Facilitating campus interactions – critical success factors according to university facility directors

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Abstract

Purpose – The purpose of this paper is to investigate which critical success factors (CSFs) influence interaction on campuses as identified by the facility directors (FDs) of Dutch university campuses and to discuss how these compare with the literature.

Design/methodology/approach – All 13 Dutch university campus FDs were interviewed (office and walking interview), focussing on CSFs relating to spaces and services that facilitate interaction. Open coding and thematic analysis resulted in empirically driven categories indicated by the respondents. Similarities and differences between the CSFs as previously identified in the literature are discussed.

Findings – The following categories emerged: constraints, motivators, designing spaces, designing services, building community and creating coherence. The campus is seen as a system containing subsystems and is itself part of a wider system (environment), forming a layered structure. Constraints and motivators are part of the environment but cannot be separated from the other four categories, as they influence their applicability.

Research limitations/implications – This study was limited to interviews with FDs and related staff. The richness of the findings shows that this was a relevant and efficient data collection strategy for the purpose of this study.

Practical implications – By viewing the campus as an open system, this study puts the practical applicability of CSFs into perspective yet provides a clear overview of CSFs related to campus interaction that may be included in future campus design policies.

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Social implications – This (more) complete overview of CSFs identified in both literature and practice will help FDs, policymakers and campus designers to apply these CSFs in their campus designs. This improved campus design would increase the number of knowledge sharing interactions, contributing to innovation and valorisation. This could create a significant impact in all research fields, such as health, technology or well-being, benefitting society as a whole.

Originality/value – This study provides a comprehensive overview and comparison of CSFs from both literature and practice, allowing more effective application of CSFs in campus design policies. A framework for future studies on CSFs for interaction on campuses is provided.

Keywords Interaction, Services, Campus, Spaces, Proximity, Shared facilities, Context

Paper type Research paper

Introduction

Dutch universities have three main objectives: education, research and knowledge valorisation (VSNU, 2013). Knowledge valorisation is often stimulated by means of a "triple helix" of academic-industry-government relationships (Etzkowitz, 2008). One example is the opening-up of the university campus. A campus is defined by Dinteren *et al.* (2017) as an active open innovation environment where actors can meet and inspire each other in the presence of high-end shared facilities and at least one renowned knowledge carrier, which largely determines the campus's thematic profiling. Many universities now seek to attract companies to their campuses to create a meeting place where the different campus users, such as university staff, company employees and students, can interact (Buck Consultants International, 2018; TU Delft, 2014; VU Amsterdam, 2014). This paper focuses on Dutch university campuses (the university is the "renowned knowledge carrier"). For companies, (re)locating to a university campus can also be advantageous. Becker *et al.* (2003) identified the following assumed benefits for corporate campuses: branding, identity and community, cost and control, security and business continuity, attraction and retention of staff, communication and collaboration and provision of amenities and services.

Co-location on a campus is assumed to increase interactions across different organisational units owing to geographic proximity, which in turn is assumed to stimulate innovation (Becker *et al.*, 2003; Curvelo Magdaniel, 2016; Geenhuizen, 2010). The built environment influences people's behaviour (Meusburger, 2009) and thus also stimulates or inhibits the interaction of the different users. Therefore, Burlage and Brase (1995, p. 140) argued that "campus architecture should be grounded in the research on behaviour". Behaviour can also be limited owing to constraints, defined in leisure research as factors that prevent or prohibit an individual's participation in an activity (Jackson *et al.*, 1993 cited Moghimehfar and Halpenny, 2016). However, Jackson *et al.* proposed that people facilitate their participation though a negotiation process, which is inspired by their motivation to attend. In other words, if there is sufficient motivation, people will negotiate constraints to be able to perform the desired behaviour, in this case interaction. In a preceding review article by the same authors, the following critical success factors (CSFs), which influence how spaces and services stimulate interaction on campuses, were identified in the scientific literature: geographic proximity, cognitive proximity, scale, transitional spaces, comfort and experience, shared facilities and events/local buzz/networks (Jansz *et al.*, 2020).

In this paper, the campus is seen as a system, described by Checkland (1981, cited Checkland, 2012) as a group of interacting or interrelated entities that form a unified whole and responds to influences from its environment (all entities outside the system's boundary). It is important to realise that the system boundary is not fixed, in the sense that the system has smaller subsystems and is in itself also a functional part of a wider system (buildings are part of the campus and the campus is part of the region). Furthermore, the system is open to influences from its environment and has to respond appropriately. Therefore, a

system will, in principle, be part of a "layered structure", making a hierarchy of systems (Checkland, 1981 cited Checkland, 2012). In this paper, the boundaries between the subsystem (CSFs), system (campus) and wider system (environment) will be assumed as perceived from the viewpoint of university facility directors (FDs). Opening up the campus involves FDs, as they are responsible for a university's spaces and services. As described in EN ISO 41001:2018:

> Facility management is an organisational function which integrates people, place and process within the built environment with the purpose of improving the quality of life of people and the productivity of the core business (NEN, 2018).

