THE DILEMMA OF FLEXIBILITY
IN THE
SPATIAL DEVELOPMENT OF SCIENCE PARKS
THE CASE OF METU-TECHNOPOLIS

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ABSTRACT

THE DILEMMA OF FLEXIBILITY IN THE SPATIAL DEVELOPMENT OF SCIENCE PARKS THE CASE OF METU-TECHNOPOLIS

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In 1970's, significant shifts occurred both in planning and design theories as a response to the decreasing role of the state in property relations and widening arena of private property. This shift in planning approaches led to an increase in the importance of 'flexibility' concept. However this study proposes that flexibility in the control of spatial development is not an indisputable solution, but rather it is a dilemma. This is because; the definition, degree and effect of flexibility may change in every step of the process depending on the actors in the process. While it may be a way of solution in one case, it may be the problem itself in another.

In the study, this dilemma is discussed in the context of spatial development in science parks. The concept of flexibility has a particular importance in respect to science parks which host especially technology based firms. Due to market changes and technology shifts, the spatial requirements of market and also the tenants change in time rapidly. That is why flexibility becomes a necessary tool in the physical planning of science parks.

In this context, firstly the role flexibility in different planning and decision-making approaches is discussed. Then the structural characteristics of science parks and specifically METU Technopolis are defined. Within this framework, the physical development process of METU Technopolis and the role of flexibility in planning and decision making processes is examined. Finally some suggestions for controlling the flexibility in planning and design processes are developed.

Key words: *Flexibility, planning process, design guideline, urban coding, master planning, science park, techno park, technopolis.*

ÖZ

BİLİM PARKLARININ MEKANSAL GELİŞİMİNDE ESNEKLİK İKİLEMİ: ODTÜ-TEKNOKENT ÖRNEĞİ

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1970'lerde, devletin mülkiyet ilişkileri üzerindeki azalan etkisi ve özel mülkiyerin genişleyen alanı planlama ve tasarım kuramlarında önemli kırılmalara yol açmıştır. Planlama yaklaşımlarındaki bu kırılma 'esneklik' kavramının öneminin artmasına yol açmıştır. Buna karşın, bu çalışma mekansal gelişimin kontrolünde esneklik kavramının tartışılmaz bir çözüm değil, bir ikilem olduğunu öne sürmektedir. Çünkü esnekliğin tanımı, derecesi ve etkisi süreçteki aktölere bağlı olarak her aşamada değişebilmektedir. Bir durumda çözüm olarak görünen esneklik, başka bir durumda ise sorunun kendisi haline gelebilmektedir.

Bu çalışmada, söz konusu ikiliem bilim parklarının mekansal gelişimi bağlamında ele alınmıştır. Esneklik kavramı teknooji odaklı firmaları barındıran bilim parkları açısından özel bir önem taşımaktadır. Hem piyasanın hem de bilim parkında yer alan firmaların mekansal gereksinimleri, piyasa koşullarında ve teknolojideki değişimler nedeniyle hızla farklılaşabilmektedir. İşte bu nedenle esneklik kavramı bilim parklarının fiziksel planlamasında zorunlu bir araç olarak karşımıza çıkmıştır.

Bu bağlamda, ilk olarak esnekliğin farklı planlama ve karar alma yaklaşımlarındaki rolü tartışılmıştır. Sonra bilim parklarının ve özellikle ODTÜ Teknokent'in yapısal karakteri tanımlanmıştır. Bu çerçevede, ODTÜ Teknokent'in fiziksel gelişim süreci ve esneklik tutumunun bu süreçteki rolü irdelenmiştir. Son olarak, planlama ve tasarım süreçlerinde esnekliğin kontrol edilmesine yönelik birtakım öneriler geliştirilmiştir.

Anahtar kelimeler: *Esneklik, planlama süreci, tasarım rehberi, kentsel kodlama, master planlama,bilim parkı, teknopark, teknokent.*

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CHAPTER 1

INTRODUCTION

1.1. Aim of the Study

Starting with 70'ies when criticisms against long-term totalistic view of comprehensive planning approach have intensified, significant shifts occurred both in planning and design theories. Moreover this shift in theories is the result of the transformation of the social structure as a whole and this has changed the socio-political and economic context of planning totally. The subject of this thesis is the two interrelated sides of this contextual change which is being lived from 70'ies onwards.

The first side which is the reflection of these changes and transformations on planning is the increasing importance of 'flexibility' concept. Flexibility as a solution to the crisis of understanding and predicting the complex and indeterminate social processes has become a key concept not only for planning and design but also for the organization of the social production as a whole. Flexible production, flexible planning, flexible control has become core concepts within local and national development policies. However, although flexibility has gradually been accepted as a definite rule in the planning field, there are still serious uncertainties and problems in defining it for concrete problems and carrying it in practice. Besides, considering that flexibility is rather a political attitude in the production of the city and ownership relations than merely a technical tool to objectively be utilized, it will be clear that solutions provided by flexible control may become problems at the same time. This brings us to the point that flexibility is not an undisputable principle but rather it is a contradictory attitude.

The second side of the transformations of the last decades that this thesis will explore is the revealing of science parks as a new spatial unit in the urban arena. As technology development and innovation became the basic determinants of competitiveness between nations, regions and firms; science parks have become one of the most important tools for politics of development and spread rapidly all over the world. Appearance of this new spatial unit means also the appearance of new problem areas for planning and design due to their development dynamics. The specific characteristics of science parks require different criteria for physical planning, different control mechanisms and different approaches for the management of spatial development. Besides the concept of flexibility has acquired a more specific meaning for science parks and science parks became places where flexible production and flexible use of space should go hand in hand.

As a result, the aim of this thesis is to investigate the role of flexibility concept in the physical evolution of space for different planning approaches and further in the specific case of science parks and finally the physical development of METU Technopolis. Within this scope flexibility will be taken as a problematic and different problem areas that this problematic involves will be revealed. In the study, the spatial development of METU Technopolis will be evaluated generally in two frames; flexibility in form and flexibility in process. Since the owner of the property of METU Technopolis is METU, and since there is no other decision maker rather than METU, the evaluations were mostly done within framework of flexibility in form.

Although the aim of the thesis is not to provide solutions to these problem areas, there is also the aim of bringing guidelines and suggestions for the management of physical development of science parks in Turkey, resulting from the evaluations to be made for the METU Technopolis case.

1.2. Scope of the Study

In the first step different aspects of flexibility problematic will be discussed and a theoretical frame that puts the role of flexibility for different planning and design approaches will be built. The analysis of flexibility problematic will be formed through a discussion of a series of problems and concepts as mentioned below. These problems and concepts will make up the axis of examination for the whole of the thesis. We may start this with firstly from the question of “what is flexibility?”

What is flexibility?

Within the context of this study, flexibility may generally be defined as not determining certain elements at the beginning and letting their formation within the process. So the concept of flexibility always gains its meaning within a ‘process’. In other words, it comes out as a ‘necessity’ to intervene a process. This brings the question of why flexibility is necessary.

Why flexibility?

Flexibility appears in a process with the aim of adopting the unpredictable developments of the process. The unpredictability of a process welds from ‘*uncertainty*’. Because uncertainty defines the boundaries of predictability and where prediction is limited flexibility appears. As a matter of fact, flexibility concept within planning field has gained importance as a result of the failure of deterministic approach and long-term predictions of comprehensive planning.

Obviously flexibility is one of the mostly emphasized points in any arena together with economic and social restructuring. This has surely implications for planning and design processes too, especially for any high-tech district no matter of which label as they emerged as an outcome of Post-Fordizm. Thus flexibility concept gains more importance considering science parks as they are already an outcome of this post-fordist flexible production.

Another reason why flexibility appears on the fore in planning process is the thought that flexibility through letting *difference* and *variety*, will open the way for a more democratic and participatory process. At this point of supporting difference and variety, the question of for whom flexibility is provided appears.

Flexibility for whom?

