Zeitschrift: IABSE reports = Rapports AIPC = IVBH Berichte
Band: 53 (1986)

Artikel: Realistic planning periods as a basis for design and construction decisions
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DOI: https://doi.org/10.5169/seals-41106

Realistic Planning Periods as a Basis for Design and Construction Decisions

Périodes de planification réalistes comme base de décisions pour le projet et la construction

Realistische Planungshorizonte als Basis für die Entscheidungsfindung während der Planung und Ausführung

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SUMMARY

The client's demand usually is defined in a static way, because the «period of interest» is relatively short. However, the building should be flexible: the life-time of the infill will be short, but long for the shell. Identical and not-identical replacements have to be made possible in design and construction. Private investments will be less speculative, since the value after the period of interest can be calculated. Public investments will not be based on the initial expenditure, but on periodical costs. The basis is a program of requirements with a clear demand for building services in time.

RÉSUMÉ

Les exigences du client sont en général définies de façon statique car la «période d'intérêt» est relativement courte. La construction devrait être cependant souple: la durée de vie du contenu est généralement courte alors que celle du contenant est en général longue. Des remplacements et des modifications doivent être possibles lors du projet et de la construction. Les investissements particuliers seront moins spéculatifs car la valeur après la période d'intérêt peut être calculée. Les investissements publics ne sont pas basés sur les dépenses initiales mais sur les coûts périodiques. Le programme des besoins est basé sur une demande précise d'utilisation de la construction en des temps déterminés.

ZUSAMMENFASSUNG

Die Erwartungen und Wünsche des Bauherrn basieren in der Regel auf momentanen Randbedingungen und Bedürfnissen. In Wirklichkeit muss ein Bauwerk in Anbetracht seiner Lebensdauer sehr flexibel sein: Die Tragkonstruktion und die Aussenhaut dauern 30–80 Jahre, während das Innenleben eines Bauwerkes bereits nach relativ kurzer Zeit erneuert oder ersetzt werden muss. Diesen Randbedingungen muss bereits bei der Planung und Ausführung eines Bauvorhabens Rechnung getragen werden, wobei erhebliche Unterschiede bestehen zwischen privaten und öffentlichen Investoren.

1. INTRODUCTION

The program of requirements usually is static, because it concerns the initial demand of the client. Since demand changes over time, the program should be made dynamic to make cost minimization possible. These costs concern the total life of the building. This usually is such a long period, that the initial investor will not calculate the costs over that period. Moreover, he is not interested in the building over its total life. His 'period of interest' usually is much shorter, which influences the wishes, that have to be translated into design and construction.

Since the period of interest and the life of the building diverge, it will usually result in a calculation of costs which is not realistic. However, one cannot enlarge the period of interest of the investor, because the production or consumption process to be carried out in or with the building is decisive. On the other hand it will most of the time not be possible or economically not attractive to shorten the technical or economical life of the building. The only way out of this problem is to calculate the costs on the basis of the economical life and to give the consequences for the period of interest. The costs should be minimized over the 'calculation life'.

An important point in that calculation will be the selling price at the end of the period of interest. This price will largely depend on the costs of adjustment of the building to changed demand. As a consequence different life-times for components of the building have to be introduced. The different lifes have to influence design and construction.

2. INVESTORS AND THEIR GOALS

The investors in buildings have to be characterized according to the kind of process they carry out and the goal of that process. We will consider: central or local authorities, individual house-owners, pension funds and industrial enterprises.

2.1 Authorities

The first point is, whether the alternative of no investment is present. For most investments to be done by authorities on local or central level the decision has been made on the basis of political arguments: services have to be supplied. As investments by authorities we consider investments in social housing and public works like bridges and roads. The design and construction is still a matter of choice, but the services have to be supplied at minimal costs. Most governments just have to balance their year to year income and expenditures, so the initial investment will be considered as the costs of the investment. Hardly ever the costs are calculated over the life of the building. This is illustrated in figure 1 by 'no period'.

2.2 Individual house-owners

A second group of investors, who usually do not realise that they are carrying out a process in or with the building are individual house-owners. They have the alternative of renting a home, but usually calculate only the costs closely connected to the initial investment over a period of about 5 years.

During several decennia the investment in a private home has been largely speculative. A house usually was bought on the basis of a to be expected rise in the investors' income and prices of houses. The calculation of costs was hardly important because a gain was nearly sure.
In present times the situation has changed: the construction costs rise only slowly, while the prices of existing houses change only marginally. Moreover, the incomes will not rise at a speed that was a custom until ten years ago. Now the cost calculation has to be the basis for the investment. The costs have to be calculated over a period which is fairly long, but the decision will be based on the results over five or fifteen years.