In this case, the core business is valorisation and the FD's contribution is to facilitate interaction through spaces and services. Of course, this system boundary may not be as rigid as it seems. As well as having a direct influence on campus, FDs can also have an indirect influence on environmental factors, such as political decisions, university strategy and city developments. For example, they may meet with the municipality to discuss increasing public transit options to campus. However, this initiative is not part of their "core domain" and opportunities to do so may differ per campus.

Over the years, campus management has become more complex and challenging, which increases the need for evidence-based management information to support campus decision-making (Den Heijer, 2011). However, the question is whether CSFs identified in the literature are the same as those used by FD's when creating campus design policies, as success factors of campuses can be increasingly complex and relative to user behaviours (Rytköne, 2016). Instead, it may be possible that FDs operate primarily on the basis of experience and intuition, designing their campus spaces in the way that they feel is most productive for facilitating interactions.

In a bid to close this knowledge gap, this paper presents the CSFs identified by FDs at the 13 Dutch universities as stimulating campus interaction. What do they see as the determining factors that they strategically act on? In-depth interviews and thematic analysis were used to collect the CSFs that they apply. The results allow a comparison with the preceding literature review, enabling a discussion. Finally, a more complete list of CSFs based on both literature and experience that may be used in future campus designs is presented. The practical implementations and experiences of FDs yield an interesting view on how campus spaces and services tend to stimulate interaction between different campus users. Their perspective adds to the existing, more formally acquired, theory.

Methodology

To be able to include all 13 Dutch university campuses and collect all CSFs FDs see as most important, an in depth interview study was used. This qualitative approach was chosen to ensure that CSFs not described in the literature would have room to emerge and the in-depth reasons as to why CSFs are important and of their interrelationships could be discussed (Hennink *et al.*, 2020).

As mentioned in the introduction, FDs may operate primarily on the basis of experience and intuition. In the literature, this experience-based approach has been referred to as "phronesis", often translated as "practical wisdom". Phronesis is the ability to use one's experience to implement general knowledge in a specific situation and is context dependent (Aristotle, trans 1976 cited Flyvbjerg, 2001). Scientific literature, on the other hand, is generally geared towards universal theories (also called "episteme"). Flyvbjerg (2001), however, argues that this focus is not appropriate for studies focussing on human behaviour. As Flyvbjerg explains, a universal theory "requires that the concrete context of

everyday human activity be excluded, but this very exclusion of context makes explanation and prediction impossible" (2001, p.40). This is because:

> [. . .] in social science, the object is a subject [. . .] these self-interpretations and their relations to the context of those studied must be understood in order to understand why people act as they do. (Flyvbjerg, 2001, p. 32)

In other words, the context influences people's behaviour, while people also influence the context.

To see whether any similarities and/or differences emerge between the phronesis and episteme approach and see whether one could reinforce the other, the results from the interview study are compared to the literature in the discussion section.

To ensure that the context would have room to emerge in the interviews, a walking interview was used to encourage spontaneous interaction, with the environment prompting the discussion of the related CSFs (Kinney, 2017). The FDs were asked to select a location on campus that embodies the CSFs they mentioned, walk through the location with the interviewer and point out examples in the space. These walking interviews generate more place-specific data than sedentary interviews and engage to a greater extent with features in the area under study and their connections (Evans and Jones, 2011).

Participants

As this paper focusses on current (and possible) interaction stimulation strategies for university facility management, the FDs of all 13 universities in The Netherlands with physical campuses were selected for the interviews (see Table 1). The FDs were contacted at one of their quarterly national meetings and all agreed to cooperate. The interviews took place in spring/summer 2018.

The participants (N = 26) were 13 facility directors (1 interim), 11 guests invited by the FD (four facility managers of the visited location, four representatives of real estate departments, two experienced facility management employees as the FD had recently changed and one director of new business development), plus two whose presence on location was unplanned (one company employee, one business incubation manager).

Interview protocol

Interviews were semi-structured to ensure that the specific dimensions of the research question could be addressed while leaving room for respondents to add context (Galletta, 2013). Interviews started with open questions about what FDs regarded as CSFs, followed by questions specifically relating to spatial and service factors because interaction is place dependent (Meusburger, 2009) and services are often indicated as an important enabler for interaction (Van De Klundert and Van Winden, 2008). The same interview protocol was used during all interviews and all preparations (invitation, briefing, etc.) were standardised to ensure comparability.