Flexibility provided for certain actors of a process may become a restriction and pressure element for other actors. At this point where we think of the cost of adaptation capacity that flexibility provides, we may see that flexibility becomes a ‘*problem of politics*’ as well as a ‘*tool for policy*’.

For example while flexibility in the organization of division of labour may mean adaptation capacity on the firms’ side, it may mean erosion of workers job security (Harvey, 1990). A policy which provides flexibility for firms may become a pressure element for the workers. Thus the concept of flexibility rather than solving the contradictions within the process may reproduce them on another level. This means that flexibility policy for the control of a process might have contradictory meanings for the different actors involved in the process. Actually when viewed from this standpoint, flexibility becomes *an arena of struggle* opened within the actors of the process. As will be discussed in detail in the second chapter the most general example of this may be the conflicts lived between two private properties or between public and private properties within the framework of property relations.

Flexibility of what?

In the control of a process, which elements to be flexibly controlled and which ones to be strictly controlled may itself be considered as a source of uncertainty. This uncertainty may in time even become a problem that limits the flexibility of the process. For example, as we will see in the case of Metu-Technopolis, it might be a strategic decision to provide flexibility for prescription of their determination for different elements as property boundaries, infrastructure routes, form of the suprestructure. Because some of these elements may have priority, or be more dominant and might remove flexibility possibility in the formation process of others. Moreover limiting flexibility possibility may itself be a conscious choice. In either way the question of 'flexibility of what?' will appear as a strategic element in the decision-making process.

How much flexibility?

Related with which elements to provide flexibility for there is uncertainty in defining the '*degree*' of flexibility. Too much flexibility may mean affirmation of already existing dynamics of the process to be controlled and thus yielding them. This will mean totally giving up of long term plans and visionary goals. For the physical form of the space too much flexibility may mean giving up unity. Thus flexibility -as a tool to provide spatial variety and richness against monotony and standardization- might cause loosing harmony and unity of parts. At this point the question of 'how much flexibility?' brings a problem of building the relations between *wholes* and *parts* and a problematic of obtaining a balance between *unity* and *variety*.

How is flexibility applied?

Another side of the flexibility problematic is 'how flexibility will be applied'. In order to realize a certain flexibility attribute, appropriate *control tools* and mechanisms should be constituted. For example search for flexibility in the control of physical space has led to new searches in urban coding systems. Especially after 80'ies urban coding systems are tried to be developed as flexible design tools that provide variety to go beyond merely being tools for standardizing and zoning. So new spatial control tools have appeared (Ünlü, 1999).As we will discuss in the coming parts, such tools play an important role in the physical development of science parks.

As a result, such interrogations that will be developed during the study show that, flexibility as a tool to overcome the problem of uncertainty has itself an uncertain, obscure and contradictory character and is much too case-dependent. Thus this thesis will concentrate more on the case study of the physical development process of METU-Technopolis rather than the theoretical discussions. At this point the genuine part of this study will stem from my position in METU-Technopolis as a planner responsible for its physical development which gives me the chance to present my personal experiences in detail.

1.3. Method of the Study

How to answer the above mentioned questions of flexibility depends on what tools and what kind of decision-making processes to utilize and the nature of the space to be controlled through planning. In other words, the answers will be built upon the relation between the characteristics of subject of planning process and the nature of object of planning process. Within the context of this thesis this object is METU Technopolis and the subject is the management company of METU Technopolis. Thus the interrelations between these two sides and the question of how these relations are founded in different planning approaches will make up the spine of this study. Here, while the subject corresponds to a certain totality, the object should be considered as an actor which tries to control the development of this totality at the same time itself being a part of this totality. So in this study, the dilemma of flexibility which appears as a prevalence of the conflict between whole and parts, will be taken as a function of the decision-maker object, that is the management company of METU Technopolis.

Consequently, in the ***second chapter*** which will define the theoretical framework of the thesis, the role flexibility plays in different planning and decision-making approaches will be discussed over the dualities of planning subject- planning object and whole-parts. In this scope firstly the meaning of flexibility will be handled in a deeper way and then the way that flexible planning approaches- which have been rising as a critique to comprehensive planning such as incremental planning, structure planning- control the tension between whole-parts, what kind of decision-making mechanisms and control tools they utilize will be discussed. Related with this, contemporary urban design approaches that have been developed against modernist urban design will be handled. Revealing the characteristics of these different approaches will help us in defining the characteristics of different phases in the spatial evolution process of METU-Technopolis.

In the first part of the ***third chapter,*** science parks will generally be examined by subject of planning – object of planning areas. Thus on the one hand the administrative and decision-making mechanisms and intervention tools of science parks (legal and administrative frame of science parks as the subject of planning) will be examined and on the other hand development dynamics and physical structures of science parks (structural and spatial characteristics of science parks as the object of planning) will be examined. This will provide us understand both the general characteristics of science parks and specific characteristics of different types of science parks.

In the same way, in the second part of the ***third chapter***, the structure of METU Technopolis will be analyzed within the framework developed in the first part of the third chapter. Thus the analysis will involve on the one side the managerial structure of METU Technopolis within the legal and administrative framework of science parks in Turkey and on the other side the spatial characteristics. Here the aim is to provide a frame of reference for the fourth chapter.

In the ***fourth chapter*** the spatial evolution of METU Technopolis will be studied in detail and the role that flexibility plays in this evolution will be questioned through the above mentioned questions about flexibility. For this purpose first different phases of development in physical development process of METU Technopolis will be determined and then the type of interventions in these phases will be revealed. Thus what kind of solutions and problems that the dilemma of flexibility produces in the planning and decision-making processes will be shown.

Finally in the ***fifth chapter*** after making a general evaluation of theoretical and empirical discussions, the role that flexibility plays in the process of spatial evolution will be put forward.

As a conclusion, it will be argued that flexibility in the control of the spatial development is not an indisputable solution, but rather it is a dilemma. This is because; the definition, degree and effect of flexibility may change in every step of the process depending on the actors in the process. While it may be a way of solution in one case, it may be the problem itself in another. This dilemma is more valid for the science parks where there are many different processes and actors. This study through evaluating the problem of flexibility in the spatial development process of METU Technopolis, will provide the understanding of its role in planning and decision making processes. It is aimed to provide the framework of spatial planning of science parks for Turkey within current contextual environment.

CHAPTER 2

FLEXIBILITY AS A TOOL OF DECISION MAKING IN PLANNING AND DESIGN THEORY

In this chapter which will define the theoretical framework of the thesis, the role flexibility plays in different planning and decision-making approaches will be discussed over the dualities of planning subject- planning object and whole-parts. In this scope firstly the meaning of flexibility will be handled in a deeper way and then the way that flexible planning approaches- which have been rising as a critique to comprehensive planning such as incremental planning, structure planning- control the tension between whole-parts, what kind of decision-making mechanisms and control tools they utilize will be discussed. Related with this, contemporary urban design approaches that have been developed against modernist urban design will be handled. Revealing the characteristics of these different approaches will help us in defining the characteristics of different phases in the spatial evolution process of METU-Technopolis.

2.1. The Flexibility Concept

When we look at the dictionary we see three definitions for the word flexibility; the first one "capability of being bent" has a physical meaning. In this physical meaning, the ability of flexibility provides the object to keep its wholeness (stay without breaking) by just changing its form, when faced with an outside effect. The second meaning is "willing to adapt or fit with others". Here there is a situation of accommodation-a compromise- of objects that are in a reciprocal interaction. The third meaning is "capable of changing in response to new conditions". Here flexibility means an adaptation capacity for future. Thus it makes sense during a *process*.

There is a common point for all these three meanings. We can see this point clearer in Whitehead's definition of flexibility:

> Flexibility can be termed that characteristics of a system and its structure which enables it to respond to secular changes with the minimum degree of disruption or disturbance to the system as a whole"(Whitehead, 1974; 35).

Similarly, Sert (1991; 12) defines flexibility as the "capacity to provide rearrangement, reorganization, and expansion, while maintaining the overall order of structural components".

