

# A THEORY OF WORKPLACE PLANNING: GENERAL PRINCIPLES AND A MANAGEMENT STEERING MODEL

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## ABSTRACT

This paper presents a theory of workplace planning and a steering model to support the management of the facility planning process. The theory links workplace planning to production, not only to construction production, but also to the organization's general strategy. A spatial investment in an operation competes for the same resources as the other investments in the operations. Spaces are the scene of a temporal flow of operations and non-use time. If waste of space for unneeded operations and waste of non-use-time can be reduced, more resources will be available for the other investments in operations, spatial or non-spatial.

In the TFV theory of production value generation is viewed as a process where value for the customer is created through fulfillment of his requirements. This research suggests that also requirement identification should be included in production. Workplace planning is a process where valuable requirements for workplace production are determined through evaluating the values of stakeholders against the organization's strategy. The product of workplace planning for the rest of construction is the stakeholders commitment.

The customer workplace is linked to a complex social system. The proposed steering model is based on dialogue between strategic and operational management. It is an application of closed loop control which operates on rapid feedback between stakeholders. The process encourages learning, group working and transparency. The steering model includes a procedure that models the customer's need for space based on the temporal and geometric factors. It gives the room schedule, functional possibilities and utilization degrees. It underlines accountability between decisions and outcomes. Achieving a final commitment of an organization is an iterative process of commitments, withdrawals and new approaches. The commitment drivers have been studied for steering model purposes.

## KEYWORDS

Commitment, complex systems, customer purpose, management steering, project definition, value generation, workplace planning.

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## **INTRODUCTION**

Programming concepts often identify workplaces in relation to design. In the corporate real estate business, workplace planning is treated as a function of the operational process; use of space is integrated into core business operations. Workplace planning allocates resources in relation to the working environment, its users and organization's strategy (Horgen et al.). The driver of allocation is value for operations or value for strategy. The concept of value has been studied in production theories. Production theories aim to improve the production process and the value of the product (working environment) to the customer (Koskela 2000). The following workplace planning is studied through concepts of production.

Production concepts state that "variability is the universal enemy" (Schonberger 1986). Complexity should be reduced, less variables, less steps in production! On the other hand, concepts of complexity state that if there is big variance in the controlled system, the destruction of the system can be avoided only if there is large variance in the controller (Ashby 1956). Workplace planning is linked to a social system and social systems are complex by nature. Some degree of complexity has to be accepted and some degree of variability is needed in the workplace planning process. Managing complexity in parallel with reducing complexity should be added to the production theory. The theory of workplace planning has to meet the uncertainty that arises from the variability in values of people in the organizations.

The principles and the methods of the theory of workplace planning is described as a steering model of workplace planning. By following this model different types of organizations are able to manage their workplace requirements on the basis of strategic and operational information. The steering model is an application of cybernetic closed loop control. The "steersman" is made up by an organized dialogue between strategic and operative management.

## **CONCEPTS OF PRODUCTION AND COMPLEXITY MANAGEMENT**

Historical analysis reveals that three different conceptualizations of production have been used in practice and conceptually advanced in the 20th century (Koskela, 2000).

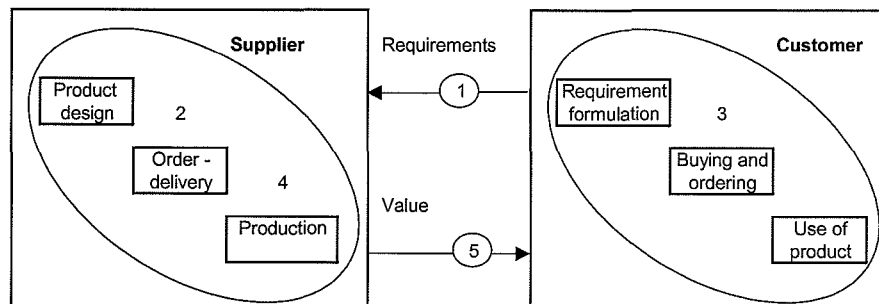
- In the first conceptualization, production is viewed as a transformation of inputs to outputs.
- The second conceptualization views production as a flow, where, in addition to transformation, there are waiting, inspection and moving stages.
- The third conceptualization views production as a means for the fulfillment of the customer needs.

