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Published in:
Proceedings of the 39th Annual ARCOM Conference

Publication date:
2023

Document Version
Accepted author manuscript, peer reviewed version

PERCEPTIONS AND UNDERSTANDINGS OF CONSTRUCTION SITE PRODUCTIVITY: INSIGHTS FROM THE DANISH CONSTRUCTION INDUSTRY

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Productivity has been a recurrent topic in construction management research for decades. While an impressive number of inquiries have explored construction sector productivity from an ex-post perspective by measuring inputs and outputs of resources in construction activities, less attention has been invested in understanding construction site perceptions of productivity and understandings of how to improve productivity. The aim of the study is to contribute to existing literature in two ways. First by providing insights into the different perceptions of productivity among craftsmen and construction managers. Second by demonstrating how ambiguous understandings of productivity adversely affect the planning and execution of construction activities and thus complicates productivity improvements. The empirical material conducted through semi-structured interviews is analysed through a theoretical framework based on extrinsic and intrinsic motivation. The findings show that the construction managers embrace the idea of monetary rewards as an approach to address productivity issues. Analogously, the craftsmen request and highlight better communication between construction managers and craftsmen as well as increased influence on the planning and execution of construction activities as ways to improve productivity.

Keywords: category; motivation; productivity; qualitative research

INTRODUCTION

Construction productivity has been a recurrent topic in construction management for decades (Hasan *et al.,* 2018; McKinsey Global Institute, 2017). A simple definition of the term is that productivity refers to the amount of output per input of a unit of labour (World Bank, 2021). In context of construction, productivity is often measured in the form of hours required to perform certain activities (Hasan *et al.,* 2018).

According to Kenley (2014), researchers have mainly examined construction productivity either at the level of the industry, firm, project, or activity. Based on this division, Kenley (2014) criticises previous studies for not adopting a systemic perspective on productivity, which is considered a prerequisite for understanding how to improve productivity in the construction industry. In a similar vein, Haugbølle and

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Bronke J and Frederiksen, N (2023) Perceptions and Understandings of Construction Site Productivity: Insights from the Danish Construction Industry *In:* Tutesigensi, A and Neilson, C J (Eds) *Proceedings of the 39th Annual ARCOM Conference,* 4-6 September 2023, University of Leeds, Leeds, UK, Association of Researchers in Construction Management, 539-548.

colleagues (2019) argue that construction productivity can be roughly divided into two streams of analysis. One stream has touched upon productivity at the macro-level, i.e., input-output studies of national accounts (e.g., Chia *et al.,* 2014; Neve *et al.,* 2020).

The other stream has been concerned with productivity at the micro-level, i.e., studies of how technologies, practices and processes in construction activities affect construction site productivity (e.g., Heigermoser *et al.,* 2019; Olivieri *et al.,* 2018). Based on the two streams of analysis, Haugbølle and colleagues (2019) express the need to bridge macro and micro studies of productivity to improve the measurement of construction output - thus echoing the argument of Kenley (2014) that studies on construction productivity should adopt a more systemic approach taking different levels of analysis into account.

The study takes its starting point from the assumption that productivity can be considered an established yet contested category in the construction industry. As an established category, productivity is a persistent and widespread concept in the industry on which groups of actors share meaningful consensus (Negro *et al.,* 2011). However, as a contested category, productivity captures multiple levels of scope and spans multiple groups of actors (as demonstrated by e.g., Haugbølle *et al.,* 2019; Kenley, 2014) who draw different beliefs, expectations, and behavioural patterns from the category (Durand and Paolella, 2013). This means that the category of productivity possesses heterogeneity and ambiguity, which is potentially difficult to reconcile and thus provides a fertile ground for category contestation to occur (Colyvas and Powell, 2006).

Drawing on literature from category research and self-determination theory, the aim of the study is to explore how productivity, as a distinct category, permeates the project level and consequently 'disciplines' (Kennedy and Fiss, 2013) groups of actors by providing category content (i.e., beliefs, expectations, and behavioural patterns in relation to productivity). In addition, we have a special interest in two groups of actors - 'project management' and 'craftsmen' - both of which can be considered members of the productivity category (Negro *et al.,* 2011) and associated with the project level. In this way, the study adopts a constructivist approach to productivity and contributes to construction management research with new understandings of productivity as a situationally contested, negotiated, and defined category (Colyvas and Powell, 2006; Kennedy and Fiss, 2013) rather than a static, 'ready-made' category (e.g., Heigermoser *et al.,* 2019; Neve *et al.,* 2020).