In other words, the basic point for flexibility concept is this: the changes in a system are limited with the parts only, and the system keeps its being as a whole while it reacts to the process its involved within, in other words the systems capacity of maintaining its totality, or with the words of Sert, maintaining the overall order of structural components (as in the case of being bent without breaking). This necessitates a hierarchy among the parts, elements and the relations that form up the totality. In this hierarchy the essential or the structural elements or relations are the ones that should be kept unchanged. If flexibility involves these elements the system may become something else while trying to adopt the changes. Thus flexibility may be in question only for the formal determination for system or an object, not for essential determination. From this point of view, planners can not know in which areas to be flexible without understanding the nature of the object to be controlled. Flexibility in certain decisions may lead to compensation from the essential principles. Thus for planning the above mentioned problem of maintaining totality means plan to maintain its own legitimacy, effect and consistency.

Having emphasized this point of whole-parts relation in the definition of flexibility, we can now carry the three meaning mentioned above to the field of planning. Because, flexibility in the field of planning and design, covers all these meanings. Carrying these meanings to the field of planning and discussing the relationships in between will provide us to form a theoretical frame of flexibility in analyzing the diverse set of cases in the physical development process of METU-Technopolis.

2.2. Definitions of Flexibility in Urban Planning

For the *first* definition that is physical flexibility, flexibility of the urban space produced through the planning process is in question. This can be defined as the capacity of the physical space to respond different needs and functions. So flexibility is for the object of planning thus flexibility is an aim to be reached at the end of a process that is when the production of the designed spaces is completed. Here flexibility appears as a *principle* of design.

For the *second* definition that is flexibility towards "the others", flexibility is as an 'attribute' that individuals have to assume to be in harmony with each other in the interaction between subjects who play role, in the planning process-make choices or take decisions or affect these. Besides we have emphasized in the first part that this attribute of harmony is a one that is reached as an outcome of interest conflicts and power struggles and in this sense flexibility is an *arena* opened towards struggle between actors.

For the *third* definition, that is the capacity of adopting unexpected changes in a medium or long-term process, is valid for planning mechanisms and the plans themselves utilizing these mechanisms. Consequently here flexibility is in question for the utilized planning approach and control mechanism that is the flexibility of the plan itself. This definition of flexibility overlaps with the definition we made in the first part: "not pre-determining certain elements thus letting them be formed within the process"

Finally the first definition which we may call as ***flexibility in form*** is about the object of planning, which is physical space of science parks within the context of this study. The second definition which we will call as ***flexibility in process*** is about the subject of planning. What we mean with the term subject is not only the institutions carrying planning functions; beyond this the term involves all the actors who play role in the planning process as a whole (from the preparation of the plan to implementation). This view is important to recognize that the relations that are subjective for individuals correspond to the objectivity when considered as a whole. Thus the third definition which we call the flexibility of the plan is a part of flexibility in process. With taking part in this, it becomes a method and tool of controlling this.

In this case the flexibility concept will be discussed under two headings in this study: flexibility in form and flexibility in process. It is clear that the latter one that is the flexibility in process which is related with the process of production of space is of more importance as the former one is related with the produced physical space. Thus in the next part we will first deal with heading of flexibility in process.

2.2.1.Flexibility in Process

Above we defined flexibility in process as a two dimensional concept of reciprocal relations. The first one corresponded to conflict- compromise attributes of relations between actors in a planning process. The second one expressed the flexibility of planning approaches and tools utilized by the planner who tries to determine or steer this process. If we use the frames Günay uses in defining planning action, we may say that while the former is within the frame of game theory, the latter is within the frame of decision and choice theory.

According to Günay, decision theory is based on the conception that a multitude of frameworks feed planning. "In this respect, decision theory claims that we are always in a continuous process of decision-making, to assess open options, while predicting the outcomes and leftover options; however, it is also a process of dealing with *uncertainty*. Since decisions are never final, they are appropriate at one moment in time, knowledge available and goals at that specific moment, and although the word denotes finality, decisions, especially in land use planning are never final." For this reason, in order to deal with changeable conditions, the planner tries to make a strategic *choice* to reduce uncertainty. Because, uncertainty urges him search a range of possible directions in future. Among these alternatives, the process of reaching the best decision is known as optimization (Günay forthcoming).

Obviously both decision and choice theories basically examine the required methods and approaches to deal with uncertainty. In other words, uncertainty is the main factor that conditions planners' approaches. Moreover as Günay emphasizes "since decisions depend on the cognition and values of the maker, there emerges a conflict between short-term decisions of the politician and the long-term strategies of the planner. Eventually the debate between scientific decision-making and intuitive evaluation processes continue. There is another struggle against uncertainty, beyond these uncertainties that are involved within the decision-making process. This is what Günay explains under the heading of game theory:

> "Hence any planning activity should end with a realization process, where the planner should acquire skills first in "gaming". Since planning decisions are influenced by political, social, economic or professional human attitudes and behaviour, this means conflicts among individuals. The basic idea is to try to understand the possible future actions the different groups in an urban setting might play, and act accordingly, considering the political atmosphere, land economics, location, legislation, taxation, planning-programming-budgeting systems, critical path methods, etc." (Günay forthcoming).

As a result, uncertainty is an inevitable problem both for the planning approach that is utilized in decision- making and choice processes and in implementation of the planning decisions. Then we may say that we will adopt a flexibility attribute in any planning process in order to cope with uncertainty. How the degree of the flexibility will be determined, how it will be implemented and fore what elements flexibility will be utilized are other areas of problem. In order to cope with these problems, the roots of uncertainty should be determined. This can be done through understanding the nature of the object of planning and analyzing the essential elements and structural relations. Obviously these elements and relations will differ in any planning process due to the dynamics producing the planned space. Anyway we can talk about a basic source of uncertainty for all planning activities when urban planning and urban space are in question.

2.2.1.a. Property relations and flexibility

All these struggles and conflicts occurring in an arena of citizens, politicians, land developers, other planners, administrators, pressure groups or as simply called - the actors, property relations in urban space holds a critical position. In other words, basic source of uncertainty is the property relations. From this standpoint, in his study "Property Relations and Urban Space", Günay (1999b) focuses on the role of property relations in the production of urban space. He indicates that;

> "The pattern of land subdivision is one of the more critical planning decisions faced by those designing human settlements. Once established the pattern essentially remains forever and can only be changed at great cost, effort and political will. The area and the geometric layout pattern effectively dictate the infrastructure networks, which represent the basic capital costs in the settlements constriction: water supply, sewage disposal, electricity networks, street lighting, streets and sidewalks." (Goethert 1999; 279 in Günay, 1999b; 3).

This quotation shows that the most permanent element of the urban space is the patterns of ownership. In this respect, property boundaries are the most "inflexible" elements among the others that constitute the urban space. This inflexibility of the property conditions makes them the critical elements that have to be considered in the decision making process and in the application of these decisions. When viewed from the point of property relations, urban space becomes a focus where actors struggle in order to control and dominate in their own interests. In this struggle planning is a basic tool for solving such problems through controlling property relations in the name of state. With the words of Günay,

> "Property is a rights relationship between the property subjects, which is owners or possessors, and property objects, that is, things or goods. In this relationship, property subjects have the right to occupy, possess or dominate the things by using, collecting the fruits of and exhausting them. The state is the control mechanism that recognizes these rights through the power of law" (Günay, 1999b).