## **THE VALUE GENERATION CONCEPT**

Workplace planning is strongly linked with value generation for the customer. The concept of value generation focuses on the interaction between a customer and a supplier. It is not the

transformation itself that is valuable, but the fact that the output corresponds to the requirements, wishes, etc., of the customer (Koskela 2000).

There are five principles which cover the cycle of value generation. They are illustrated in Figure 1.



Notes: 1. Requirement capture. 2. Requirement flow-down. 3. Comprehensiveness of requirements. 4. Capability of production subsystems. 5. Measurement of value.

Figure 1. Principles related to the value generation concept (Koskela 2000).

## COMPLEXITY MANAGEMENT

Drucker (1989) argues that the value of the product can be determined only in reference to the customer. “The result of business is a satisfied customer” (Drucker 1989). He proposed a conceptualization of production that incorporates the customer.

Workplace planning is linked to a complex social system. In the initial stage of workplace planning in a multi-user organization the customer is divided into many departments all having an operative responsibility linked to the organization’s strategy. These departments compete for the same resources. In the initial stage of workplace planning the outcome is not known, nor is there any quality specification against which success can be measured in a deterministic way. Instead, there are a lot of specifications and wishes, many of them in contradiction to each other and, when combined, they are generally in serious competition for the resources available.

In the value generation concept the needs and wishes of a customer are condensed into a specification of the product, and the specification controls the value generation. Actually, something has happened before. The client has already identified the valuable requirements and condensed them into a specification. This identification is in a black box in current value generation concepts. As far as complex social systems are concerned, valuable requirements identification and complexity management must both be added to the current value generation concept as a part of production.

There is much uncertainty and many iterations in design (Koskela 2000). There may be also much uncertainty and many iterations in the valuable requirements identification. If we combine iterations of valuable requirements identification with the iterations of the design, the amount of iterations would expand enormously. It might be asked: could the space for an activity, that in the end proves superfluous, be located in the basement, as in this sketch or on the third floor, as in another sketch? This kind of decision making is very slow and

expensive. Complexity is unnecessary if an enormous amount of complex variables that are orthogonal (not having interaction with each other) are combined.

Complexity management can be simplified if we observe internal customer relationships in production. The rest of the production can be considered as a customer of the valuable requirements identification process. The next internal customer would be design. In design, the project requirements are translated into a design solution. In production, this solution is realized. Vague requirements of the stakeholders harm design (and production). Design (and production) require the elimination of uncertainty regarding stakeholders' requirements.

Workplace planning (the identification of valuable requirements in the construction industry) does not aim for an optimum because an optimum does not exist in a complex system. It aims for a "good" solution. There are numerous working environment solutions that can be considered acceptable. What is the criteria that differentiates the chosen solution from the bad ones and from the other good ones? It is the *commitment* of the participants to something achieved. The product of value identification process for the rest of production is the stakeholders commitment.

Indeed, stakeholders' commitment to the common values and requirements is an absolute necessity in all production to enable value generation. Thus it is a crucial part of the production.

#### **VALUE GENERATION CONCEPT AND COMMITMENT**

In a complex social organization there are many participants with many values. The different values may all be "right" but when combined cause disturbance to production. Is there a framework in which the stakeholders commitment to common values in a specific production case can be achieved? The purpose of the organization is determined by the organization's strategy. The identification of valuable requirements must be done in the context of the organization's strategy.

Shewhart presented value generation with the customer-supplier relationship (Shewhart 1931). Many production tasks, e.g. design, may be done by the organization under the direct control of the customer (the customer organization itself or the consultant). The valuable requirements identification process is also a part of production, and is mainly carried out by the customer organization. In a complex environment the value generation concept must incorporate the customer directly in the production decision making process in order to manage (and reduce) complexity, as shown in fig. 2. The customer communicates with the production parties and commits to production requirements by evaluating potential values to his strategy.