	GOAL	supply of services	speculative	return on investment
INVESTOR	authorities	X		
	individual		X	X
	pension fund		X	X
	enterprise			X
	PERIOD	'no period'	5-15 years	30 years

Fig. 1 The goal of investors and the period of financial interest.

2.3 Pension Funds

Investors like pension funds usually were more interested in a safe investment, than in a maximisation of the periodical return on the investment. Invested was usually in office buildings and in large housing projects. The renting market for both groups was rather sure, but the rental income in the second group was relatively low because of government intervention in some countries. For both groups could be stated, that the increase in building costs and the large demand resulted in a constantly increasing selling price which 'guaranteed' the investment. Both types of buildings were sold after about 15 years, just before the maintenance costs or the reconstruction costs would increase sharply.
Nowadays the situation has changed. The increase in prices has slowed down and rehabilitation expenditures have to be made to make it possible to rent or to sell the building. The investments in housing projects nearly have ended because of low rents. In the case of office buildings more investments are needed, since the demand changes in character because of technological developments. The costs have to be calculated over a longer period and more precisely.

2.4 Industrial enterprises

The three groups discussed consider the exploitation of the building as a more or less isolated project. The process hardly needs other production factors, than those necessary for keeping the building in good condition; in economical sence.

Private enterprises, who do not produce building services, use the building as only one of the production factors. The main difference is that this factor has - compared to the others - a long life. The calculation of the costs, however, is calculated basically in the same way; after 30 years results a scrap value. Within that period the building is adjusted to changes in the process, for which depreciation out of sales of products is available. This group of investors bases the investment decision on a calculation of costs over a realistic period (fig. 1).

3. PERIOD OF INTEREST VERSUS ECONOMICAL LIFE

In this section for each investor the short 'period of interest' will be compared with the long (economical) life of the building; the 'calculation life' (fig. 2).

3.1 Authorities and buildings of general interest

The depreciation period has to depend on the period in which one can be fairly sure, that the building can and will be used. This period will be very long for public goods. Roads, bridges and houses in the social sector will be used and demanded for over a very long period and for the structure it will be the technical life, which limits the economical life. As long as the demand for the services concerned is sure, the depreciation period can be very long. One can calculate on the basis of 80 years, but a difference of 10 years does hardly influence the periodical costs as long as they are calculated on the basis on annuïties. In other systems as well the interest expenditures will largely exceed depreciation costs. As far as a miscalculation gives rise to extra costs it will be collective responsibility.
The period of interest has to be the depreciation period when collective investments are concerned which results in a long calculation period (fig. 2). Additional costs have to be calculated over that period as well. Changes in demand can result in shorter lifes for parts of the building, but here as well year-costs will be decisive.

3.2 Investments in privately owned houses

The difference between the period of interest and the calculation of debt-costs for privately owned and used houses seems to be a problem. The period of interest for an individual house owner is limited to a period of between 5 and about 15 years. Contrary to that it will be possible to get mortgages over a period of 30 years. The mortgage period should be considered as a - badly determined - depreciation period. This period deminishes the risk for the bank, because usually the value of the building will not drop as fast as the value of the debt. But in periods without a considerable prise rise and without necessary rehabilitations carried out it is possible that the value of the building will drop faster.
For good decision making maintenance and the moments of rehabilitation have to be predicted. As a consequence more depreciation periods will be used and made realistic by design and construction.
For private houses the period of interest can - and usually will - be equal to the part of the building with the shortest depreciation period. The calculation life will be extended to about 50 years. This is shorter than for social housing in order to limit the risk of the private investor.

3.3 Pension funds investing in office buildings

Office buildings will resemble houses: the demand for this type of buildings will last for a very long period; globally as long as for houses. The supply of services and the investment however is not a collective responsibility or decision. So the investor will depreciate on the basis of a shorter period: 50 years seems to be realistic, comparable to the period for private houses. To keep the building rentable, adaptations inside the building have to be carried out because of changing demand. A realistic calculation of short run depreciations will make the selling price after the period of interest less speculative.