Thus, Günay describes the property as the main generator of conflicts in the urban arena and as an object of relationship or struggle for dominating the urban space. According to him, "in the framework of game theory when we are talking about actors in the city, we are talking about owners of property and their conflicts" (Günay forthcoming)

Consequently, not only the form of a space but also which activities and relations take place, in other words by whom and how the space will be controlled is determined through property relations. So the basic determination of the physical space is indeed an unphysical condition- the owner and use of the property. However the owner can utilize his possession only under the conditions imposed by the planning decisions. In such a way public control on a private property determines the area of flexibility for the landowner. The wider is this space the more chance the individuals have for maximizing their own interests, while this also increases the conflict between private actors. In this situation the chance to provide the totality we talked about above- which we may summarize as realizing the public good for the field of planning- may no longer exist. So, the essential relation that provides totality for in the development process of space is *public control over private property* and the tension this control creates is the most important problem area in the problematic of flexibility. Also for the reason of bringing control over private property through planning within the conflict between actors on this urban property, pressure occurs on planners and decision-makers. Private owners want to maximize their area of action in utilizing their property rights. The degree of limitation that planning imposes on other actors may give us an idea of degree of flexibility. On the one hand too little flexibility may create a resistance against plan and this may result in the collapse of plan, and on the other hand too much flexibility may result in the problem of loss of unity, in other words planning mechanism to loose its reason for being.

Evaluating the Turkish planning mechanisms from this point of view puts forward interesting outcomes. 'İmar planlaması' (development planning) with the approach of deterministic understanding of physical planning- determines in detail the form that space will take in a long period of time. This makes the plan conflict with the new situations (within the frame of property relations and demands created by the market dynamics) that occur in the future Therefore, the contradiction between the static-comprehensive approach of development planning that sees the city as a controllable physical object in a long term and the weak control of the state on production of urban space has been the major deficiency of planning system. So the *inflexibility* of the development planning practice is the mostly emphasized criticism by the authors discussing about urban design and development planning (Baş, 2003;7).

On the other hand, as Akçura (1981;65) emphasize the inflexibility of urban planning in Turkey does not only arise from the development legislation, but also from the administrative, technical and managerial customs of the planning authorities. According to him, the development legislation is open-ended in many aspects. It doesn't assign distinct rules about the decision areas of plans. It means that inflexibility of Turkish planning system does not simply arise from a technical deficiency resulting from the legislation, but from the way legal tools are used by planners.

Besides, it will be insufficient to explain the reason of plans not to be realized as a result of inflexibility if we consider that planning mechanism is not only a legal mechanism but at the same time a political mechanism. On the contrary we may say that planning in Turkey is very 'flexible' if we evaluate the planning process as a whole. As a matter of fact the PhD study of Ünlü (2006) on plan modification made in the 20 years planning process of Mersin shows that 'plan modification' have become essential elements of planning system. It is seen that nearly all of the changes which reach a number of approximately 2000, are made in order to increase building permissions on private properties. The outcome of such a process is an urban space produced by spontaneous dynamics of market rather than planning mechanisms. According to Ünlü the reason why the mechanism of plan modifications is used such effectively by the actors of the market is that the system of development planning 'imar planlama' is not conceived to form up a *context* on the space rather it is designed specifically to produce development plots 'imar parseli'. In other words, the essential aim of development planning system is not the whole or the structural essential elements, but simply its parts. Then we may say that the development planning system which looks comprehensive, wholist and rigid, is indeed incremental and much too flexible. Such that this too much flexibility that market actors acquire, make up much too inflexible conditions for planners to shape space. So the concept of flexibility should be evaluated within this conflicting content.

From this standpoint, we can assert that it is not sufficient to explain the flexibility of a planning system merely by the characteristics of the legal mechanisms or the attributes of planners. Beyond these flexibility is a function of *the power of public control over private property*. It is related to the control power of the planning subject- the institution that owns the plan and the tools it uses- for flexibility to be realized either as a method of control or as a lack of control. And this is as Günay emphasizes determined within the frame of game theory in political struggle.

In conclusion, if we turn back to the concept of flexibility in process, the concept of flexibility has a conflicting content both as a struggle-compromise process within the actors and as planners who want to control physical development through directing this process and determines the action area that actors who take role in the process of production of space dominate. In other words this area of action is not independently determined by the planning mechanism, but is determined within the frame of property relations. Thus property relations are of great importance for flexibility in process. Relatedly, we will claim that, 'physical flexibility' which we will handle as a characteristic of design approaches adopted in physical determination of space, is determined within the frame formed by flexibility in process.

2.2.2.Flexibility in Form

We have already defined the 'flexibility in form' as the capacity of physical space to respond to different needs and functions. Thus we proposed it as a concept related with the object of planning that is designed physical space. Here flexibility is an aim or a principle that will be realized when the production of space is completed. We can say by generalizing that, where 'flexibility in process' is the subject of procedural theories of planning (theories related with the method, form of planning and decision-making and choice processes), 'flexibility in form' is the subject of substantive theories(theories related with how the object of planning will be conceived and how it should be shaped)

We can handle flexibility in form in three ways. The first one is the flexibility in the control of individual designers who design partial units that make up the urban space- architects. This flexibility is important for providing formal variety in urban space. Consequently, here flexibility will play a role in a tension created between unity and variety. The second one is about the capacity of the space which is produced through plan to respond to different functions and needs. This flexibility is important for the physical space to adopt itself to changing needs and reveals itself as a tension between form and function. As an extension of this the third one is related with the flexibility of the elements that form up the physical space.

2.2.2.a. Flexibility as a tension between unity and variety

We may talk about many physical design elements starting with general determinations that form up the physical structure and overall form of urban space such as density, continuity, closure, direction, height, size, scale, spine, centre and spatial hierarchy, to more specific determinations such as hard and soft landscape elements, inside structures of masses, their forms, facades, materials… All of these can be designed from the beginning to the end starting with the most general elements to the most specific details in the process of shaping urban space. In this case the form of the space will totally be an outcome of the creativity of one designer and the responsibility of the individual designers will be reduced to the implementation. Another attribute may be designing only some of the mentioned elements, and leaving others to the initiative of the designers that will be involved in the process under certain circumstances. In this case the space will be made up through coming together of the works of different designers.

These two situations we mention represent different flexibility attributes in shaping space. As Günay (1999a) mentions, these attributes gave way to discussions between planners and architects on the definition of urban design. While planners are inclined to determine parts starting from whole with a deductive approach, architects on the other hand give priority to the individual characteristics of the elements they design with an inductive approach. There is the danger of creating a monotonous environment, when planners determine all the elements of urban space from upper scales. On the other hand when architects apply their own design approaches independent from each other, this may lead to not being able to provide a harmony of parts and an overall character for urban space. Thus questions of whether unity or variety will be at the fore in shaping space, or how both can be obtained, so how relations can be built between individual designs appear as flexibility problematic in the field of urban design.

As we will see at the end of this chapter, this problematic can also be solved within the frame of property relations. How the relation between planners and architects will be built will be revealed related with problems such as whether we design for one property or multiple properties or who has the right to say in financing and implementing the projects.

2.2.2.b. Flexibility as a tension between form and function

The capacity of a space to respond different needs and functions depends on the form of space. Form can make it harder or even impossible any function changes in the process. This creates a tension between the activities in the space and physical form of the space. Günay explains the inflexible situations created by form of the space as a tension between the dynamic structure of physical space and the static nature of physical fabric.

> "Urban form is an outcome of the bonds between *activities – adapted spaces* and *flows – channels*. Within this relationship, if a new activity system is generating a new physical structure in a new development zone, this will open the way to the famous design strategy: *form fallows function*. However, if that new activity is to reside in an existing physical fabric, a tension will emerge between form and function, since activity structure is dynamic apt to frequent changes, and physical structure is static and difficult to change. Because existing form has not been able to easily follow new functions, there arose a multitude of planning and design problems" (Günay, 1999a; 36, 37).

This flexibility that the physical space has is important as will be seen in the case of METU-Technopolis for the development dynamics of science parks. Everchanging profile and needs of users make flexibility a main strategy in the development of science parks.

2.2.2.c. Flexibility of physical elements that constitute urban space

We can divide the physical elements that make up the urban space into three: infrastructure elements, superstructure elements and landscape elements. In fact all of these elements are produced dependent on the property patterns. But if we leave apart the inflexibility of the property pattern, we may define a flexibility problem for costs, production, permanency, transformability and possibilities of coming together for each of different infrastructure elements such as roadways, sewage system, electricity and water, superstructure types of different functions and different landscape elements that make up open spaces

Each of these elements may show different resistance and incompatibility to change and additions. Thus it may be strategic to decide which ones to produce first. Because the existence of one of them may effect the design of another. This may lead for certain choices to become useless. For example pre-building of an important infrastructure even sewage system may later make development on that line necessary. Or the existence of a building may prevent a suggested infrastructure system to be realized, and a new route for the system may necessitate changes in site plan. Even aforestation of an area at the beginning may become a restrictive element in the future development of the settlement.

