

THE ROLE OF FACILITIES MANAGEMENT IN BUILDING PROJECTS

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Abstract

One of the problems in the building industry is a limited degree of learning from experiences of use and operation of existing buildings, when new building projects are planned. Can the development of professional Facilities Management (FM) be the missing link to bridge the gap between building operation and building design and what role can facilities managers play in this context?

This is one of the research themes in the new Centre for Facilities Management – Realdania Research in Denmark, which is investigated in two ongoing research projects. One project investigates the theme in relation to building projects in general based on a knowledge management approach. The other project investigate Public-Private Partnerships (PPP) with the focus on the possible effects that the inclusion of public building projects in a PPP contract may have in relation to FM.

Based on a theoretical model and preliminary results from the ongoing research projects the paper will discuss the role of facilities managers and FM knowledge in relation to building projects and propose possible improvements to the learning circle from experience of use and operation of existing building to the planning of new building projects.

Keywords: Facilities Management, theoretical model, knowledge transfer, building process, Public-Private Partnerships

INTRODUCTION

Many users of new buildings experience problems with the quality of the buildings, both in relation to the basic usability for the end users and in relation to difficult operation and maintenance for the professional users like facilities managers and the service staff. There is a lot of anecdotal evidence of this, but it is not an area, which has been much researched. However, an ongoing Danish research project has given some documented evidence and examples of such problems and also indicates that the reason is not a lack of knowledge about how to prevent such problems. This apparent paradox is caused by a number of different barriers, which are identified in the project together with a number of possible solutions in the short term and long term (Damgaard and Erichsen, 2009).

One of the major barriers is the strong focus on the capital investment and the lack of focus on the life cycle cost in building projects. Public-Private Partnership (PPP) is often seen as possible solution to ensure that considerations for the whole life cycle of buildings are taken in the building process. However, this is also an area which has not been much researched, but another Danish research project has been started to investigate to what degree PPP is a relevant solution (Kristiansen, 2009).

Both research projects are concerned with the role of Facilities Management in the building process. Facilities Management (FM) is in a European standard defined as “integration of processes within an organization to maintain and develop the agreed services to support and improve the effectiveness of the primary activities (CEN, 2006). This paper will present a new theoretical model for knowledge transfer from FM to the building process. The model will be tested and discussed based on preliminary results from the two research projects.

The theoretical model was developed by the first author, who is director of the Centre for Facilities Management – Realdania Research (CFM). CFM was started as a virtual national research centre with an administrative base at the Technical University of Denmark in 2008. The second author is project manager of the research project on Implementation of FM knowledge in building projects and the thirds author is project manager of the research project on Public-Private Partnership and procurement of FM services. Both research project are part of CFM’s project portfolio.

METHODOLOGY

The methodology is described in this section subdivided in paragraphs for the development of the theoretical model, for each of the two research projects, and finally for the method used to develop this paper.

The theoretical model

The theoretical model has been developed in several steps. The first part includes what in this paper is called “Front end knowledge transfer from FM to the building process” (shown as the left part of figure 1). This part was developed in 2008 from a combination of a literature study on the relation between FM and the building process, a major case study with participatory observation on a huge building project for the Danish Broadcasting Corporation (Jensen, 2007) and a research project on FM best practice with 36 case studies from Denmark, Norway, Sweden, Finland and Iceland (Jensen et al, 2008). The first part of the model was presented in a conference paper (Jensen, 2008) and is included in an article in a scientific journal (Jensen, 2009a). It has been slightly modified in this paper.

An essential aspect of the model is the concepts of continuous briefing and continuous commissioning (shown in figure 1 and 3). The idea to combine these concepts was developed in the beginning of 2009 as part of the preparation of a paper for a keynote speech on HVAC and FM (Jensen, 2009b). The last part of the model in the present form is called “Back end knowledge transfer from FM to the building process” (shown as the right part of figure 1), and it was based on an analogy to the first part and an idea of symmetry between briefing and commissioning. This was developed in spring 2009 as part of the preparation of this paper. Thus, the total model is completely new and is presented publicly for the first time in this paper.