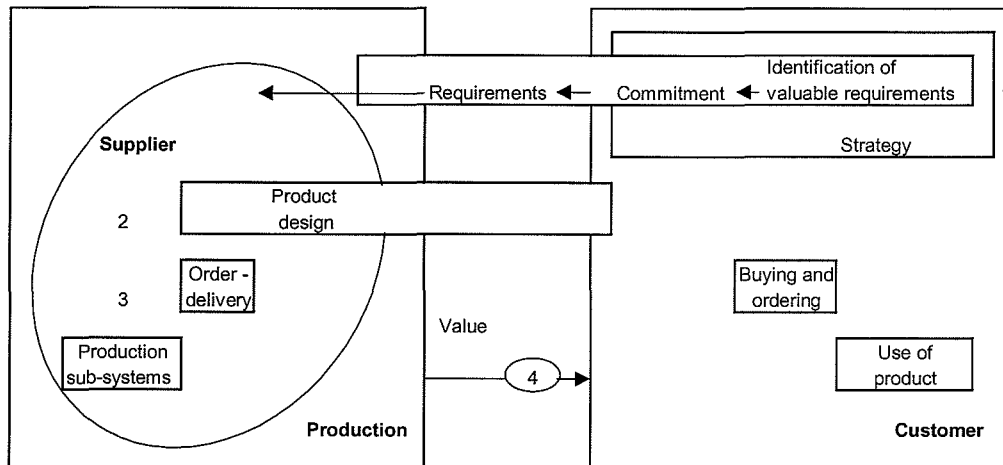


Figure 2. Principles related to the value generation concept in complex environment.

## COMMITMENT

### CONCEPTS OF COMMITMENT

An actor, e.g. operative or strategic manager, might be committed to a project or organization in four forms or archetypes (Abrahamsson 2002):

1. **Affective commitment:** refers to an actor's attachment to, identification with, and involvement within the respective entity (an organization, a project...) (Meyer & Allen 1991).
2. **Continuance commitment:** refers to an awareness of the costs associated with leaving or abandoning the respective entity (e.g. aborting a project) (Meyer & Allen 1991).
3. **Normative commitment:** reflects a feeling of obligation to continue membership with the entity in question (e.g. a project) (Meyer & Allen 1991). As normative commitment may only last until the "debt" is regarded as paid, it is to be subject to be lost later on.
4. **Instrumental commitment:** refers to a form of involvement for specific, extrinsic rewards (O'Reilly & Chatman 1996). E.g. a manager is not committed to the project goals because of personal recognition, but due to a desire to derive benefit and avoid punishment.

### Commitment Process

An individual's commitment changes continually. This change in commitment has been studied in a Information Systems project (Newman & Sabherwal 1996). The individual stakeholders are committed to their various different goals during the initial stage, so there may be conflicts between goals, personnel etc. To find a new target for mutual commitment, new approaches must be identified. Achieving a final commitment of an organization is an iterative process of commitments, withdrawals and new approaches.

## **Commitment and Workplace Planning**

What archetypes of commitment are interesting to a workplace planner?

- Workplace planning seeks common goals in a complex social system. If instrumental commitment is used, the goal should be determined first (tamed complexity) and a reward should be set for achieving that goal later. It would mean tamed complexity.
- To be effective, normative commitment has to be built into an organization before workplace planning starts through the socialization process. A newcomer to an organization learns what is valued and what is expected of a novice by that organization. Then he/she learns to behave in an acceptable manner. A workplace planner can not create it within a limited time.
- Previous investments, financial or mental, affect continuance commitment. Workplace planning is usually done at a very early stage. Continuance commitment in the beginning is rare but, of course, it is possible at the end of the process.
- Affective commitment may be created or strengthened in the beginning and during the workplace planning. It is worth concentrating on variables affecting affective commitment.

Work experiences are seen to play the most important role in the development of affective commitment toward a commitment target. Following variables have been found to be important: (Meyer & Allen 1997):

- support and stimulate strategic and operative managers to participate in decision making
- decentralize the decision making to the levels where responsibilities are met
- be transparent in terms of information handling
- treat all information equitably, regardless of its origin

These characteristics must be constructed in an iterative steering model because previously committed stakeholders need an opportunity to commit to common goals.

### **THE THEORY OF WORKPLACE PLANNING**

The workplace planning theory links workplace planning to production, not only to construction production but also to the organization's general strategy. The theory is a combination of TFV-concepts of production.