If we approach from the opposite side, such elements may be used in order to restrict the choices of development of a space. For example a road passed in a direction, may limit development options in another way, in other words it may remove the uncertainties for the direction of development with reducing the flexibility of taking different decisions in the future.

As a result, while flexibility in process is about the interrelations between the actors playing role in the production of a space, formal flexibility is about characteristics of the physical elements that belong to the produced space and the design approaches that aim at creating these characteristics. Within this frame, we can say as an abstraction that flexibility in process is a characteristic of *urban planning* process and the flexibility in form is a property of *urban design.* We may comment that flexibility in process covers and determines flexibility in form through property relations just as planning process covers and determines urban design process. Therefore, in the following part of Chapter 2 we will handle first basic planning approaches with reference to their attribute towards flexibility, and later the differing approaches will be evaluated from the point of unity-variety tension mentioned above. This will form the theoretical frame for evaluating different stages and approaches of planning and development of Metu- Technopolis within the context of flexibility.

2.3. Flexibility in Urban Planning and Design Approaches

Certainly we can talk about many different planning approaches depending on their planning procedures and tools, attributes towards environmental and historical areas, political contents etc., such as advocacy planning, sustainable planning, strategic planning, participatory planning, communicative planning and deliberative planning. However within the context of this thesis we will study only three main ones: comprehensive planning, incremental planning and structural planning. These three approaches correspond to three basic attitudes towards flexibility. Putting forward these three approaches will make up the frame for evaluating the physical planning experience of METU-Technopolis.

2.3.1. Comprehensive Planning

As the planning approaches of the 19th century that comprehend space as a physical entity were insufficient in solving the problems of the rapidly growing industrial city, searches for new approaches began. Together with the developing urban sociology studies that started from the beginning of the 20th century, planning approach getting out of the frame of architecture began to be directed towards a comprehensive approach which comprehends the city as a whole together with all social and economic dimensions. Planning instruments like land use planning, zoning, urban standards were improved in this period, in the frame of the principles of Patrick Geddes summarized as “survey, analysis, plan” which constitutes the scientific basis of urban planning.

The basic characteristic of comprehensive planning is that it depends on positivist, scientific knowledge. The supposition that dynamics of urban development can in all ways be comprehended and calculated provided for long-term predictions utilizing scientific methods. As Alexander (1981; 121) mentions comprehensive planning recognizes the complexity of factors which “include social and demographic characteristics of population, economic variables such as income and local or regional economic base and transportation factors. Comprehensive planning aims to take all these factors into account in a rational, analytic planning process”.

Therefore, comprehensive planning is based on a technical procedure. Planners as technical expertise have the means of putting forward how city should be developed. Planners equipped with technical knowledge and methods can determine the goals and set of values for planning rationally and a priori. As Camhis (1979) explains in detail, the procedure of comprehensive planning starts out from a priori goals and puts forward all the alternatives of urban development through detailed analyses and then identifies the consequences of them in order to find the best alternative whose consequences rates highest on the agreed values. Thus the principle of 'optimization' that we discussed in choice theory has a central role comprehensive planning. Because, comprehensive planning deals with *uncertainty* by eliminating it, through detailed and comprehensive analysis. So predictions, calculations and optimization can be done without any error. Thus there is no need for a flexible attribute in decision-making. In other words, the *deterministic* approach of comprehensive planning leaves no room for uncertainty and this lets flexibility to be kept in a minimum level.

Together with this when we evaluate comprehensive planning within its historical context, instead of dealing with it on a conceptual basis, we are faced with another scene. Comprehensive planning has been possible as the capitalist state with an approach of planned development, kept market under control under social welfare principle. As Günay (1999,b) emphasizes comprehensive planning and related approach of production of space was realized through total control of the state over property. Comprehensive planning remained ineffective in countries where the state does not have this power as seen in the Turkish example mentioned above. Thus the main reason that has been put forward for this failure has been inflexibility. However if we look at the European examples where control over property can be provided, comprehensive planning has been criticized on the ground of its success in controlling the space rather than ineffectiveness of planning (see Jacobs, 1963). The rigid and inflexible control of comprehensive planning has been viewed as an element of pressure which limits the freedom of other actors in the city and destroys the liveliness and variety of city life.

However abandonment of the comprehensive planning approach was not only because of such criticisms but also because of the beginning of a new crisis period for capitalist system in which the state accepted that it couldn't dominate space totally. Neo-liberal policies such as privatization, decreasing state investments and rise of the private property, removed all the possibilities of long-term control for comprehensive planning. So the approach of comprehensive planning that focuses on unity and total control over all the parts that form up that unity was abandoned and more flexible planning approaches against flexibility appeared on the agenda.

2.3.2. Incremental Planning

Incremental planning approach which is generally related with Lindblom's theory of politics, was developed as a reaction to the determinist, rational analysis of comprehensive planning. Dahl and Lindblom (1953) claimed it was inevitable for processes of rational calculation and rational control to face with problems in any stage. The contradictions between individual desires and objectives and the presentation of common good, normative issues, unconscious and impulsive actions, limited capacity of individuals and uncertainties between the decision makers in the process of decision-making limit the possibilities of rational calculation and control and prevent common values to be formed.

For this reason, according to Lindblom *agreement on policies precedes agreement on values*. Administrators simply, deal with the value problems by producing policy alternatives. However, policy is made and re-made endlessly. So policymaking is a process of successive approximation for some desired objectives in which what is desired itself continues to change under reconsideration. Moreover, administrators chose ends by selecting the means at the same time, so there is no any process necessitating the production of ends before means (Gündoğan, 2005; 22).

Therefore, there is a tension between the long-term policies of planning and intuitive decisions of administrators. Administrators have to deal with actual problems depending on their experiences. Thus, for Rosenhead, policies are developed as a trial and error process in incrementalist approach;

> "Incrementalism limits its consideration to policies which differ only slightly from current policies, examines only the direct and major effects of these policies, and selects only objectives which seem reasonable in the light of available means. Choice between alternative policies is carried out by successive limited comparisons – that is on the basis of marginal analysis of gains and loses on different objectives. Problems are not solved all at once but are attacked repeatedly" (Rosenhead, 1980; 211)

Therefore, incremental planning focuses on explicit conditions of existing problems, avoiding from long-term wholist goals. From this point of view we may claim that incremental planning is actually non-planning. In this approach the problem of uncertainty is overcome with the compensation of long-term predictions, calculations and policies. Because in a process which operates with immediate interventions to immediate problems, and new situation will signal the beginning of new decision-making process. This means a very flexible decision-making process indeed.

Incremental planning presented itself as a method which is flexible enough to adopt the dynamic nature of market by recognizing the role of market and property relations. However in recognizing the property relations it has yielded existing relations and actors dominating these relations by accepting that these relations are unchangeable.

As a result the high level of flexibility in incremental planning faced two main criticisms:

Firstly, it leads to incoherence and lack of direction. Another is that it favors the already powerful.

2.3.3. Structure Planning

Structure planning can be defined simply as the combination of the deductive method of rationalist-comprehensive planning and the inductive method of incremental planning, while eliminating their negative aspects. We have already mentioned that the main problem of comprehensive planning is its static-inflexible decisions. On the other hand, incremental approach is lack of a long term direction and it is not capable to create comprehensive innovations in the development of cities. Thus, structure planning is an attempt to create a flexible decision making process without loosing long-term goals and directions.

The theoretical framework of structure planning was founded by Etzioni who established the dialectical relation between fundamental and incremental steps through mixed-scanning method.