Theory

This section outlines the theoretical basis of the study. The section starts by elaborating on the core assumptions from category research and the relevance for the study at hand. A branch of self-determination theory is then introduced as a complementary framework to gain a deeper understanding of the underlying implications of category membership in relation to motivational orientations among groups of actors.

Productivity as a Category

In the words of Durand and Paolella (2013, p. 1100), categories represent "a meaningful consensus about some entities' features as shared by actors grouped together as an audience". In this way, categories can be seen as 'social agreements' about which beliefs, expectations and behavioural patterns that are consistent with its

label, i.e., "the category's descriptive tag" (Negro *et al.,* 2011, p. 1449). Likewise, these shared agreements about category content reflect both the cognitive and normative conditions for membership (Durand and Khaire, 2017) and offer a lens for interpreting reality (Kennedy and Fiss, 2013; Negro *et al.,* 2011). Recent studies within this area have explored how categories emerge, change, dissolve, are merged or contested (cf. Delmestri *et al.,* 2020). Studies have also articulated the importance of categories in terms of defining interactions and exchanges between organizations (Durand and Khaire, 2017) and thus in influencing organizational outcomes (David *et al.,* 2023).

Categories can vary significantly. In their stocktaking paper on the current and future research paths on category research, Delmestri and colleagues (2020) make a distinction between market categories, organizational categories, and professional categories. Although this distinction should not be considered the universal truth, it nicely demonstrates the breadth and varied nature of categories. In context of construction, market categories may include contract award criteria, forms of contracts or forms of tenders. Organizational categories may include sectoral affiliation, stakeholder base or core business. Finally, professional categories may include educational background, occupation, or trade union affiliation.

A common assumption in the literature is that actors (organizations and individuals) are members of multiple categories (Durand and Paolella, 2013), and thus draw on different cognitive and normative sources at the same time. Another widespread assumption is that categories are not necessarily as homogeneous and stable as they may appear but can possess considerable heterogeneity and ambiguity (Colyvas and Powel, 2006) and be emerging and changing (Durand and Khaire, 2017; Kennedy and Fiss, 2013). Applying these insights to the productivity category under scrutiny, it can be said that productivity represents one of many categories in the construction industry that actors orientate themselves towards in pursuit of efficiency, elimination of waste and economic gains (Hasan, *et al.,* 2018; Kenley, 2014; McKinsey Global Institute, 2017). Moreover, the productivity category spans different members who draw different beliefs, expectations, and behavioural patterns from the category. For example, in Denmark, productivity has been a recurring topic among policymakers, industry associations and firms for more than a half century. Over the years, productivity improvements have been highlighted both as a means of increasing Danish exports (Kristensen *et al.,* 2005), increasing efficiency at the construction sector level (Gottlieb and Frederiksen, 2020) as well as increasing craftsmen efficiency at the project level (Neve *et al.,* 2020). However, we still have little understanding of how different groups of actors (members) put category content on productivity into practice, and what motivational consequences it has when different, disparate interpretations of the content collide.

Extrinsic and Intrinsic Motivation

Self-determination theory originates from the 1970s comparative studies of extrinsic and intrinsic motivation, which spawned a growing awareness of the importance of intrinsic motivation for human behaviour (e.g., Deci, 1971). Extrinsic motivation refers to the effort of individuals to do 'something' because it is associated with a separable outcome (Ryan and Deci, 2000). Analogously, intrinsic motivation refers to the effort of individuals to do 'something' because it is considered inherently rewarding or enjoyable (Ryan and Deci, 2000). A central argument in self-determination theory is that people have three innate psychological needs that, if met,

will results in individuals are likely to be intrinsically motivated, i.e., they will perform activities because they consider them rewarding or enjoyable (Amabile, 1997). Conversely, when these needs are not met, individuals may become extrinsically motivated, i.e., they perform activities for external reasons such as to obtain monetary rewards or avoid sanctions (Ryan and Deci, 2000). The three psychological needs - autonomy, competence, and relatedness - are briefly elaborated in the following.