As described earlier, a place-based, participant-driven (walking) interview was used because of the focus on the spatial or locational cues that respondents assumed influence human interaction behaviour and increase knowledge sharing. However, as confidentiality cannot be assured when interviewing in a public place and participants might be concerned about being overheard, the walking interview was combined with a desk interview (following the advice of Kinney, 2017). One respondent only took part in an office interview because there was "no interaction-oriented location available".

Respondents were asked to decide on a location beforehand; it had to be a notable example of a place on campus where unplanned interactions between companies and the university might

University	Interview location	Type of university	Services and real estate	No. of students	No. of companies (Buck, 2018)	Included in number of companies (Buck, 2018)
Erasmus University Rotterdam	**Office interview only, respondents reported that there was no suitable location*	Med/Gen	Separate	28.047	–	–
Vrije Universiteit Amsterdam	Amsterdam Venture Studios	Med/Gen	Combined	22.359	31	VU Campus
University of Amsterdam	Start-up village	Med/Gen	Separate	31.019	159	Amsterdam Science Park
Maastricht University	Employee lounge – School of Business and Economics	Med/Gen	Combined	16.861	73	Brightlands Maastricht Health Campus
Tilburg University	Intermezzo (Toren)	Gen	Combined	13.050	–	–
Radboud University	Outdoor campus spaces	Med/Gen	Separate	19.899	77	Mercator Science Park
Leiden University	Wijnhaven	Med/Gen	Separate	26.853	135	Leiden Bio Science Park
University of Groningen	Energy academy	Med/Gen	Separate	28.875	198	Campus Groningen
Delft University of Technology	YES! Delft	Tech	Separate	21.651	245	TU Delft Science Park
Eindhoven University of Technology	Cataclyst	Tech	Separate	10.766	143	TU/e Science Park
Utrecht University	Vening Meineszgebouw A	Med/Gen	Separate	30.523	103	Utrecht Science Park
University of Twente	The Gallery	Tech	Combined	10.026	471	Kennispark Twente
Wageningen University and Research	Plus Ultra	Tech	Combined	10.779	140	Wageningen Campus

Table 1.
Overview of Dutch universities, med = medical, gen = general, tech = technical

take place. Before starting the interview, participants were given an informed consent form stating that the interview would be recorded and transcribed and that all information would be anonymised in any resulting publications. Interviews began with a short introduction, explaining our aim to find what spatial and service characteristics could be identified as critical success factors for interaction. The interview protocol included 14 questions.

Analysis

The data was recorded and transcribed. An inductive thematic analysis was conducted (Braun and Clarke, 2006) using ATLAS.ti V8 software (Friese, 2014). As described by Braun and Clarke (2006), thematic analysis consists of five steps: data familiarisation; initial coding; searching themes; reviewing themes; and defining and naming themes. An additional step was added to this process during step 4. At this stage, not only did the first author review the themes but a second coder also reviewed all codes, quotations and themes created by the first author in the first three steps. This was then combined into a final set. To ensure readability, the themes were grouped by the first author based on the interview data, using the categories defined by the respondents as a starting point. Only later, in the discussion, was this grouping compared to the grouping found in the literature. In the data, multiple quotes used slightly different names for the same categories. The names "designing spaces and building community" were taken directly from the data, while the names "constraints, motivators, designing services and creating coherence" were agreed upon by the authors (Figure 1). Only those mentioned 10 times or more or mentioned by more than half of the respondents were included in the categories "designing spaces and designing services".

Results

The interviews produced a series of statements about what FDs consider to be CSFs, as well as statements suggesting certain perceived categories, hierarchies and interrelations. The following quote illustrates the recurring CSF categories mentioned by the respondents:

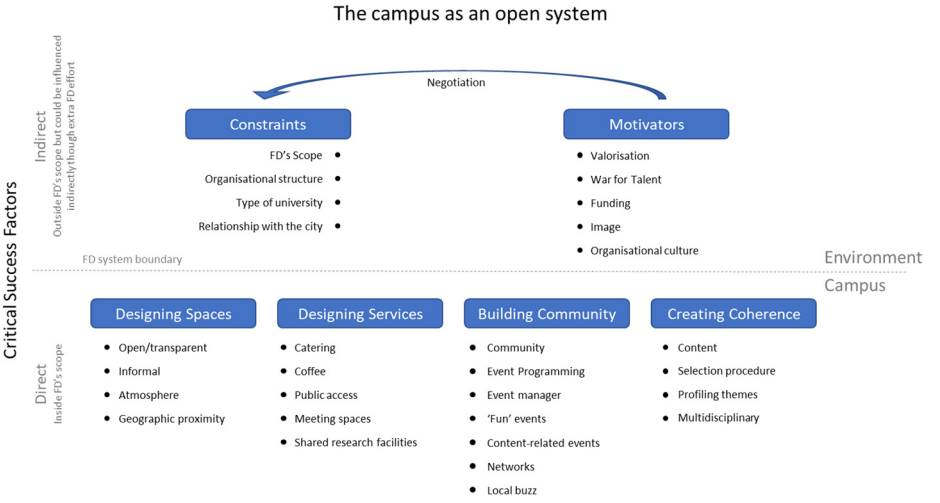

Figure 1.
Final themes and categories

Constraints and motivators beyond the system's boundary (originating in the environment) surround and influence the campus, affecting which CSFs can be implemented. Strengthened by motivation, actors can negotiate constraints that are limiting interaction behaviour on campus.

> You need content. You need vision. Then you'll need a place [. . .] and a program to run in this place. And then of course, communication is important to properly set up the network". (INT-07)

Another respondent framed it slightly differently: "You need three things: a community [. . .], a space [. . .] and a program [. . .]" (INT-11). The authors further refined these category names into the following six categories, to most accurately capture the full scope of the CSFs in these groups: constraints, motivators, designing spaces, designing services, building community and creating coherence. "Constraints" was the only factor not mentioned as a specific category by the respondents, possibly because they found it too obvious to mention.

Whereas the four categories of designing spaces, designing services, building community and creating coherence all include CSFs that can be directly influenced by FDs, the other two categories are of a special type. Constraints and motivators are outside a FD's sphere of influence (e.g. campus size) and set the stage for the applicability of CSFs. They are a part of the environment and outside the system's boundary (see methodology). For example, motivators may relate to a university's strategy and long-term goals, steering the directions FDs may choose when implementing CSFs. In other words, constraints and motivators are CSFs that are not part of the design itself but which set the stage for which CSFs from the other four categories can or cannot be included in the campus design.

This hierarchy between the categories was also indicated by respondents when they emphasised why certain measures from other campuses would not work on theirs. Just as a campus consists of different layers (campus, buildings, floors, rooms), the CSFs in the open campus system are part of a layered structure. Constraints and motivators are part of the environment (higher layer) and directly influence the applicability of the categories in the lower layer (Figure 1). Constraints limit interaction behaviour on campus but (as described in the introduction) motivators can inspire a negotiation process that facilitates the desired behaviour, in this case interaction.

As mentioned in the methodology section, the CSFs above the dotted line are outside the system's boundary (outside the FD's scope) and can only be influenced indirectly by FDs. The four categories below the line are part of the "core domain" of the FDs and represent how they can add value to the campus by including these in their campus design. It is clear that this includes not only designing spaces and services but also building community and creating coherence on the campus. These four core activities are at the heart of the FD's scope of work. However, the system boundary will not be the same for each campus and may change over time. An FD's scope can be expanded, or constraints and motivators may change, creating new opportunities for FDs to add value.

As the interviews specifically targeted CSFs relating to spaces and services, most of the emergent themes are in these categories. This was also clearly the area where respondents felt most comfortable making statements although not all agreed on exactly which services or design choices should be included in their scope. In other words, the system boundary and which factors can be directly or indirectly influenced by FDs, differs per campus and may change over time. Because of space constraints, not all CSFs relating to spaces and services mentioned by one or more respondents can be discussed in this paper. Therefore, only those CSFs named ten times or more, or by more than half of the respondents, are included in these sections.

Constraints

The respondents were very aware of both their significance and their limitations in facilitating interaction through campus design. While they named many CSFs that they use to stimulate interaction, they were also very aware of the environment in which they operate, including the constraints and motivators. The "constraints" category includes CSFs

that are outside the FDs' sphere of influence (structural constraints, e.g. campus size or distance to the nearest city) and, therefore, outside the system boundary (see methodology). However, constraints are all-important when considering interventions:

> All those concepts, you can't apply those here. You have to analyse the situation every time; what's the context, what type of people, what type of university, which strategy can you apply to what you are in that moment. For example, [X] might say 'only one lunch location for the whole campus' but imagine we did that here: we'd have to supply them with bicycles because of the huge distances". (INT-09)

Depending on an FD's scope, they may or may not be in a position to implement certain measures to facilitate interaction. Even though many campuses have existed for several decades, no ideal blueprint for the organisational structure of campus facility management has emerged. In some cases, real estate management (campus planning, building projects, etc.) is organised separately from campus services (catering, cleaning, etc.), while in other cases, these are housed within the same department (Table 1).

Some campuses have an organisational structure with a separate campus management organisation to increase accountability for overall campus integration, which can affect an FD's scope. It may include developers, consultants, event managers, campus planners and municipal and/or neighbourhood representatives. They can be in charge of the selection procedure for which companies may or may not be located on campus.