> Unlike 'rationalism' which would try to examine the entire sky in every detail and 'incrementalism' which would focus on those areas in which similar patterns developed in the past, and perhaps, on a few nearby regions, 'mixed-scanning' would use two types of cameras: a broad-angle that would cover all parts of the sky but not in great detail and one which would zero in on those ares revealed by the first camera to require in depth-examination (Camhis, 1979; 57)

According to this statement, there are two levels in the decision making process of structure planning: A higher order of fundamental policy-making process which sets basic directions and an incremental process which prepares for fundamental decisions and revises them after they have been made. In other words, the first level is the fundamental decisions that include long-term, general values-goals and the second level is the incremental decisions that include the detailed objectives (Camhis, 1979; 57). The critical point is that the first level is not static but can be reformulated according to the unexpected failures in the accomplishment of detailed objectives.

Therefore, the central feature of structure planning is its attitude against uncertainity. The recognition of the central importance of uncertainty and ways of managing it in a creative and positive way leads to a view of planning as being fundamentally a process of strategic choice. The structure plan provide a context, or a framework, within which decision maker can cope effectively with uncertainties and with inter-relatedness of the choices facing them (Floyd, 1978; 478 in Sert, 1991;43).

In other words, structure planning controls the structural and the essential elements while leaving the control for others to incremental decisions that will be given in changing circumstances, instead of controlling the whole as a totality as does comprehensive planning. Which elements to be pre-controlled and which ones to be formed within the process is a matter of strategic choice. As long as this can not be accomplished the long-term goals are reformulated.

It will be insufficient to explain the prevalence of this flexible attribute just as a methodological change in planning theory. In order to understand this better we should look at the historical circumstances that gave rise to structure planning.

Günay indicates that the regulatory plan which was the basic controlling document of the era of comprehensive planning was supposed to control all land use decisions, densities and circulation. At a time when public policies prevailed, there was total control over public property at the vacant peripheral zones of the towns, the regulatory plan worked. But when in the post-war period the public bodies began losing their power in the real property market, comprehensive planning assuming total control failed especially against the mechanism of private property, to be replaced by the more flexible 'structure planning' in 1970s (Günay, 1999b; 154). Because, "the dynamic capitalist society could no longer be dominated by static comprehensive plans. The 'regulatory plan' is found too static to solve the intrinsic behavior of both real property disputes and property relations in general coming out of change and growth" (Günay, 1999b; 181). For this reason, structure planning is more explicitly concerned with activities and individual behavior rather than general land uses and land use control of comprehensive planning. As Günay states,

> Now private property restoring itself, which meant that there would be many goals and alternatives open to debate. This meant uncertainty and optimization. The simple functional discourse proved insufficient in a market economy. The deductivism of comprehensive planning was replaced with an inductivist outlook, trying to understand the parts of the city and the processes which made it (Günay, 1999b; 182).

As a result, structure planning is a response to the decreasing role of state in property relations and widening arena of private property. It appeared as a flexible planning approach to direct the processes of conflict-compromise lived between multiple actors with different demands and goals and to cope with the uncertainties resulting from the dynamic nature of market. Thus we can say that strategic planning is essentially a derivative of structure planning that is developed with components as participation and governance.

2.3.4 Flexibility in Urban Design Approaches

As we mentioned before, the concept of urban design appeared as a result of discussions between planners and designers and its content has changed during this discussion which is still continuing. Günay handles this discussion as a conflict that arises from the nature of planning and architecture disciplines and evaluates this conflict as a phenomenon that enriches urban design;

It is in the nature of planning to bureaucratize and socialize, while architecture tends to individualize and liberate. This is the basic dialectical bond between the *urban* and *design* sides of urban design" (Günay, 1999a;32). "If these two sides are integrated, this contradiction may be a dialectical relation that supplies urban design. It may provide the dialectic between induction and deduction and between the provocative individuality of architecture and comprehensive rationality of planning" (Günay, 1999a;75).

In the relation formed within this frame, flexibility shows itself as a determinacy relation between planner-architect. We will assume that this relation is generally realized through legal tools such as zoning regulations, development laws or bylaws that are generally labeled coding. So that as the relation between planning and urban design changes, the function of urban coding and thus the role of problem of flexibility plays also changes.

For example the modernist urban design approach that has rose in 1930's and became the prevailing approach in the production of space in Western countries after World War II, is based on a hierarchical boundary relation between planning and architecture. In other words urban design has been realized as large scale projects designed by architects and that were realized at the end of the planning process (Baş, 2003).

In this context, modernist urban design functioned as a tool for planning to shape space. Therefore, the progressist-functionalist space understanding of CIAM and the approach of comprehensive planning were overlapping. Both of them suggest a space production type under the total control of state, and domination of public property. In this context, regulatory plan was the basic instrument of comprehensive planning which was supposed to control all land use decisions, densities and circulation. Zoning was the main tool to apply these planning decisions. On the other hand, urban design treated as an architectural product design in one property dominated by state bodies.

Architects to design on a single property at a large scale provided a high level of flexibility. Within this flexibility modernist architects could reflect their own design approaches onto the space. Modernist urban planning and design aimed to create a modern city in which everyone benefits equally from "sun, space and greenery" in a standardized, homogeneous geometric setting. Instead of the street, they advocated high-rise blocks surrounded by extensive green areas, mainly in dispersed suburbs (Baş, 2003; 123). Together with this, the flexibility of modernist-functionalist designers in shaping space may mean an insistence for the individuals living in these cities. Similarly, in the process of producing space on small pieces of property as distinct buildings instead of large scale projects, planners bring significant limitations to architects with the zoning regulations. A striking example is the small-scale development that is called 'apartmanlaşma' in Turkey. The restrictive and rigid conditions of plot-based development in Turkey are the main source of the complaints of architects about development plans and bylaw. They are restricted in boundaries of plots with strictly prescribed development conditions and architectural standards.

As a result, both in mass housing projects realized on a single property and in spaces formed by the buildings coming together on small pieces of properties under prescribed conditions, the result is monotonous environments lacking diversity. As a matter of fact, one of the most important principles of post-modern design approaches that have emerged against understanding of modernist space is increasing variety in urban space. For this reason, developing urban coding tools which will provide a more flexible frame for individual designs has been the major concern of contemporary planning and design approaches. So the relation between planning and architecture and thus the problematic of flexibility has been redefined by urban coding:

> "in the conditions of neo-liberal period after the 1970s, flexible strategies has prevailed instead of comprehensive planning assuming total control of the state on urban space. Thus, urban design emerged as a new concept and field between urban planning and architecture to compose the changing design approaches with new flexible, strategic approaches of planning. Urban coding gained a new role with this redefinition of the relation between planning and design. From then on urban coding would function as an integrating mechanism between planning and design processes**"** (Baş, 2003; 124).

Thus, planners attempted to develop urban coding tools in a way that they provide flexibility for individual designers in expressing their design understandings, while maintaining an overall harmony and achieve a unity. However, this was a hard task and lead to an important debate in the planning and design fields. In this task, flexibility has appeared as a dilemma between planner and individual designer, and between variety and unity. So, urban codes of the comprehensive planning turned into design codes which use diverse design criteria as different types of urban codes. These new types of codes are called as design guidelines. Different from the earlier codes which provide detailed prescriptions, these new guidelines depends on performance criteria.

The advantage of performance guidelines is that they don't prescribe a standard solution and leave flexibility for creativity of individual designers. For example, a performance guideline might say that any design is acceptable provided a particular amount of sunlight falls on a particular piece of ground between certain hours on a certain day (Lang, 1997;82) However, as emphasized by Baş (2003; 47), "it is hard to evaluate the compatibility of a development to some performance criteria and such a control provides flexibility and creativity for the developers in the implementation. But the result of flexibility may be the destruction of common characteristics of the site unless the variety coming from flexibility is controlled by some common features. Therefore, it is a dilemma of design control, which finds its solution in the planning practice rather than theoretical debates".