Autonomy refers to the need for individuals to feel in control of their own lives and decisions (Baard *et al.,* 2004). It is the feeling that one is acting in accordance with one's own interests and values, rather than being controlled by external factors (Deci, 1971). Autonomy is considered important because it allows individuals to feel a sense of ownership over their actions, which in turn can increase intrinsic motivation and engagement in activities. When individuals feel that they are acting autonomously, they are more likely to experience positive emotions, perform better and persist in challenging tasks.

Competence refers to the need to feel capable and effective in one's activities (Ryan and Deci, 2000). It involves a sense of mastery and the feeling that one's efforts are producing desirable results. Competence is important because it allows individuals to feel a sense of accomplishment and self-efficacy, which is said to increase intrinsic motivation and engagement in activities. When individuals feel competent, they are more likely to take on challenging tasks and persist in the face of difficulty. Amabile (1997) explains that a mixture of expertise, creativity skills and task motivation is a source to 'professional creativity', which is considered a source of problem-solving and thus a way of feeling capable.

Finally, relatedness refers to the need to feel connected to others and to be a part of social groups (Baard *et al.,* 2004). It encompasses a sense of belongingness, intimacy, and social support. Relatedness is important because it allows individuals to feel supported and valued, which in turn can increase intrinsic motivation and well-being. When individuals feel connected to others, they are more likely to engage in prosocial behaviours, cooperate with others, and experience positive emotions.

We use insights about the three psychological needs as we believe they can enrich our understanding of the productivity category and how category content affects motivation. Specifically, by using self-determination theory in combination with category research, it is possible to better understand the motivations and experiences of individuals that are members of the productivity category.

METHOD

One of the authors collected the empirical material for the study in spring 2020 using a research design based on semi-structured interviews and a questionnaire. In Denmark, project managers usually have an educational background in which they have been introduced to, and thus are familiar with, the interview method. In contrast, craftsmen have rarely used (as an interviewer) or been the subject (as an interviewee) of the interview method, which means that they are likely to consider the interview situation as 'foreign' and uncomfortable. The research design was therefore chosen to ensure that the collection of empirical material was conducted with respect for the informants' different needs and preferences, and not because we had a particular interest in generating qualitative as well as quantitative data.

A total of seven semi-structured interviews were conducted with project managers employed in medium-sized or large contractor firms in Denmark (five unique firms). The interviewees were appointed in collaboration with a contact person from each of the firms. Our only selection criterion was that the appointed project manager had to have sufficient knowledge of the day-to-day work on construction sites in Denmark to be able to reflect on our interview themes. The interviews were conducted based on an interview guide (Kvale and Brinkmann, 2009) consisting of an initial set of 25 interview questions, which were categorised under the following four themes: (1) personal information, (2) construction site productivity, (3) means of rewarding and punishing and (4) motivation. It was not intended that all interviewees should be asked all 25 interview questions. Instead, the set of interview questions served as a catalogue where the interviewer could find inspiration for formulating questions as the conversation progressed (Rubin and Rubin, 2012). All the interviews, each of which lasted approximately one hour, were audio-recorded and selected passages of the conversations have subsequently been transcribed. In addition, all interviews were conducted on a construction site at the request of the interviewee.

The questionnaire consisted of 19 questions based on two different types of questions (Krosnick and Presser, 2018). These questions were structured around the same four themes as the interviews. The first type of questions was closed-ended multiple-choice questions, where the informant was asked to select one option, for example regarding their professional affiliation (bricklayer, carpenter, plumber, etcetera) or the most common way of rewarding (bonuses, gifts, praise, social events, etcetera). The second type of questions was open-ended questions, where the informants were asked to provide an answer to the question in their own words. Here, the informants were among others asked which measures that could increase productivity among craftsmen and which efforts that could foster intrinsic motivation. The questionnaire was physically handed out to craftsmen working on four different construction sites and 62 of the 73 craftsmen filled it out. Although the questionnaire was distributed randomly among the craftsmen on the construction sites, it turned out that 48% of the informants were carpenters.

FINDINGS

This section elaborates on the different perceptions and understandings of the productivity category, category content and the implications for intrinsic motivation among project managers and craftsmen working at the project level.