> [. . .] they have a separate entity responsible for communication, business development, I believe there are 10-15 people working on a day-to-day basis to improve the cross-fertilisation between university, companies, municipality, province, and all the other parties currently involved there. They're really driving that and developing a score of events looking for this interaction between the different campus users". (INT-07)

But, the respondents stated, this separate organisation must have a sufficient mandate to be functional.

The type of university influences "creating coherence" (see below) and a university's level of attraction to companies, thus influencing the interaction potential. The different types mentioned by respondents are technical, medical and general universities, broader and smaller scope universities and large and small universities (in terms of either student numbers or campus size). For example: "At a technical university, you will see this more often because of the combination of facilities" (INT-08), referring to the shared use of costly facilities.

Based on a campus' relationship with the city there is a difference in the spaces and services that FDs feel they need to provide. For campuses that are within the city, some spaces and services can be shared:

> The city is a very important meeting place for us. People come to [X] because it is [X] and that is where you meet, in endlessly different ways you meet each other there. For us, it is often not so obvious to do something ourselves because a lot of facilities are already in the city itself and people have very different needs. (INT-12)

For campuses that are a fair distance from the city, these spaces and services will have to be provided by FDs.

The city may also play a role in the thematic direction of the campus:

> This campus is really oriented towards the city and the added value for the city. Here, we try to connect with all ministries, hospitals, governments and more. Here, it is really focused on the themes of [the city]. (INT-05)

Motivators

The "motivators" category shows why (unplanned) interaction between companies and universities is needed, what results are expected and it allows FDs to weigh the advantages and disadvantages of different strategies. These are often formulated in the university's strategic vision, which should be connected to both the university board and employees (INT-11).

The main reason to look for cooperation with companies is to increase a university's valorisation efforts:

> This university has three core objectives: 1) Education, 2) Research and 3) Valorisation. Valorisation is no more than the practical application of your knowledge and that's where you get the connection with companies". (INT-11)

Generally, a certain chain of events is expected, leading from interaction, through knowledge sharing, to innovation and valorisation (Jansz *et al.*, 2020).

The war for talent is named as one of the main reasons why companies want to be located on campus. "[those companies] [. . .] only want one thing: to be close to the students" (INT-10). Expected results for this CSF range from joint projects between companies and students to start-ups and being able to recruit the talented workforce that companies need.

Private funding (e.g. through contract research) is becoming increasingly important for universities, as public funding is not keeping pace with the growing student numbers. Also, grant applications often require matching by private companies. "And it has to do with finance. That you do scientific research in cooperation with someone who is also physically present, that almost guarantees long-term cooperation in the research" (INT-13).

A university's *image* or brand is very important, as a major part of university funding is linked to the number of students. Having companies on campus can play a large part in enhancing this image.

> It's exposure, of course [. . .] their image is very important for a university. So, when you have an important cooperation partner physically present on your campus, that also gives a good appearance. (INT-13)

Organisational culture can contribute to or block spontaneous meetings. Respondents mentioned having to actively "pull people out of their buildings" as one of the main reasons why there was less spontaneous interaction than they would have liked. A good way to achieve this is to organise events, giving people a reason to go to a different or new location. "You have to make sure people come out of their buildings or into each other's buildings, you have to make sure there is programming" (INT-01). "It all adds up to the open character of the campus to make sure people feel it's a matter of course to come out of their buildings [and interact]" (INT-01). Another issue is fear of intellectual property theft. One respondent mentioned mixing different sectors in an incubator setting to prevent these issues.

Designing spaces

When asked where most spontaneous meetings take place on campus, one respondent said:

> The interaction actually takes place on different levels of scale. At the level of the campus as a whole, zooming in on the building level it is at theme-oriented facilities, such as the [sustainability themed department], [incubator spaces] or [multi company building]. And at the floor level we have living rooms people can use on a daily basis and bring their guests. (INT-07)

The respondents agreed that the spatial design of spontaneous meeting places plays a distinct role in stimulating unplanned interactions but not all respondents felt that it is within their scope to design these. "That is not my expertise. That would be interior

architecture" (INT-13). However, they do have a clear vision and named the following concepts to stimulate unplanned meetings through spatial design: open/transparent, informal, atmosphere and geographic proximity.

Creating an open and transparent space means that people should feel free to enter the space and participate in whatever is going on. The space should be visible, easy to find and accessible. You should be able to see what is going on inside before entering the space. Closed-off spaces (such as closed offices or inaccessible buildings) were specifically named as a barrier to interaction.