Implementation of FM knowledge in building projects

The preliminary project started in 2008, and the project report was published in April 2009. The objectives of the preliminary project have been to (1) document the problem that: “FM knowledge is only to a limited extent implemented in new construction, reconstruction or renovation”; (2) establish an overview of the published literature on how FM knowledge can be transferred between projects and how it is implemented in projects and (3) to identify possible barriers and solutions for including FM knowledge in building projects (Damgaard & Erichsen, 2009). The project has mainly focused on large and complex building projects as these are experiencing the greatest difficulty in including FM knowledge in the building design process.

First both Danish and international literature has been studied to document the problem as well as to establish an overview on how FM can be transferred between and included in projects. The literature study has been supplemented by interviews with key informants with experience from public and private as well as small and large building projects to get a better understanding of the problem. The selection criteria for the key informants have been based on knowledge about implementation or lacking implementation of FM in the building design process. Based on this two focus group interviews with different network actors in the building industry were carried out to get their perspectives on the problem and to discuss barriers to knowledge implementation and possible solutions to overcome them. The literature study and interviews have been the basis for analyzing and identifying barriers for knowledge implementation and possible solution criteria. These results in relation to the theoretical model are presented in this article.

Starting in March 2009 a new research project based on the preliminary project is focusing on developing a model for implementation of FM knowledge in building projects. The project is divided into two sub projects. Sub project 1, led by University of Southern Denmark, is an interaction research project related to a new university building project in Kolding. Through interaction and observation in the building process of the new university building sub project 1 will analyze the building process, and which positive effects and barriers emerge when FM knowledge is being implemented in building projects. This will lead to a deeper practical understanding of the subject including the development of directions and a model for how to work with the implementation of FM knowledge in building projects.

Sub project 2, led by the consulting engineering company COWI, is a best practice project that delivers best practice examples related to the current university building project as well as the analysis of FM implementation in building projects. This is done through interaction with sub project 1 and discussions between experienced FM employees connected to the

project. The two sub projects are tied together by a bridge building function consisting of researchers from both SDU and COWI.

Public-Private Partnership and procurement of Facilities Management services

The project started in September 2008, is scheduled to finish September 2010 and involves one year of work. A committee with members from public authorities and construction industry with a particular interest in and knowledge about public-private partnerships, is giving advice to the project. The research includes theoretical studies on conditions for successful integration of facilities management considerations in planning, design and construction as well as case studies of examples of such successful integration.

The first phase of the project is now finished. Interviews were made with participants from all sides of the industry and public clients that had experience from the rather few PPP projects that have taken place in Denmark so far. And a literature review on PPP in general has been made. Results from this first phase have been documented in an unpublished working paper. The author has participated in a parliamentary hearing on investments in public traffic infrastructure with a paper and an oral presentation on experiences with PPP (Kristiansen, 2008). And the results from the first phase of the project have been presented at a CIB working group conference in Hong Kong (Kristiansen, 2009)

The idea of the research project is to look for the factors that in PPP projects actually lead to integration of FM considerations in the construction project, assuming that PPP in itself in spite of the incitements of the procurement model does not automatically lead to the intended integration. The results from the first phase point in the direction of partnerships as a possible positive factor.

The development of this paper

This paper is a result of a collaborative research work between the three authors. Based on the detailed description of the theoretical model below, the preliminary results from each of the two research projects concerning possible knowledge transfer from FM to the building process have been analysed to identify to which degree they can be categorized in relation the methods of knowledge transfer included in the model and to which degree they cannot be included in the model. Based on these analyses the model and the role of FM in the building process are discussed.

THE THEORETICAL MODEL

The knowledge transfer between FM and the building process is basically seen as a combination of knowledge push and knowledge pull. At the front end of the building process the knowledge mainly concerns the user organisation's requirements in relation to the building to be designed and constructed, while the knowledge at the back end of the building process mainly concerns the performance of the finished building.

The requirement push from FM at the front end can be divided in a competent involvement in the building design or knowledge codification. The term "competent involvement" is used, because research and experience shows that involvement does not have a positive effect unless it is combined with appropriate competences. The requirement pull from building design can be divided in increased awareness among client and/or designers and use of power by clients towards designers or by authorities towards clients and/or designers.

The combination of two forms of requirement push and two forms of requirements pull gives four methods of front end knowledge transfer from FM to the building process as shown on the left side of figure 1.