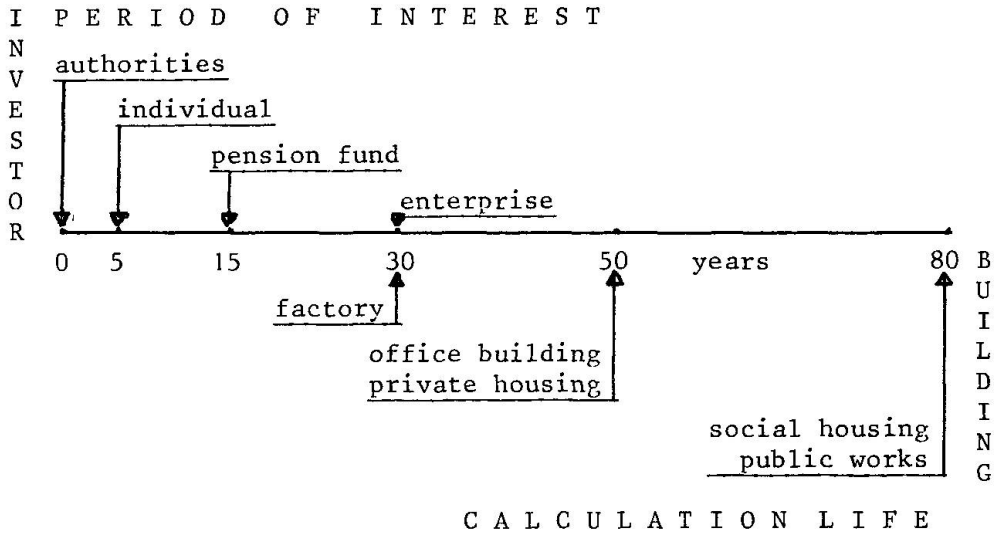

Fig. 2 The conflict between period of interest and prefered calculation life as basis for design and construction.

3.4 Industrial investments

An enterprise, that needs a building for the production process most of the time has to build it, because the wishes usually will be rather specific. The consequence of the specific wishes is or can be, that the usuable life of the building will be relatively short. However, the depreciation period will be much longer than the period over which the firm can plan its activities. But, the structure of the building will not change, so it can be depreciated in about 30 years. It is hardly possible to predict whether the building can be used by the firm or someone else after that period. The value will be assumed to be zero after the depreciation period. All costs are calculated over the usuable life, which equals the period of interest. The wishes about the building usually are well defined.

4. COMPONENTS WITH DIFFERENT LIFES

4.1 Identical and not-identical replacement

Usually the period of interest is much shorter than the life of the building. The period of interest most of the time is limited because of changes in demand for building services combined with the investors possibility to invest in another investment good. In both cases the building needs important investments to keep the investment interesting in terms of return on invested capital.

Construction activities to keep a building usable can be considered as an extra-investment or as a replacement investment. Most of the time the investment - or at least a substantial part - will concern replacement, which can be identical or guided by changing demand. The main point is, that a part of the building is outdated and has to be replaced. The invested amount of money concerned should have been earned back and available for reinvestment. Reinvestment should be technically possible without substantial additional expenditures. At the moment of new-construction the lifes of the different parts have to be predicted with keeping in mind that not identical replacement should be possible (fig. 3).
The devision in components and the life-times concerned depends on the character of the building and the production process for which it is needed.

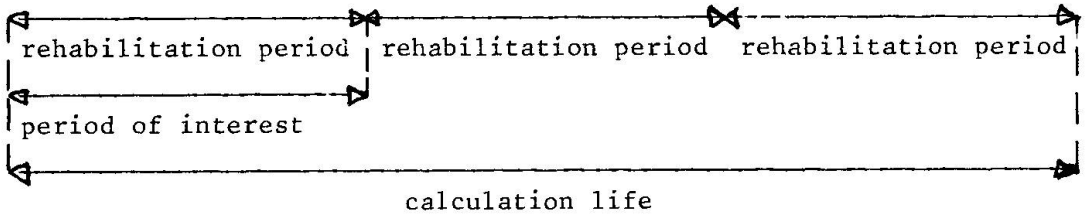

fig. 3 Partial combination of period of interest and depreciation periods (rehabilitation and calculation life).

4.2 Shell and infill

In general a building can be devided in a shell and an infill. For the user of the building can be stated, that he is only interested in the shell as long as it gives a good cover against the environment. Changes in the shell do hardly influence the usability of the building, as long as the insulation meets minimum standards. When this is not the case, it will influence the rentability, but it will not be the user who has to invest in the shell. The shell is the interest of the investor.
The infill however is the interest of the user, who can be the same as the investor. The infill will be closely connnected to the process that will be carried out in the building and will be substantially influenced by changes in that process. The changes can concern the use of the available space, or the finishing. As a result we can consider more than two lifetimes, because the inside wall will have a life shorter than the shell, but longer than the finishing.

The selling price of the building will depend on the changes in demand and the possibilities to adapt the building to keep it rentable. This selling price will link the calculation life and the period of interest. On this basis an extra initial investment to facilitate adaptations can be acceptable.

5. REQUIREMENTS BASED ON REALISTIC LIFES

5.1 Industrial buildings

In the case of industrial buildings we can observe a rather sharp division between housing costs and the costs of the infill, which are a part of the costs of the production process. Only the costs of the shell are considered as housing costs. These costs are the direct consequence of the investment like interest and depreciation, to which have to be added the maintenance costs. Sometimes it will be necessary to replace some parts of the shell, because the technical life has expired. These lifes can and have to be predicted. The replacement will be economically identical, but can be technically different because of technological development in the building process. The demand for shell-services will be relatively static, while the demand for infill changes frequently. Support and infill usually are separted in technical and financial sence. Industrial investors plan their demand in technical and financial terms in a realistic way.