There is a clear need for informal spaces, where you can talk about different topics in an informal way, as opposed to more formal rooms (such as meeting rooms). This is often combined with catering facilities and good coffee (mentioned specifically 30 times). This informality can be achieved through the use of furniture and lounge areas and by giving people an opportunity to make a space their own. This is also connected to a space's atmosphere, which gives people an opportunity to choose which space best suits their needs. "And it's also putting people at ease, saying: it's ok. You can come in here. You can sit here, and you can just talk to each other here, to create that informal atmosphere" (INT-01). However, creating a certain atmosphere also depends on current trends: "[This building has] a pit where a lot of dialogue or session dialogue-like things happen. But after five years it is almost dated again so you need something new. That changes very quickly" (INT-01).

Geographic proximity was also mentioned, but on a very general level. Often, respondents were referring to being on the same campus as a measure of proximity, though not necessarily in the same building or on the same floor. However, they did point to "being close to your colleagues" as a way to stimulate interaction and mentioned long distances and urban structures that inhibit easy travel as main barriers to interaction, originating in the environment. Furthermore, there is the risk of creating only a temporary effect: "Once you are closer to each other, first you find each other more often than before, but then you get used to it and it decreases" (INT-12).

Designing services

The services provided on campus were often cited by respondents as the main reason for companies to wish to be located on campus. In general, respondents especially mentioned coffee, public access, opening hours, provision of information, relaxation opportunities and parking as important campus services. Most of these are on the building or floor level. However, when focussing on strategies for services that can positively influence interaction between different campus users, they most frequently mentioned catering, meeting spaces, shared research facilities, sports, a library and event locations. Depending on the strategy, these can be on the level of the campus, building or floor. "Good coffee always does the trick. Good coffee. Really good coffee" (INT-14). (For readability, only those mentioned 15 times or more have been included in Figure 1.)

For shared research facilities, especially those that are costly have the greatest effect as this cooperation creates new opportunities to use this equipment. "The shared [laboratory] facilities [are the key], because it's such a costly and expensive facility that the joint management is effective and efficient for both parties" (INT-14).

Building community

Respondents felt that the campus should be an integrated whole, home to an innovative community where interactions and knowledge sharing are appreciated:

> And we really try to stimulate [interactions in public spaces] as it's always a barrier to sit down on someone else's turf or to do something there or to have to go there". (INT-05)

A large part of creating a community is event programming: "[. . .] if you want to make this successful, you'll have to set up a substantive program. Because if you don't [. . .] it'll die out" (INT-05). This requires an event manager dedicated to programming, which can be an opportunity for campus facility management:

> If you really leave it up to the campus users, it won't take off. That's when this employee can take up a broader role. They can be a broker between different research areas, close to the action, who knows people. And that makes it easier for others with ideas as well, as they have an easy point of contact to spar with. (INT-05)

"Fun" events such as weekly drinks are considered to add to the overall campus experience, as they create an atmosphere where people feel free to interact with each other. However, respondents also stressed the importance of content-related activities, such as conferences, workshops and lectures. "And then you see that people congregate who have at least one thing in common. [. . .]. And then you get new interactions very easily" (INT-01). While some respondents see event programming as a way to actively contribute to the campus's success, not all respondents feel that it should be part of their scope. Another possibility is to set up the initial program and then transfer the management of the program once everyone is convinced of the added value.

Networks were often mentioned as part of a healthy community. Respondents also relate network building to creating a talent base and opportunities to share knowledge:

> We would like companies located on campus to be more aware of and more knowledgeable about each other so you can build and sustain a kind of network. [. . .] For example, so you can ensure that they can find each other better and know about each other's presence more. (INT-02)

Respondents mentioned local buzz as an important CSF and the result of a well-functioning community. Gertler (1995) defines local buzz as the information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region (Gertler, 1995 in: Bathelt *et al.*, 2004). "Yes, so, that local buzz, the chance of collision, local buzz, that's what companies find important. The unexpected interactions. Being able to quickly contact a researcher" (INT-01).

One respondent gave a clear overview of what was needed to create a community:

> If I were to start a new community, I'd need three things: someone to facilitate everything on location, a space where everyone can meet. And that space must have an innovative atmosphere, so when you enter it's like 'Yes! This gives me energy, and this is where it happens, I want to be here. And third, there must be a program. (INT-11)

Creating coherence

The CSF named most often and by all respondents was "content": the interaction must be able to provide knowledge useful to the university's primary process of education, research or valorisation. This is not unexpected as it is part of the definition of facility management (see Introduction). This category has been named "creating coherence", as all CSFs relate to making sure the right people (with complementary skills or knowledge) meet each other.