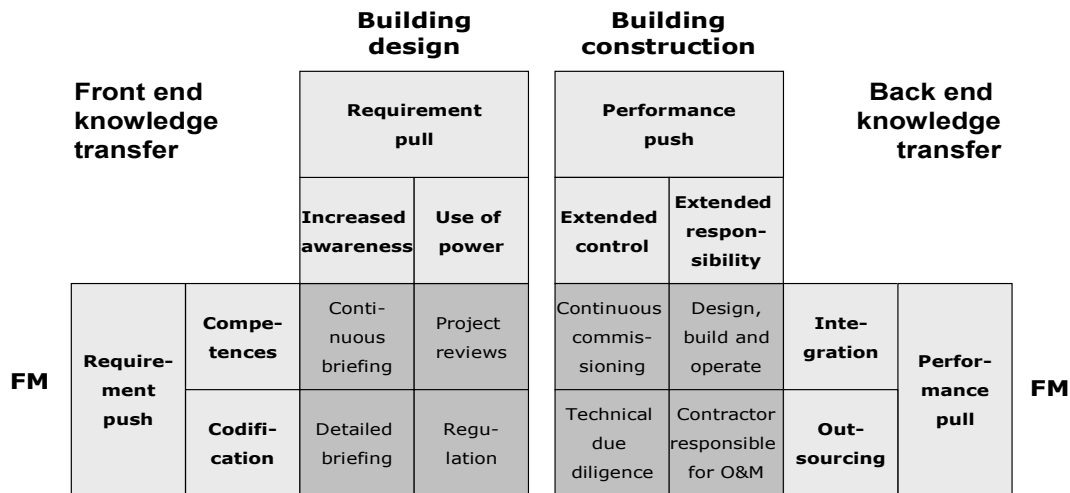


Figure 1: Model for front and back end knowledge transfer from FM to the building process

The four methods of front end knowledge transfer are:

- Involvement of competent facilities managers, users and/or FM consultants in a continuous briefing process during design, which can increase the awareness among clients and designers.
- Use of power by clients to ensure that designers take considerations for FM seriously by using the competences of facilities managers and/or FM consultants in control activities like projects reviews.
- Codification of knowledge from facilities managers, users and/or FM consultants in detailed briefs or tools like guidelines, checklists and databases, which can increase the awareness among designers.
- Use of power to make regulations to ensure that codified knowledge from FM is used by the design team, for instance state regulation for energy consumption and use of Life Cycle Costing (LCC).

The performance pull from FM at the back end can be divided in integration and outsourcing, while the performance push can be divided in extended responsibility and extended control. The combination of two forms of performance pull and two forms of performance push gives four methods of back end knowledge transfer from FM to the building process as shown on the right side of figure 1.

The four methods of back end knowledge transfer are:

- Integration of design, construction and operation in a process consortium with full responsibility (including economical risks) to deliver purpose built and facilitated accommodation to a client over a number of years
- Integration of experienced facilities managers and/or commissioning consultants in a continuous commissioning process in the design and construction process to ensure that the performance of the building is verified
- Outsourcing the responsibility (including economical risks) for operation and maintenance of a building or a system in a building to the contractor responsible for its construction over a number of years

- Outsourcing the responsibility (including economical risks) for operation and maintenance, for instance as part of a integrated FM contract to a FM provider, who as part of the handover carry out a technical due diligence to verify the performance of the building over a number of years.

In the following the concepts of continuous briefing and continuous commissioning will be explained further.

The term “continuous briefing” was introduced in Jensen (2006) as a way to describe a broader dialogue based briefing process as a contrast to the traditional more delimited and specification focused process. A comparison of the two briefing processes is shown in figure 2. It should be stressed that there is not one unified and generally accepted new way of briefing. Continuous briefing is used to capture various trends. In a recent book on Architectural Management the term “inclusive briefing” is used in stead of continuous briefing (Jensen and Pedersen, 2009).

The term ”continuous commissioning” is for instance used in an official American guide book on commissioning (US Dep. of Energy, 2002). The International Energy Agency, Annex 40 on Commissioning (Visier, 2004) gives this definition of commissioning:

“Commissioning is a documented way to diagnose and verify building systems performance, and to propose ways to improve the performance in compliance with owner’s or occupant’s requests. Commissioning is performed in order to keep the system in optimal condition through the life of the building from viewpoints of environment, energy and facility usage. The commissioning begins with pre-design phase and can be applied through life of building including all phases, which are pre-design, design, elaboration, construction and operation and occupancy phases.”