Project Managers

The project managers frame productivity as an expression of how well a project performs in relation to the vertices of the 'iron triangle', i.e., the due date, agreed budget and determined quality level. By extension, a productivity improvement is referred to as an improvement within one of the vertices of the iron triangle without causing significant harm to the others. However, one of the project managers explains that productivity improvements are difficult to achieve because the individual construction crew pursue their own craft-specific goals at the expense of the specific project's overall objectives. As explained by the project manager: "A major problem is that the craftsmen often pursue improvements within their own domain without considering whether it could potentially harm the overall planning of the project". In a similar vein, another project manager explains metaphorically: "They [the craftsmen] have to play together on the same pitch instead of playing separately on each half of the pitch".

Project managers who are to put category content on productivity into practice must thus facilitate coordination among the different construction crews and their activities in pursuit of the overall project objectives. This is perceived to be a responsibility of the project managers themselves, which means that the craftsmen are rarely involved, or given voice, in the overall coordination and planning of construction site activities. In addition to the craftsmen who are merely pursuing own craft-specific goals, all the project managers highlight poor design as another main reason why productivity improvements are difficult to materialise. Examples of this, which are emphasised by the project managers, are missing or wrong information from consultants, continuous changes in drawings and discrepancies between project descriptions and the actual progress and conditions of the project. Poor design is considered a source to several extra tasks that overload the project managers and consequently decrease the focus on delivering results in accordance with the iron triangle.

The project managers have a need to feel in control when it comes to the overall planning of the project and decisions made in relation to ensuring the progress of the project. The craftsmen's efforts to realise their own craft-specific goals and poor project design, however, complicates decision-making, thus reducing the project managers' autonomy. Hence, the project managers experience a need to demonstrate professional creativity, i.e., devise novel ideas that are appropriate for solving the experienced problems (cf. Amabile, 1997), thus mitigating high project complexity and poor design.

Craftsmen

The craftsmen frame productivity as being synonymous with effective execution of their own craft-specific activities carried out by the construction crew. A productivity improvement according to this perception is thus associated with highly efficient performance of specific work activities, often measured in time spent per activity. This perception can be grounded in the fact that most of the craftsmen (the informants who completed the questionnaire) work on medium-sized or large construction sites where piecework is common, i.e., the craftsmen are paid according to each activity performed. The questionnaire responses reveal that two thirds of the craftsmen always or often do piecework, while the last third never do piecework. In addition, the responses also show a high monetary focus with 44% of craftsmen highlighting bonuses as the most common way of rewarding and 40% emphasising wage as the most important thing about their job.

Craftsmen who are to put category content on productivity into practice must thus demonstrate that their own craft-specific activities are efficient compared to an industry baseline while demonstrating fine craftsmanship. A common way to demonstrate this is by achieving a higher wage compared to a regular hourly wage. An obvious downside to this, however, is that an increase in productivity within the individual construction crew does not necessarily lead to an increase in productivity in the project at large. Instead, it requires an ongoing adjustment between the progress of the craftsmen's activities and the overall planning of the project. However, only 20% of the craftsmen respond that they regularly contribute to solutions that go beyond their own crafts-specific activities and benefit the project at large. When the craftsmen are asked (open-ended question) which conditions that counterpoint productivity improvements, the following three conditions are mentioned most frequently: (1) unrealistic planning by the construction management, (2) lack of

updated drawings and (3) poor communication among construction crews as well as between craftsmen and project managers.

The craftsmen have a need to feel in control in relation to the craft-specific activities in the project and affect the overall coordination and planning that interfere their own activities. However, the craftsmen explain that they experience being shielded from the overall project planning and only are given voice when the project managers need craft-specific knowledge to ensure project progress. The craftsmen have a strong relatedness to the construction crew and secondarily to the project. In addition, 80% the craftsmen emphasise that most of their activities are 'simple' routinised work and therefore do not require their full competences.

DISCUSSION

This section begins with an overview of the main findings extracted from the empirical insights (see table 1). Next, it discusses construction site productivity as a contested category and the motivational consequences that different perceptions give rise to. Finally, it reflects upon the relevance of the new understandings on construction site productivity in relation to future construction management inquiries.