In spite of these difficulties, urban design practice in many cases has developed many successful examples. Design guidelines has gained a rich content including topics such as "materials, shop fronts, house extensions, advertisements, conservation areas, housing, landscape, car parking, density, residential roads, disability provision, grant aid, town scheme, crime prevention" (Punter and Carmona, 19997;323). Moreover, different countries have developed many distinct types and methods of design control in the frame of their development legislation. Table 2.1. below shows types of design guidelines classified by Lang according to their control purpose.

Table 2.1. Classification of Guidelines According to Their Purposes

General Purpose	Type	Specific Purposes
Defining and designing the public realm	Guidelines	for disabilities
	Guidelines, such as specification materials, vegetation, order of trees, the nature of street furniture	to ensure the consistency in the design of public spaces, especially for the pedestrian landscape
	Guidelines	to ensure that interior public spaces is open to the public
Specifying and/or restricting certain uses and built forms	Zoning ordinances	to control the type and intensity of uses
	Transfer of development rights	especially, from historical protection sites
	Prescriptive codes and guidelines, such as street and plaza layout, height, site coverage, setbacks	to control physical form and pattern
	Aesthetic guidelines dealing with building envelope, facade design, scale, meterials, textures, color	to ensure a harmonious relationship
Mechasims to stimulate particular types of development	Catalytic interventions	to change the character of an area in order to attract designed development
	Legislative tools, such as zoning incentives, special zoning districts, planned unit development, tax credits	
Preserving existing urban environment	Preservation programmes or guidelines	to maintin such environments and to prevent demolition
Specifing the nature and location of public art	Public art programmes	

(Source: Baş, 2003; 47)

Within the scope of this thesis we will not enter into the details of different types of guidelines mentioned above. Here what should be mentioned is that the outcomes of these guidelines will bring on space is related directly with the existing property structure and the mechanisms that transform property relations. Such that, the characteristics of the design process that is realized can show great variations depending on the property structure. Günay explains this phenomenon as follows:

> "... rearrangement of property is a basic task of urban transformations. It is where the distinction between architecture and urban design starts. Architectural products are shaped between the responsive actions of demands of the owner and the architect's design approach. On the other hand, the existence of varying preferences and ownership patterns, and corresponding activity and style demands in the urban context require the development of design strategies" (Günay, 1999a; 42).

Similarly Lang (1994;78-80) describes four types of situations in which varying degrees of control designers exert over the actual design. These types can be seen as different models of developing a site and each model has a different attitude in respect to the problem of flexibility in the relation between planners and architects. These are summarized in Table 2.2.

Table 2.2. Types of Urban Design

Types of Urban Design	Description	Readjustment of Property	Examples
The Urban Design as a Total Design	Architectural product design on an urban scale by a single deigner or design team, then preperation and application of a development programme for the scheme	Design in one property, transformation from consolidated to consolidated ownership pattern	Central. governmental, touristic, cultural, business, and housing complexes, admisnistered-gated comminities
All-of-a Pieces Urban Design	An overall illustrative design is done by one team, and guidelines are written for developersand architects to follow in the design of individual buildings. The design team acts as the reviewer of each subproposal and elements of the project built in a short period of time.	Design of overall scheme in one property, transformation from consolidated to fragmanted, or from consolidated to consolidated ownership pattern	New towns developed by a firm, such as Seasside of Duany and Plater Zyberk, urban renewal and redevelopment projects, university campuses
The Urban Design as the Design of Infrustructure	Organization of public spaces and facilities, Intervention in two ways; formation of the pattern itself and catalytic effect of such facilities on their surroundings	Design in public property or expropriation of private property	Such as roads, transport nodes, parks, plazas, city halls, musemus, schools.
The Urban Design as Design of Guidelines for Design	Overall control of the process of urban formation in the frame of municipal design policies and policies through various regulations, guidelines at various scales.	Desing for many property, vaious types of land readjusment	Design revies and design control processes of many cities in the Europe and US.

(Source: Baş, 2003; 48)

As a result, it is possible to consider the problem of flexibility as a dilemma between rigid control and flexible control, between public control and private design, between planners and architects, between deduction and induction, or between homogeneity and diversity on the basis of readjustment of property pattern and the development models.

CHAPTER 3

STRUCTURAL CHARACTERISTICS OF SCIENCE PARKS and METU TECHNOPOLIS

Development of High-Tech districts is the outcome of the structural modifications lived in cities and regions. According to Castells and Hall (1994:3) three significant processes lie under this modification:

- the first is a technological revolution based on information technologies,
- the second is the formation of a global economy, that is the structuring of all economic processes on a planetary scale. By a global economy we understand one that works in real time as a unit in a world wide space, be it for capital, labor, technology, information or markets. Even firms that are anchored in and aimed at domestic markets depend on the dynamics and the logic of the world economy through the intermediation of their customers, suppliers and customers.
- the third is the emergence of a new form of economic production and management that is termed informational. It is characterized by the fact that productivity and competitiveness are increasingly based on generation of new knowledge and on the access to, and processing of, appropriate information.

  Furthermore the informational economy seems to be characterized by new organizational forms both for large corporations and small businesses. Horizontal networks substitute for vertical bureaucracies as the most productive form of organization and management. Flexible specialization replaces standardized mass production as the new industrial form best able to adapt to the changing world demand. This new production form is labeled as Post Fordizm.

Jessop (1994) highlighted the main features of Post-Fordizm:

- Labor process consists of a flexible production process that is based on flexible transfer machines, flexible workers who are multifunctional and flexible work team who are responsible for performing all the operation necessary for completing a specified stage in the manufacturing stage. Its hardware is based on information and communication technology.

- Macroeconomic growth is based on flexible, diversified, and innovative production, increased demand for differentiated goods and services, increased profits deriving from full utilization of flexible capacity, reinvestment in flexible production equipment and processes, new sets of products, and new organizational forms that ensure economies of scope and ongoing innovation.
- Social regulation pattern involves supply side of innovation that is the promotion of competitiveness and technological innovation through monopolistic corporations, which have greater financial resources and incentive to promote technological advance that is Schumpeterian workfare state.

Obviously flexibility is one of the most emphasized points in any arena together with economic and social restructuring. In High-tech districts, no matter of which label as they emerged as an outcome of Post-Fordizm, since flexibility is the part of economic and social restructuring, and fast changes and uncertainty always occur in the process, therefore the planning and the design processes have to be in a flexible way, too.

In this chapter science parks as high-tech districts, will generally be examined as the subject and the object of the planning. In the first part of this chapter, the development dynamics and physical structures of science parks (structural and spatial characteristics of science parks as the object of planning) and on the other hand administrative and decision-making mechanisms and intervention tools of science parks (legal and administrative frame of science parks as the subject of planning) will be examined. This will provide us understand both the general characteristics of science parks and specific characteristics of different types of science parks.

In the second part of this chapter, the structure of METU Technopolis will be analyzed within the framework developed in the first part of this chapter. Thus the analysis will involve on the one side the structure of the subject of the METU Technopolis Development process within the legal and administrative framework of science parks in Turkey and on the other side the spatial characteristics of METU Technopolis. Here the aim is to provide a frame of reference for the fourth chapter.

3.1.Science Parks as the Object of Planning

Today there is no generally accepted definition of a science park, it shows great variety. The relevant literature is full of a wide range of terms like ‘Science Park’, ‘Technology Park’, ‘Research Centre’, ‘Technopole’, and ‘Science City, etc., and a number of other terms that have to do with business support (Kung, 1997). This variation of forms and names for science parks occur within the context of different time and spaces. This is partly due to diversity of local contexts such as degree of development, or particular needs of regions and countries, and partly due to the evolution of the concept in time (Benko, 1991: 11). The concept “Science park” mostly use in United Kingdom. In US “research park”, in France “technopole”, in Japan “technopolis” and in Germany “grunderzentrum” is preferred to use for defining the high-tech districts (Babacan 1994: 4). Differentiation of each model is discussed in section 3.1.3 in detail.