Connection to the primary process, or content, is all-important: "If there is no connection on content, the presence of a company makes little sense. [. . .] You're looking for partners, companies, government agencies that make you stronger" (INT-12). To ensure this connection on the content, many campuses (though not all) use a selection procedure to see if

a company should be allowed to locate on campus or not. "This interaction between research and companies is required, otherwise a company cannot establish itself here. [. . .] We're not just a business park, we're a university" (INT-09). To set selection criteria, it is essential that a campus has a clear profiling theme. This brings clarity to all campus users and visitors and ensures that everyone shares a common interest. The profiling themes are expected to work best when campus users have different backgrounds or come from different disciplines (multidisciplinary) and are, therefore, able to bring new and unexpected knowledge into these interactions and to stimulate interdisciplinary research areas.

Discussion

Now that the CSFs of FDs have been identified, these can be compared to the CSFs identified in the preceding systematic literature review by the same authors (Jansz *et al.*, 2020) and the added value for companies located on a corporate campus (Becker *et al.*, 2003). Figure 2 shows the open campus system, with its layered structure of CSFs and the parallels (confirmations) between the CSFs found through experience and in the literature.

Before making a comparison, it is important to look at how FDs view their part in facilitating interactions on campus. Clearly, FDs feel that they have an important part to play in facilitating interactions, yet they are very aware that they cannot force these interactions to take place. They put into perspective how manageable this goal is. The CSFs'

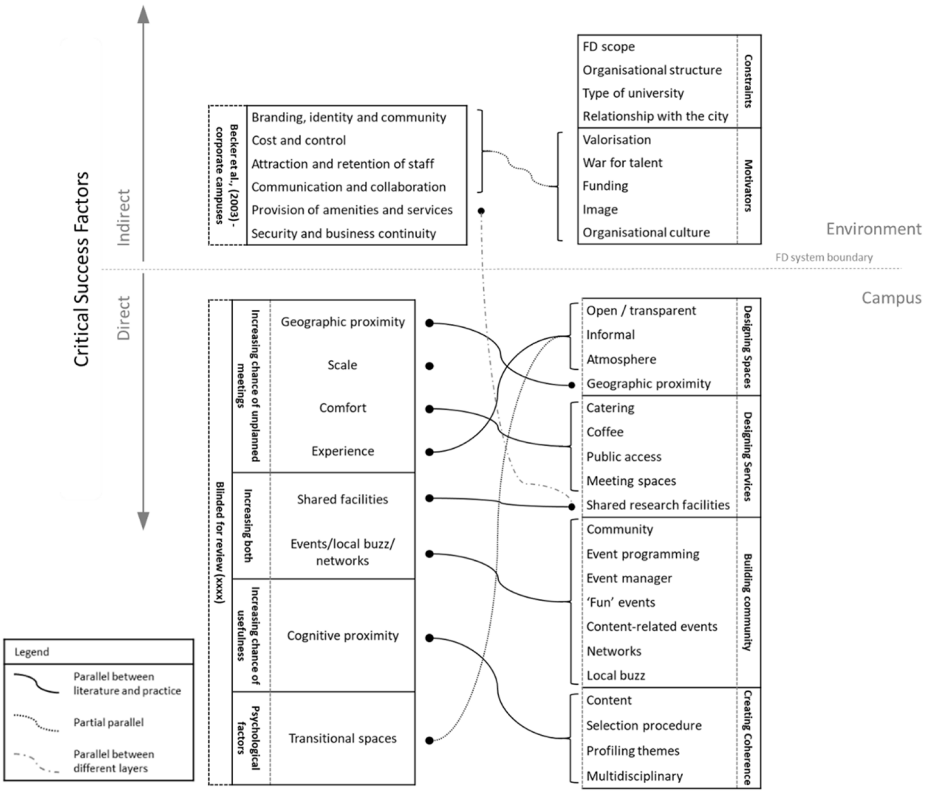

Figure 2.
Open campus system – comparison of CSFs in literature (left) and in experience of FDs (right)

value is relative, as FDs operate on a complex playing field in which constraints originating in the environment can limit their opportunities to implement certain strategies. This is a very different mindset to that of the scientist, who identifies CSFs based on observations and a focus on general theories.

The respondents see the CSFs as part of a layered structure with many different subsystems, which itself is part of a wider system (as described by Checkland, 2012) see introduction), making the factors interrelated and interdependent (this interconnectivity is evident in both the literature and in practice). An example is the connection between community, networks, local buzz and event programming (as also [partially] described by Breznitz *et al.*, 2018 and Capdevila, 2015): to kick-start the community, a certain amount of effort is required to organise events. Also, spaces, services and cohesion need to be supplied by the organisation. Once events are happening in the community, this will create local buzz and strengthen the network, which will in turn increase event attendance. When the local buzz reaches a high enough level, some of it may feed back into the ecosystem in the form of informally organised events. This would allow a formal event planner (an opportunity for FDs to add value) to withdraw and transfer this task to the campus users. This requires FDs to think in terms of webs of strategic interventions, rather than lists of factors in their own right.