Table 1: Overview of main findings

	Project managers	Craftsmen
Scope of attention	Overall objectives of the project	Crafts-specific goals (self-interest)
Rationale for decision making	Ensure project interest	Ensure crew interest
Perception of productivity category	Deliver according to the iron triangle by coordinating activities between different construction crews	Deliver according to own crew-specific goals, mainly determined by the piecework system
Motivational orientation	Intrinsic	Extrinsic and intrinsic
Autonomy	Have a sense of control over the project at large and feel that decisions are made on an informed basis that reflect own interests and values	Have a sense of control over own craft-specific activities and having a voice in relation to the overall coordination and planning of construction site activities
Competence	Competences are being activated due to an experienced complexity in the project, which requires a high degree of professional creativity	Competences are not being activated as most craft-specific activities prescribe 'simple' routinised work. The craftsmen's competences are only activated when there are deficiencies between project design and actual progress of the project (i.e., misalignment between drawings and practice)
Relatedness	Part of the construction management	Part of the construction crew before being part of the project
Extrinsic focus	-	Performing activities with the highest possible efficiency in order to maximise wage during piecework despite detriment to the overall planning and progress of the project
Intrinsic focus	Performing activities in relation to coordination and planning of construction site activities because of a genuine interest in making the project succeed	Performing activities based on the desire to demonstrate fine craftsmanship

Construction Site Productivity as a Contested Category

The empirical findings reveal varying interpretations of productivity and its practical application. These differences encompass productivity scopes (project versus crew), perceptions of productivity (performance according to iron triangle versus piecework system), and motivational orientations (intrinsic versus extrinsic). For example, project managers and craftsmen hold divergent views on productivity improvements. While project managers emphasise monetary rewards as the primary motivational factor, craftsmen place importance on increased involvement in project coordination and planning, and improved project design. A project manager's account illustrates how attempts to boost craftsmen's motivation and productivity by raising wages did not yield the intended effects.

Contesting Future Inquiries on Productivity in Construction Management Research

Considering productivity as a contested category in construction management research is essential to advance and challenge prevailing understandings of productivity. By recognising that productivity is not a static, 'ready-made' category (Heigermoser *et al.,* 2019; Neve *et al.,* 2020), but a situationally contested, negotiated, and defined category, construction management researchers can delve deeper into the multifaceted nature of productivity. For example, construction management researchers can explore how different groups of actors define and assign content (i.e., beliefs, expectations, and behavioural patterns) to the category of productivity (Kennedy and Fiss, 2013). Situational factors that increase complexity (Frederiksen, 2021) at the project level and thus affect construction site conditions as well as organisational cultures can also be examined to obtain a deeper understand of how project complexity affects productivity perceptions on the construction site. Construction management researchers can also develop alternative measures based on qualitative indicators that capture the multidimensional aspects of productivity, thereby going beyond the traditional metrics such as hours required to perform certain activities (Hasan *et al.,* 2018). Finally, embracing productivity as a contested category emphasises the need for strong collaboration between researchers, professionals and policymakers in co-developing policies, strategies and practices that can purposefully and effectively improve productivity.

CONCLUSIONS

The aim of the study was to explore how productivity, as a distinct category, permeates and affects groups of actors associated with the project level. The starting point of the study was to consider productivity as an established yet contested category in the construction industry. Drawing on literature on category research and self-determination theory, the study concludes that productivity is perceived differently by project managers and craftsmen.

Most notably, project managers' scope of attention is at the project at large while the craftsmen's scope of attention is bounded by their own craft-specific activities. Accordingly, productivity improvements among the project managers are directed towards the vertices of the iron triangle whereas productivity improvements among the craftsmen are directed towards crew interests. A consequence of this is that efforts to improve productivity by one group of actors opposes the opportunities to improve productivity by the other group of actors. The different perceptions of productivity set up different needs in relation to autonomy, competence, and relatedness. As shown in

the study, these different needs collide when they meet in practice which complicates the effort to motivate the individual. For example, the project managers' need to feel in control over the project reduces the craftsmen's opportunities to be involved in the overall coordination and planning. Moreover, the project managers consider themselves part of the project at large while the craftsmen consider themselves as a part of a crew before being part of the project.

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