Traditional briefing	Continuous briefing
Concerns new building/construction	Concerns all client/user needs in developing facilities
A definite phase at an initial stage	A continuous process with changing focus in different phases
An expert based information collection	A guided learning and dialogue process
Users mainly involved as data sources	Users actively involved as part of a corporate change process
The result is a brief, i.e. a requirement specification	The result is acceptance of solutions based on a brief

Figure 2: *Traditional and continuous briefing*

A combination of the concept of continuous briefing and continuous commissioning in relation to a companies property development can be illustrated as shown in figure 3.

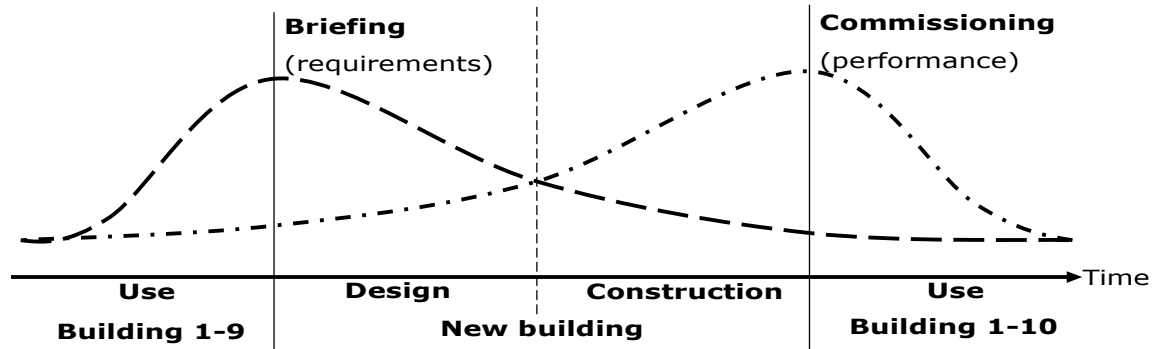


Figure 3: The pincer movement of FM on the building process

The briefing process takes place during the use of existing building as an ongoing capturing of requirements based on experience and changing needs. When the need for a new building evolves the briefing activity intensifies and has a peak around the start of the design phase, but continues as a dialogue with designers during the design phase and to a certain degree with designers and contractors during construction. When the new building is occupied briefing continues as an ongoing capturing of requirements in the extended portfolio.

The commissioning process has a similar development but with an opposite intensity. During the use of existing buildings it takes place as an ongoing optimization of building performance and when a new building project starts, the commissioning process of ensuring and verifying the performance of the new building begins and intensifies during design and construction with a peak, when the new building is occupied. When the initial building performance is verified, the commissioning continues as an ongoing optimisation of the extended portfolio.

PRELIMINARY FINDINGS

The preliminary findings are described in this section in relation to the theoretical model with paragraphs for each of the two research projects.

Implementation of FM knowledge in building projects

This research project documents that the problem of implementing FM knowledge in building projects is not because of lacking knowledge among project participants. Both analysis of FM literature and interviews with experienced key personnel within construction, building projects and Facilities Management shows that the reason why existing data and information is not turned into knowledge in building projects is rather because of a number of barriers for realizing knowledge (Kakabadse, 2003; Damgaard & Erichsen, 2009). In connection to the identified barriers, the project also points out some solution propositions that can prevent these barriers in relation to the theoretical model stated in this article.

The preliminary research project has identified four groups of barriers for why existing data and information about FM is not turned into knowledge and realized in building projects (Kakabadse, 2003; Damgaard & Erichsen, 2009). These barriers are:

Project related barriers: Building projects are subject to project related barriers. A building project can be characterized by huge complexity and temporary involvement of many different participants, with different focus and interests (Damgaard & Erichsen, 2009; Ford et al., 2003). The responsibility for FM and especially operations and maintenance is often not clear and consequently FM has a tendency to become reactive rather than proactive and strategically focused (Barrett, 2000a; Damgaard & Erichsen, 2009). These barriers point to the necessity of continuous briefing and continuous commissioning.