There are many parallels between the CSFs mentioned in the literature and in practice (Figure 2), confirming their importance. For example, both stress the importance of a connection of the content ("cognitive proximity" (Zhong and Luo, 2018) or "creating coherence") However, although there are direct relationships, similar categories do not always encompass exactly the same things. For example, while "events/local buzz/ networks" is also represented in the "community" category, this category is more extensive. Also, "transitional spaces", such as "third spaces" (public places on neutral ground where people can gather and interact (Oldenburg, 1989)), is partly covered by "open/transparent, informal and atmosphere", but is broader than just these three. Finally, "geographic proximity" is defined differently: while FDs refer to geographic proximity as being on the same campus, the scientific literature describes how unplanned interaction through geographic proximity alone is limited to 50 m for frequent interaction (Allen, 1997), or to the building floor for less frequent interaction (Becker *et al.*, 2003; Schwab *et al.*, 2016).

While campus users will ideally move through the campus automatically, creating opportunities for unplanned meetings on the campus level, this is generally not the case. Scale has an effect on the interactions taking place or not (Capdevila, 2015; Schwab *et al.*, 2016; Venable, 1981). In fact, many meetings take place on the level of the workplace, floor or building. This relates to the fact that interaction is an inherently individual activity and while both individuals are on campus, their direct environment is always on a smaller scale (the system boundary of the individual is different from the system boundary of the campus). The challenge is, therefore, to facilitate easy movement between these levels of scale, so that users may encounter each other all over the campus, which is an opportunity for FDs to add value.

Also, not all CSF categories named in practice are represented in the literature (Figure 2). The layered structure indicated by the FDs shows the interconnectivity of the CSF categories and reveals that the categories located in the environment, which are fundamentally linked to the applicability of the CSFs within the system's boundary, were not identified in the previous literature review: constraints and motivators (although motivators does hold many parallels with Becker *et al.* (2003) for corporate campuses). Constraints can eliminate the implementation of certain CSFs, while motivators may inspire a negotiation process to remove these restrictions (Moghimehfar and Halpenny, 2016). It is

important to note that the previous literature review did not specifically look for these constraints and motivators (as they are outside the system's boundary) but neither did the interviews. However, the FDs clearly stated (unsolicited) that the system cannot be viewed fully outside its environment. It is an open system that can only operate within the constraints and motivators originating in its environment, responding to any changes that may occur. This (unsolicited) inclusion of the layered structure might be expected to appear in the literature as well, but it did not. This may be indicative of the different points of view of practitioners and scientists.

Whereas, scientists look for universal laws and patterns that will pass peer-review tests, practitioners such as the FDs have a perspective rooted in implementation and justification while being aware that they cannot force interactions to take place. Traditionally, scientists analyse the campus in isolation from its environment, effectively assuming that it is a closed system. However, the respondents feel that the campus is an open system, which needs to be viewed in its environment to result in practically applicable guidelines for campus design. This difference in their relationship with reality has also been addressed by Flyvbjerg (2001) through the concept of phronesis (see methodology).

Conclusion

This paper has looked into the experience-based knowledge ("phronesis") of university FDs regarding CSFs for interaction in campus design. These CSFs are especially important as campuses are opening up to company (re)location to create a meeting place where the different campus users, such as university staff, company employees and students, can interact. These CSFs, within the system boundary of the campus, were then compared to those found in the literature.

In thematically analysed interviews, the FDs of the 13 Dutch campuses, identified six main CSF categories: constraints, motivators, designing spaces, designing services, building community and creating coherence. These are part of a layered structure, with subsystems, which is itself part of a wider system in which constraints and motivators affect the other four CSF categories, showing that the CSFs are interrelated and interdependent.

There are many parallels between the CSFs identified in the literature and in practice although similar categories can be broader or smaller in either. Also, even though they use the same terminology, they may not always mean the same things. An FD addition to the current literature is the acknowledgement that the environment, with its constraints and motivators, cannot be fully separated from the system. It is an open boundary and the precise location of that boundary may differ per campus and change over time.

FDs are very aware that they cannot force these interactions to take place, they can only be facilitated. They emphasise the role of the environment and put the value of the CSFs in perspective, as they operate on a complex playing field. This provides us with a richer view of the CSFs that influence interaction through campus design. Respondents clearly state that although interaction should take place on the campus scale, the scale of the interaction itself is always on the individual level. The present authors, therefore, suggest that the movement between the different levels of scale needs to be as comfortable as possible, which is where FDs can really add value. Further research on where these interactions take place and how a campus user moves between these different levels of scale could further support FDs in the future.

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