth of the 'Kodak Moment': Institutional entrepreneurship and the adoption of new technologies. ***Organization Studies,*** 26(11); 1665-1687.

Ragin, C. C. 1987. ***The comparative method: moving beyond qualitative and quantitative strategies***, Berkeley: University of California Press

Rao H. 1994. The social construction of reputation: Certification contests, legitimation, and the survival of organizations in the American automobile industry 1895-1912. ***Strategic Management Journal***, 15, Special Issue: Competitive Organizational Behavior: 29-44.

Rao, H. 1998. Caveat emptor: The construction of nonprofit consumer watchdog organizations. ***American Journal of Sociology,*** 103: 912–961.

Rogers, E. M. 1983 [1962]. ***Diffusion of innovation***. New York: Free Press.

Scott, W. R. 1987. The adolescence of institutional theory. ***Administrative Science Quarterly,*** 32: 493-511.

Strang D., & Meyer, J. W. 1993. Institutional conditions for diffusion. ***Theory and Society***. 22: 487-511.

Scott, W. R. 1995. ***Institutions and organizations.*** Thousand Oaks, CA: Sage.

Suchman, M. C. 1995. Managing legitimacy: strategic and institutional approaches. ***Academy of Management Review***, 20(3): 571-610.

Suddaby, R., & Greenwood, R. 2005. Rhetorical strategies of legitimacy. ***Administrative Science Quarterly***, 50: 35–67

Thornton, P. H., & Ocasio, W. 1999. Institutional logics and the historical contingency of power in organizations: Executive succession in the higher education publishing industry, 1958-1990. ***American Journal of Sociology***. 105:801-843

Tolbert, P.S. & Zucker, L. G. 1983. Institutional sources of change in the formal structure of organizations: The diffusion of civil service reform, 1880-1935. ***Administrative Science Quarterly***, 28: 22-39.

Treuttel, J. J. 1993. ***L'immeuble collectif à ossature béton : l'apogée et la chute***. Paris : Ecole d'architecture de Nantes. Bureau de la recherche architecturale.

Vayssières, B.H.1988. Reconstruction - déconstruction : le Hard French ou l'architecture française des Trente Glorieuses, Paris: Picard.

Yin, R.K. 2002. ***Case Study Research – Design and Methods*** [3rd Ed.]. Newbury Park: Sage.

Zilber, T. 2006. The work of the symbolic in institutional processes: Translations of rational myths in Israeli high tech. ***Academy of Management Journal,*** 49(2): 281-303.

Zucker, L. G. 1986. The production of trust: Institutional sources of economic structure 1840-1920. In B. Staw and L. L. Cummings (Eds.), ***Research in Organizational Behavior***, 8: 53-111. Greenwich, CT: JAI Press.