### **THE CONCEPT**

The purpose of the organization is determined by the organization's strategy. The strategy is realized by the operations.

## Value

A spatial investment in an operation competes for the same resources as the other investments in the operations. Workplace planning brings spatial investments and values concerning the spaces into line with the other factors of production. Workplace planning is a process where valuable requirements for workplace production are determined through observing and evaluating the values of stakeholders against the organization's strategy. The product of workplace planning is the stakeholders commitment to the spatial needs of the operations.

## Transformation

The size of a space is dictated by the operations (transformations) taking place within that space and these operations can be decomposed to sub-processes which are also operations.

## Flow

Spaces are the scene of a temporal flow of operations and non-use time. The number of spaces is due to the temporal utilization of the spaces.

## The Principles

Spatial investments in operations that are not needed for the organization's strategy are not value-adding and therefore are waste.

The operations time is value adding whereas the non-use time is not value adding to the strategy. Non-value adding time is waste and should be reduced or removed. Temporal waste can be removed by following these principles:

- Combine diverse activities into the same working environment.
- Plan spaces to be flexible enough to support diverse activities.
- Combine similar activities of separate operational departments to same environment

If waste of space for unneeded operations and waste of non-use-time can be reduced, more resources would be available for other investments, spatial or non-spatial.

The value of a spatial investment in an operation cannot be predicted based on the initial information. decision making is linked to complex economic-technical-social systems. Commitment to common values can be achieved via iterative steering concepts of complex social systems (Fig 3).

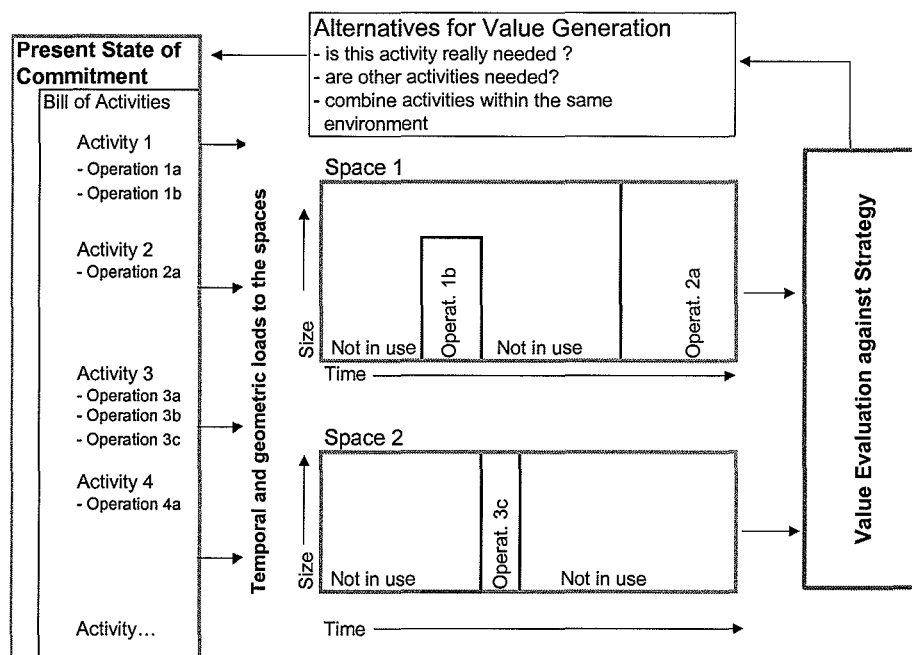


Figure 3. Workplaces as a transformation/ flow /value generation process.

The activities take place in spaces as operations. The size of the space is dictated by what operations an activity requires. Temporal flow in a space is a mixture of operations-time and non-use-time. If waste of space for unneeded operations and waste of non-use-time can be reduced, more resources would be available for other investments, spatial or non-spatial.

## THE STEERING MODEL OF WORKPLACE PLANNING

The steering model is a mode of action that systemizes the organization's decision making actions, produced information and specific methods in accordance with workplace planning theory. By following this model different types of organizations are able to manage their workplace requirements on the basis of strategic and operational information.