Structural- and legislative barriers: Structural and legislative barriers also causes considerations about FM to be down prioritized (Damgaard & Erichsen, 2009). The building client often has a focus on the capital investment which does not include FM costs (Damgaard & Erichsen, 2009). This investment focus affects the other project participants to adapt a short term focus on construction costs causing sub optimization in the project group. At the same time the tender rules for public buildings provides a legislative barriers that makes it difficult to transfer knowledge from one project to another as participants are often not the same. Project reviews and regulation can be methods to overcome these barriers.

Competence related barriers: Competence related barriers are an important reason for the lack of FM focus in building projects (Damgaard & Erichsen, 2009). The FM competences and communicative skills among FM personnel as well as building consultants and building clients differ very much and are often not adequate to include important FM issues in the design phase (Jensen, 2008). Competence among FM personnel along with group structure and relations between project participants are therefore seen as important factors for the lacking communication skills and efforts about FM in building projects (Sun et al., 2005; Damgaard & Erichsen, 2009). This underlines the focus in the model on competent involvement methods.

Sociological barriers: Sociological barriers can be characterized as the internal struggles for power in the project between different participants and views (Damgaard & Erichsen, 2009). FM often has a lower status among building client and architects, and combined with lacking competences and communication skills at the FM personnel this gives FM a lower prioritization. In different ways the back end knowledge transfer methods take this into consideration.

Based on these barriers the research project has analyzed how they can be overcome, which is presented in figure 4. The table presents the proposed solution criteria to the barriers as found in the research project and relate these to front end and back end knowledge transfer as described in the theoretical model. This will be addressed further in the discussion section below.

Barrier	Solution criteria	Front end knowledge transfer	Back end knowledge transfer
Project related barriers	Best practise	X	X
	Participation from building client and FM	X	X
	Life Cycle Costing	X	X
Legislative and structural barriers	FM in legislation	X	X
	Change in tendering rules	X	x

Competence related and sociological barriers	Visualisation	X	X
	Balanced expectations	x	x
	Partnering	x	x
	PPP	-	X
	Educating FM personnel	x	x
	Educating project participants in FM	x	x
	Quality focus	x	x
	Relationship and trust building	-	-

Figure 4: Barriers and solution criteria for knowledge transfer

X: Solution criterion supports knowledge transfer in theoretical model

x: Solution criterion partly supports knowledge transfer in theoretical model

-: Solution criterion is not included in theoretical model

Public-Private Partnership and procurement of Facilities Management services

In PPP projects the front end knowledge transfer from FM to the building process will be divided into two phases. During the competitive dialogue between the public client and the tendering consortia integration of FM considerations can be promoted both through demands from the public client and the inside work of competent FM consultants that can strengthen their influence through use of codified knowledge. Pressure from public regulations demanding for example use of LCC and low energy consumption will tend to promote this integration of FM. In principle the public client will have to restrict himself to performance demands and leave the development of specific solutions to the bidding consortia.

When the contract between the chosen consortia and the public client is signed the integration of FM will be handled solely by the team and the subcontractors. The consortium will take most of the economic risk for delivering the building and the related services. Front end knowledge transfer can continue during this phase as project reviews and detailed briefing but also as competent involvement, if the project team wants to involve users and the public part in the design process. Back end knowledge transfer should have ideal conditions in PPP projects that by definition have design, construction, ownership and operation integrated in one consortia and where the responsibility is outsourced from the public client.

However the preliminary results from the research project indicate that a number of factors tend to limit the actual integration of FM in PPP projects. The interviews demonstrated that because of the cost structure integration of FM can only lead to minor cost reductions compared to for instance financing. It was also said that a proposal will win because of its general appeal including many aspects, not because of a promising integration of FM. And that innovation increases the risk, meaning that there will be good reasons for preferring well known solutions. Cultural differences were said to be a barrier for integration of FM. And that the space for innovation is very limited when the service package is restricted to operation and maintenance, which is the case in the Danish PPP projects.

These points of view from the Danish PPP community seem to be supported by the scientific literature. Leiringer states that innovation in PPP's are hindered by the influential role of the financial part and the tendency to transfer as much risk to the private part as possible

(Leiringer, 2006). Johnstone has observed fundamental cultural differences between construction and FM. (Johnstone, 2007) Brady emphasizes that integrated delivery of products and services is a radical change that takes many years to develop (Brady, 2005).