5.2 Office buildings

The services of this type of building can differ, depending on the furnishing and finishing, either rented or assembled by the user. In both cases the shell - occasionally including the inside walls - will be calculated seperately. The period costs of the shell have to be minimized over a life of e.g. 50 years and for the inside structure over 25 years. Within these periods the furnishing and finishing can be replaced. The infill can be calculated over a period of 15 years, which is the period of interest. Depending on the process carried out in the building, it will be possible that some replacements are necessary. Usually the value of the infill will be considered to be zero at the end of the period of interest. The selling price after 15 years will be closely connected to the expected period costs in the following 15 years and is not the basis for the calculation, but the result of it.

The consequences for design and construction will be, that the initial investment has to be compared to the complementary costs over a long period; longer than the period of interest. For the second-hand buyer it can be made clear that if the selling price is higher than expected it is due to the cost minimization in the long run.
The design and construction of the infill has to be based on the initial demand and on the decomposition at the moment of replacement and occasionally re-use of elements. The extra costs of a simple decomposition have to be recalculated over a relatively long period (in fact 50 years) to get the period costs.
It will be possible that for the user the infill will be cheaper when the shell or skeleton is designed to facilitate the assembling of the infill. In that case the rent can be slightly higher.

Two facts are important for the rental possibilities of an office building in time. When the user will rent the office for a short period (several years at maximum) he will rent the infill as well. The period of interest of the renter is short, too short for an investment.

Specially in 'smart' office buildings we have to calculate with short lifes, while the life of the shell will be long and untouched. Only in the case of good design and construction the value of the building will be untouched over a long period.

5.3 Social housing

In social housing will be invested by central or local authorities and - substantially - by private investors. This last category of investors has a relatively short period of interest compared to the calculation period. The problem of getting money for investments in social housing can only be solved by a calculation with real lifes of components, which will give results for the period of interest as well. Even more important is the selling price after the period of interest, which will be more clear and less speculative.

The period costs will be minimized in the long run. Design and construction have to consider several investment periods. This gives rise to the possibility to invest in design and construction to make adjustments in the future cheaper. As well, it will be the basis for a depreciation scheme to collect money for replacements.
The user can be given some influence in new building and replacements as well, which will influence the design process. Shell and infill have to be designed and constructed seperately; to some extend.

5.4 Privately owned houses

The category differs from the preceeding one, because only one decision maker with one period of interest has to be considered. The building principally is the same: it will be cheaper to adjust the building and - closely connected - it will be more easy to estimate the selling price. Future costs can be predicted more carefully.

An even more interesting point is, that the bank can coordinate the mortgage period with the life of the separate parts of the building (e.g. two parts). The basis will not be the period of interest and not an 'average life', but the economical lifes of the components.
The advantage will only be substantial when design and construction will consider the different lifes of components and as a consequence the fact that the components have to be decomposed several times during the life of the shell of the house.

5.5 Buildings of public interest

The Ministry of Transport will be the principal, but the Ministry of Finance has to pay. When the building is ready and paid for we look for new projects. But in reality the former project has only be ended after more than several decennia. It would be a good thing to calculate the costs over the real life and to have the Ministry of Transport paying for the period costs. It would result in a more balanced demand and a minimization of the period costs, both being the result of a dynamic program of requirements for design and construction.

6. CONCLUSION: DESIGN FIT TO LIFE

A building usually will survive more than several decennia. During that period a substantial part of the building has to be replaced, to keep it usuable, due to technical or economical circumstances. This means, that at the moment of new building the costs of the building have to be calculated on the basis of different lifes of components. Moreover, the replacement has to be made as cheap as possible by balancing the initial investment and the replacement expenditures. The replacement possibilities depend on design and construction and on the amount of money available out of realistic depreciations. Replacements have to be considered most of the time as not identical. Since the character of replacement hardly can be predicted the choice in the future should be as free as possible from the initial investment decision. Not-identical replacement should technically be made possible, while the use of the possibilities depends on the change in demand.

When, in design and construction, flexibility is incorporated it will be possible to calculate the period costs of the building more accurate. As a consequence:
- the periodical costs can be minimized;
- the investment will be less speculative, and
- the financing can be based on real expenditures.

The basis, however, is that the client can and will make his interest in the building explicit.

The client has to consider his demand in time as user and as investor. His period of interest in the building most of the time is much shorter than the period over which the shell of the building can be used. As a consequence a part of the building only fits to demand for a relatively short period, a period of interest.
When the demand in the short run has been made clear (the period of interest) and the costs of the components of the building with a long life (the calculation period) have been calculated in a realistic way we have found a economical basis for design and construction.

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