## THE STRUCTURE OF THE STEERING MODEL

Workplace planning is linked to a very complex system; sets of goals, a wide range of needs, different viewpoints of the owner and user etc. Even though in strategic workplace management there is no one correct answer, there are certain limitations on decision making



that can not be exceeded. The most important points are economic and temporal limitations. The system needs a damped feedback system to keep it in balance. New viewpoints and creative ideas will be welcome if they produce new alternative solutions in an area possible to business. An individuals commitment changes continually. An iterative dynamic system would support participants' commitment towards common goals (Newman & Sabherwal 1996). The Steering Model for Workplace Planning is an application of cybernetic closed loop control.

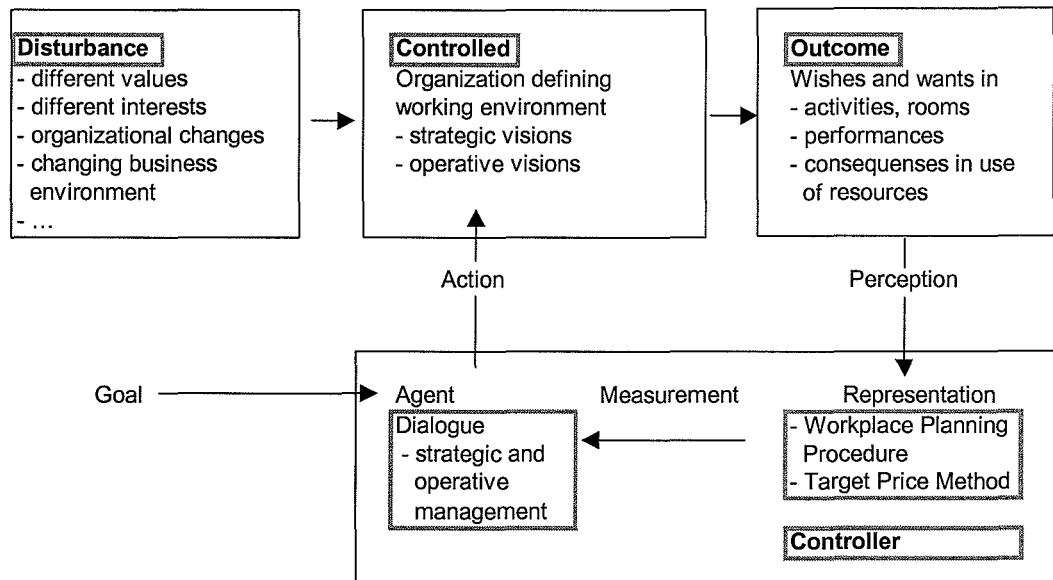


Fig. 5. Closed loop control adjusted to workplace management

## **Controlled System**

Controlled system is the organization's definition of its working environment. The organization must be organized for workplace planning so that strategic decision makers and operative decision makers ("collecting points for decisions") are represented and identified. They will represent the whole organization during the dialogue and value generation.

## **Disturbance**

Disturbance comprises everything that causes complex variation in the outcome. Disturbance is normally linked to

- different values of the stakeholders
- organizational changes
- changing business environment

## **Controller's representation**

The controller's representation measures system's outcome. It is built up of two mathematical models to create information for dialogue, namely The Workplace Planning Procedure and The Target Price Method.

## **Dialogue**

Dialogue is the steersman which is responsible for the actions. In transparent dialogue, strategic and operational management examine the workspace environment from their own positions. Operative management looks for functional rooms for the operations they are responsible for. Strategic management maps the activities that the business idea requires. Achieving final commitment of an organization is an iterative process of commitments, withdrawals and new approaches. Dialogue is a way to find new approaches and to stimulate managers to transparent decision making.

## **The Workplace Planning Procedure and Target Price Method**

The controller consists of a representation of a controlled system. The representation is composed of two mathematical models:

- the Workplace Planning Procedure
- the Target Price Method (Haahtela-Kiiras 2003)

In the workplace planning process the client does not dictate the spaces and areas that he or she requires but describes the activities that he or she needs. The Workplace Planning Procedure supplies dimensions for the working environment and lists it as spaces required.