The preliminary results of the research indicate that PPP in itself does not automatically lead to integration of FM considerations in planning, design and construction of buildings. This links the issue of integration of FM in PPP's to the continuing discussion on the limits of a project based production in relation to developing partnering, partnerships, collaboration, supply chain management, relationship management, innovation, learning, product development, user orientation and other initiatives that tend to link the project based activities with the business processes of the firm (Gann, 2000).

DISCUSSION

The solution propositions in figure 4 addressing project related, legislative and structural barriers in the research project to a large extent supports the methods for front end and/or back end knowledge transfer in the theoretical model. In general there is a growing focus on professionalization and integration of FM in building projects symbolized for example by an increased outsourcing of FM services, FM consultancy services and new ways of collaborating in building projects (Damgaard & Erichsen, 2009). This supports both the concepts of continuous briefing and continuous commissioning as front end and back end knowledge transfer in the theoretical model.

A solution to force building projects to include FM consequences is to use LCC principles as a way to bring in codified knowledge. But even though regulation makes the use of LCC in public building required, the fact that building responsibility and FM responsibility often are separated makes it likely, that the cheapest alternative is selected, if the financing part is not willing to increase the fixed budget. Furthermore it can be argued that lack of knowledge about calculation methods and materials etc. as well as knowledge of which FM tasks to include in the calculations can hold back the use of LCC. In PPP-projects the FM provider can use his position as part of the client consortium to enforce the use of LCC as a tool to support the implementation of considerations for FM in the design process.

These tendencies clearly address project, legislative and structural barriers and may also bring competence into projects and thereby break down sociological barriers. But in order to bring in codified knowledge such as detailed briefs, FM guidelines and cost calculations, it also requires a better education and preparation of the project participants in understanding how the building project is structured, responsibilities of project participants and not least the importance of considering FM tasks for the future building (Damgaard & Erichsen, 2009). A lot of this knowledge of FM is characterized as tacit knowledge connected to individual persons in single projects, which makes future projects dependent on the participation of the right individuals in terms of FM knowledge (Nonaka et al., 2000; Kakabadse, 2003).

Therefore an emphasis must be put on making this knowledge explicit, but an underlying factor for successful implementation of processes and structures supporting this is to build relationships and trust in the project group and by making all project participants aware of their own project role in relation to decisions about design including FM (Damgaard & Erichsen, 2009). The research offers different proposals for this, e.g. visualization of

operations & maintenance costs for different scenarios regarding material and technical installations etc.

A way to build trust between participants on short term is through partnering and balancing expectations based on an open discussion between project participants about building objectives and agreeing on these from the beginning (Damgaard & Erichsen, 2009). In a wider context trust may only be built through long term experience and relations between project participants across several projects (Barrett, 2000b). This is possible in private building, but can be difficult to achieve in public building due to the public bidding form. Even though PPP by definition involves partnerships between public and private partners, it is just as much dependent on real partnerships among the different private partners in the consortium.

The model only indirectly takes the need to increase the competences in relation to understanding considerations for FM among all participants in building projects into account. However, this is a prerequisite both for increased awareness among building clients and designers, for competent involvement of facilities managers and for extended control activities.

CONCLUSIONS

The research presented in this paper shows that there are a number of barriers for facilities managers and FM knowledge to be integrated in building projects. However, the research also shows a number of possible solutions to improve this situation. Several new models of collaborations give more incentives towards more holistic thinking of buildings' whole life cycles. PPP is one of these models, but PPP does not necessarily lead to more integration of FM in building projects.

The theoretical model presents a new way of looking at knowledge transfer from FM to building projects by introducing the concepts of front end knowledge and back end knowledge transfer. The two research projects provide evidence that this represents a sophisticated and useful way of looking at the different mechanisms of knowledge transfer. It also changes the often dominating focus on requirements towards a more balanced view on requirements and performance as complimentary concerns of the building clients, users and facilities managers.

The model presented here is not seen as a final version but as a preliminary result part of an ongoing development. At the moment the model in figure 1 is very much divided in the front end and the back end part, but how these two parts relates to each other and can be combined should be clarified. The analogy and symmetry between continuous briefing and continuous commissioning shown in figure 3 gives a relation to the building process over time, which could be a basis for a further development of the whole model. Any comments and input to such a development of the model is very welcome.

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