The Target Price Method calculates the budget based on the rooms and the requirements for those rooms. The Target Price Method is a mathematical model that creates the link between the requirements the client sets on the rooms and the possible distribution of elements + use of resources connected to running costs (energy, cleaning...). The budget can then be addressed back to the activities by tracing paths back in the Workplace Planning Procedure. After measurement the client knows the current or desired state of the system;

what kind of working environment it would be, which resources the environment demands and what activities cause them.

During the process participants develop alternative solutions, reshape the corporation's activities and working models. These changes can be added to the workplace planning model for present and future use (principle of learning).

### **Agent**

The dialogue is led by an agent, a professional with experience of the steering model and the required procedures. The agent is aware of the goal. The agent compares the current representation with the goal and suggests actions which will minimize the differences between them. Therefore purposeful behavior by the controller is represented by an agent.

### **Goal**

The goal is based on a client's business plan. The spatial environment must support the corporation's basic idea. Before the workplace planning process, the client and the agent describe the most important goals of the corporation (e.g. core activities required and constraints in economy and time). Some goals are easy to understand and compare with, e.g. money that can be spent. Some goals are described with organization's strategy language and thus they are not unambiguous benchmark for comparison. It is the dialogue's duty to evaluate whether a working environment for an activity is worth investing for the strategy or not. The goal is not necessarily a constant fact in a complex social system, sometimes workplace planning leads to change strategy in some parts.

## **THE WORKPLACE PLANNING PROCEDURE**

The Workplace planning procedure is a Web-based application programmed in Haahtela-kehitys Oy. Wide applicability of the workplace planning procedure requires a theory of spatial requirements, which adequately describes the variability in the usage of space. The horizontal geometric quantification can be made accurately with the help of the following factors:

- the total volume of the functional sector
- the activity bill programmed for the sector
- the time strain of activities and targets for the use of time in the space
- the geometry of the people working and the objects to be placed in the space
- legislation, instructions, norms.

Table 1 illustrates the nature of the quantitative model.

Table 1 Space Quantification Example

Quantification Variable	Description	Example of Education Institution
The total volume of the sector.	No. Of Customers or Products. Floor space per group size.	Two hundred design students.
The activity bill programmed for the sector.	Core Services. Supporting Services.	Teaching & Research. Administrative activities. Dining.
The temporal strain of functions and goals for the use of time in the space i.e. operating degree.	Temporal Strain.  Operating Degree.	Teaching Design Theory 2 hours per class, three times a day equals a 6 hr temporal strain on the classroom. If the teaching class has a 50% operating degree, then 4 hours are available. Another classroom will be required.
The people working and the geometrics of the objects to be placed in the space.	Each function requires space expressed as a performance result.	Lecturer requires 10sq. Meters of lecture area. Students require standard 1sq. meter workspace.
Regulations.	A society defines regulations to the quantification of space.	A basketball court have certain dimensions

Consider an education institution that operates in a teaching facility. The volume for the sector is the number of students learning in the facility. This serves as the driver for determining service levels for the learning space. The Activity bill is a description of the core and supporting activities that are employed to ensure that the organizational goal is fulfilled. The core and supporting function take form in operations; e.g., teaching and research functions. These operations occupy a space or a part of a space for a unit of time. The time strain on a teaching classroom may be two hours per class. The space may have a number of classes scheduled during a specified operating period. An expected level of efficiency for the space affects the quantity of spaces and the flexibility of functions requiring the use of the space. The operating degree specifies how flexible the space needs to be. Low operating degrees provide good flexibility but require extra spaces to accommodate the strain. Functions are defined in appropriate hierarchies to define activities and actions occurring in the space area or volume. A student may require 1m<sup>2</sup> of study space to perform his/her actions. Regulatory specifications are included in this model as necessary.

### WORKPLACE PLANNING IN PRACTICE

The Workplace Planning Theory states that a spatial investment in an operation competes for the same resources as the other investments in the operations. If waste of space for unneeded operations and waste of non-use-time can be reduced, more resources will be available to the other investments for operations, spatial or non-spatial. Seeking for alternatives in value generation is an allocation process. Allocation deal with the questions

- can activities be combined within the same environment?

- is the activity really needed ? Compared to the others ? Are other activities needed ?

An example of combining activities within the same environment is the case of Arcada Health Care Labs. The health sector wanted a clinical treatment lab, a polyclinic treatment lab and a maternity ward lab, which, according to the Workplace Planning Procedure feedback, would require altogether 134 m<sup>2</sup> of space and would all be in very low use (Fig 6).

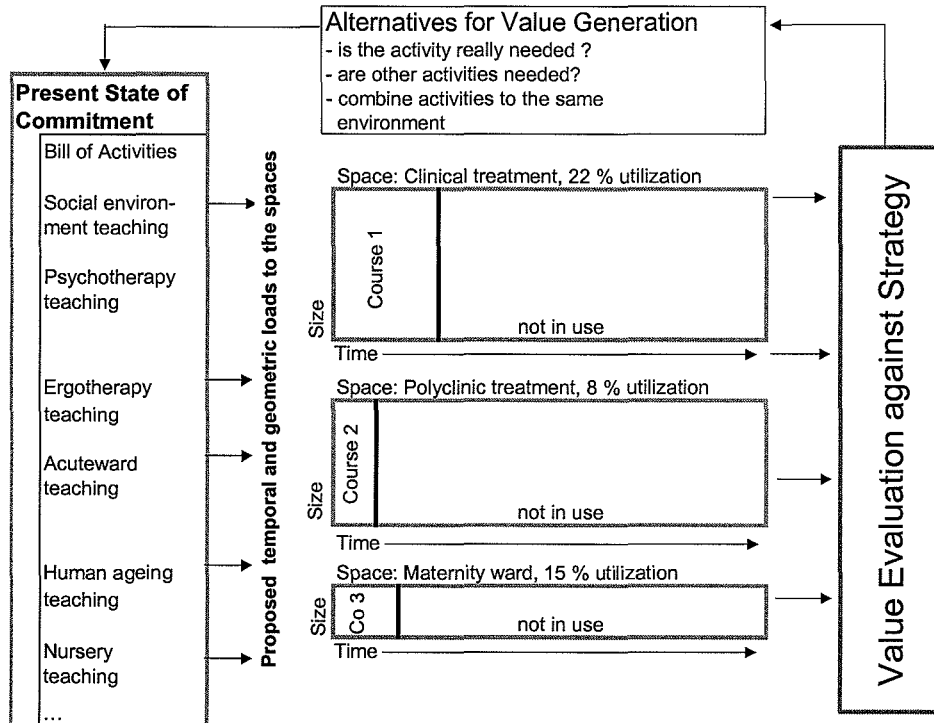


Figure 6 Flow/transformation of labs in Arcada Polytechnic before value evaluation.

Much of the investment would have been wasted, as there would have been a great deal of temporal waste. On the request of strategic management the workplace planning team started to look for similar environments (actions) among the labs. The clinical treatment, polyclinic treatment and maternity ward labs were similar (ward type, people in beds, working at benches, need of for water supplies...). Ward type activities were combined within the same working environment. The internal functions of the environment (actions) were studied and re-planned to suit for all activities. The room size 75 m<sup>2</sup> (4 beds, storing capacity, workbenches, rocking chair for maternity ward) was adequate for operative managers.

Value generation of workplace planning is shown in Fig. 7 concerning these health care sector labs. Activities in the clinical treatment lab, polyclinic treatment lab and maternity ward lab were combined within the same Ward-type activities lab. The need for space decreased from 134 m<sup>2</sup> to 75 m<sup>2</sup>. All the activities can still be supported; the utilization degree is only 45 %.

The building costs have been reduced in all cases when allocating resources to activities (even though it has not been always the aim of the workplace planner). In the case studies the Workplace Planning Steering Model has reduced waste (Whelton 2004).

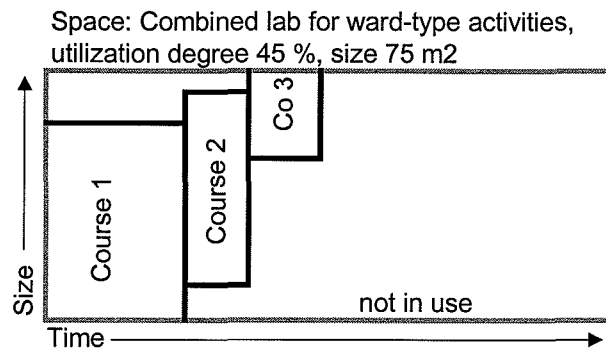


Figure 7. Flow/transformation of labs in Arcada polytechnic after Value Evaluation.

## CONCLUSIONS

This paper presented a theory of workplace planning and a steering model to support the management of the facility planning process. The theory links workplace planning to production, not only to construction production, but also to the organization's general strategy. The theory is a combination of TFV-concepts of production:

- The size of a space is dictated by the operations (transformations) taking place within that space (transformation concept)
- Spaces are the scene of a temporal flow of operations and non-use time. The number of spaces is due to the temporal utilization of the spaces (flow concept).
- Workplace planning is a process where valuable requirements for workplace production are determined through observing and evaluating the values of stakeholders against the organization's strategy (value concept)

The operations and operations time are value adding whereas the non-use time is not value adding to the strategy. If waste of space for unneeded operations and waste of non-use-time can be reduced, more resources would be available for other investments, spatial or non-spatial.

The customer workplace is linked to a complex social system. Eliminating complexity would mean eliminating the customer. This paper proposes complexity management instead of complexity elimination to be included to the value generation concept of the production. Workplace planning is a valuable requirements identification process and the next internal customer in the process is design. Design require reducing uncertainty regarding stakeholders' requirements. The product of value identification process for the rest of the production is the stakeholders' commitment to the common goals. Valuable requirements identification must be considered as part of the production and this also incorporates the customer directly to the production in order to manage complexity.

The proposed steering model is based on dialogue between strategic and operational management. It is an application of cybernetic closed loop control which operates on rapid damping feedback between stakeholders to keep the system in balance. The process encourages learning, group working and transparency. Achieving a final commitment of an organization is an iterative process of commitments, withdrawals and new approaches. The steering model needs methods to produce feedback information. The workplace planning procedure uses user activities as input data and returns the spaces needed and their temporal utilization. The target price method transfers the spaces to life cycle costs by using required performances as input data. Methods connect power to accountability.

## REFERENCES

- Abrahamsson, P. (2002). The role of commitment in software process improvement. University of Oulu, Department of information processing science. Oulu. Internet (2002): <<http://herkules.oulu.fi/isbn9514267303/>>
- Ashby, W. Ross (1956). *An introduction to cybernetics*. Chapman & Hall, London. Internet (1999): <<http://pcp.vub.ac.be/books/IntoCyb.pdf>>
- Haahtela, Y. & J. Kiiras (1980). *Rakennuttajan ja suunnittelijan kustannustieto*. Insinööritieto Oy. Helsinki (in Finnish only)
- Horgen, T.H.; M.L. Joroff; W.L. Porter; D.A. Schön (1999). *Excellence by design, transforming workplace and work practice*. John Wiley & Sons, Inc
- Koskela, L. (2000). *An exploration towards a production theory and its application to construction*. VTT Publications 408, Espoo, Finland.
- Meyer J.P. & N.J. Allen (1991). *A three-component conceptualization of organizational commitment*. Human Resource Management Review 1: 61-89.
- Newman M. & R. Sabherwal (1996). *Determinants of Commitment to Information Systems Development: A Longitudinal Investigation*. MIS Quarterly 20: 23-54.
- O'Reilly C. & J. Chatman (1986). *Organizational Commitment and Psychological Attachment: The Effects of Compliance, Identification, and Internalization on Prosocial Behavior*. Journal of Applied Psychology 71: 492-499.
- Pennanen, A. (2004). *Workplace planning - User Activity-Based Workspace Definition as an Instrument for Workplace Management in Multi-user Organizations*. Ph.D. Dissertation, Department of Architecture, University of Tampere, Finland. Internet (2004): <<http://www.haahtela.fi>>
- Schonberger, R. (1986). *World class manufacturing*. The Free Press, New York
- Whelton, M. (2004). *The Development of Purpose in the Project Definition Phase of Construction Projects - Implications for Project Management*. Ph.D. Dissertation, Department of Civil & Environmental Engineering, University of California, Berkeley.