3.1.1. Definition of Science Parks

Many definitions are developed for science parks by different authors such as Massey (1992:2), Castells and Hall (1994:1), Benko (1991:13), Worthington (1982) etc. and different organizations such as; International Association of science parks (IASP), United Kingdom science park Association (UKSPA), but the definition of Association of University Research Parks (AURP) can be considered as the most proper definition for this study:

> A science park (a university research park) is a property-based venture, which has:
>
> - Master planned property and buildings designed primarily for private/public research and development facilities, high technology and science based companies, and support services
> - A contractual, formal or operational relationship with one or more science/research institutions of higher education
> - A role in promoting the university's research and development through industry partnerships, assisting in the growth of new ventures and promoting economic development
> - A role in aiding the transfer of technology and business skills between university and industry teams
> - A role in promoting technology-led economic development for the community or region

The definition of a research or science park differs almost as widely as the individual parks themselves. However, the science park concept generally includes three components:

• A real estate development

• An organizational program of activities for technology transfer

• A partnership between academic institutions, government and the private sector. (Link, 2003: 1325)

3.1.2. Development of Science Parks

An interest in the economies of spatial agglomeration can be traced back to the late 19th century and Marshall's observations about specialist industrial districts in the UK. According to traditional Marshallian conception, the advantages of agglomeration are rooted in the reduced costs that arise from the operation of three sets of localization economies: the growth of various intermediate and subsidiary industries which provide specialized inputs; the development of a pool of skilled labor; and the establishment of a dedicated infrastructure and other collective resources. In the context of a shift towards a knowledge based economy, particular emphasis is now placed on knowledge and information spillovers. From 70'ies onwards both public and private sectors had begun to focus on use of innovation to gain economic advantage in the global markets. In the 80'ies innovation theories began to expand rapidly and the success stories of science parks proliferated this interest more and more each day.

The first science parks were Stanford Research Park in Silicon Valley and Boston-Cambridge in Route 128 in U.S. (Massey et al., 1992: 5). The success story of Stanford Science Park and Silicon Valley has had the consequence to attract the attention from other regions in the U.S., the Research Triangle Park in North Carolina and from Europe, Sophia-Antipolis, and Cambridge-UK are examples of European science parks, which have been inspired by their U.S. equivalents (Roberts, 1998; Storey and Tether, 1998). Today there are many successful science parks in the world from Far-East to South America.

3.1.3. Typologies of Science Parks According to factors that Effect Spatial Structure

According to different ciretia, there are different typologies of science parks. While examining the typologies of science parks will help us to understand the inner forces of the science parks, which leads us to find out the essential elements and crucial actors, and therefore to understand the development of METU Technopolis.

Types of Science Parks according to Conceptual Differentiation

According to conceptual differentiation, science parks can be classified under five headings; Incubation centre, research park, science park, technology park (technopark), high technology industrial park, technopole, science city (tecnopolis). The table-3.1 developed by Carver, Baker and Parry summarized the terms according to their spatial features.

Table 3.1- Spatial Features of Parks according to their conceptual differentiations

Type	**Likely location**	**Permitted activity**
Incubation Centre	Urban building or may be part of suburban campus style research or science park development	Incubation of science, knowledge and technology based businesses
Research Park	Urban or suburban style campus development	Research, development and design activities
Science Park	Urban or suburban style campus development	Research, development and design activities and some high value low volume manufacturing activities
Technology Park	Suburban style campus development	Research, development and design activities, but with a greater proportion of high value low volume manufacturing
High Technology Industrial Park	Suburban style campus development	Usually relatively little research, development and design but with proportionally more high value low volume
Technopoles	Allocation of city, zone of city, locality or region to support wealth creation through investment in science and technology	A city or region committed to developing its economy based on science, technology and advanced engineering activities
Science City (Technopolis)	New or existing city for development through a regional or national policy	Whole new or existing city developed with purpose of creating a centre for science and high technology activities

(Source: Carver, Baker, Parry, 2006: 81)

Types of science parks according to their location

Proximity to a university or a research organization, proximity to an industry zone, market and a city, proximity to highly-skilled labor force, proximity to transportation infrastructure (mainly high ways and airport), and the proximity to high-quality natural and social environment, can be declared as the main locational requirements, that affect the site selection of science parks. According to their location, science parks can be classified under three headings; Urban Type, Suburban / Periurban Type and Rural / Green Type. *The Urban Type* science parks are densely developed as part of cities' urban fabric and usually next door to an existing university or research centre. This type of science parks result from the need to be very close to an existing establishment and from the lack of space within an existing neighborhood. *Suburban/ Periurban Type* science parks have looser layout and are organized in away that facilitates the interaction between education, research and technology development. They are usually founded on the outskirts of cities, combining built-up areas with some green open spaces and landscaping in order to create a pleasant man made environment. Due to their distance from urban areas they are equipped with full range of activities. *Rural/Green Type* science parks are made out of clusters of buildings integrated in existing large green areas. They have very low density and a freer lay out. As they are far from the city centre, they are usually equipped with a full range of activities. Sophia-Antipolis and Research Triangle are examples of this type of development.

Types of science parks according to their Development Type

For Marshall, the concentration of firms in close geographical proximity allowed them to enjoy the benefits of large scale industrial production and technical and organizational innovations. High technology industries also tend to flourish in particular kinds of environments, develop together, and cause agglomeration effects that further reinforce clustering (Roberts, 2005:481).

When we look how these agglomerations of innovative firms happen we can see basically two models: *Spontaneous* and *Planned*. As Rosenfeld and Cooke mentions "most of the world's successful clusters were accidents of circumstances, thus spontaneous developments (Rosenfeld, 2002: 11) (Cooke,2001: 23). Cooke also mentions this point as "the clear difference between linear technopole and innovative 'cluster' policies is that the former is hierarchically planned, agglomeration is induced but no effort is made to create linkage, while the latter is more organically evolved, networking is promoted and linkage stimulated" (Cooke,2001: 23).

Although, science parks (technopoles) generally are planned developments (Castells and Hall, 1994:1), one should not forget that the success of high-tech districts is not directly related with its being planned or spontaneous. The determining factors for success are rather about industry and innovative capacity and entrepreneurship. Most of the planned developments that look unsuccessful are mainly because of regional policies that aim at developing the regions that are without potential.

Types of science parks according to their Sectoral Differentiation

Science parks are places where high tech companies are housed in. According to International Science Parks Association and Association of University Research Parks data; life sciences and information communication technologies are the most dominant technologies in the sectoral profile of science parks. Electronics, new materials, pharmaceutical, fine chemicals, energy, environment and agro-food can be mentioned as other technology based sectors located in science parks. According to their sectoral profile there are two types of science parks *generalist* and *specialist.*

In generalist type of science parks we do not see the dominancy of a specific sector. Any sector of prevailing in the area may locate in such places. On the other hand specialist science parks focus only on the expertise area of city, the related university or research institute. The dominating sectors in specialist science parks are biotechnology (biopark), ICT (ICT park- IT park) and agro-food (agropark).

Considering that different sectors have differing space requirements, for generalist parks physical development necessitates a more flexible attribute than a specialist park.

3.2.Science Parks as the Subject of Planning

3.2.1. Actors in the Development of Science Parks

3.2.1.a. Defining the Actors According to Foundation (Establishment) Models

A categorization of science parks can be made according to the founders. Whether it is a profit, non-profit or not-for-profit organization determines to a large extent the administrative and managerial orientation of the park. However this categorization is not a solid one, most science parks lie in between, and these typologies are defined rather due to dominancy of one or more partners.

The foundation model of the science park will show us the areas of concentration, guide us to define the actors and their role in the physical development process of the science park. Each founder, sponsor and the stakeholder has their own objectives for the establishment and the development of a science park. While for private science parks profitability will be more important the ones that are tied to universities will concentrate on research and development and specialization on strength areas, the ones that are tied to local governments will stress regional development and the ones tied to public authorities will have more strategic goals (Babacan, 1995: 31) (Babacan, 1994: 34).

According to the domination of the founders the following three models are widely accepted.

Public or Local Government-based Model

In this model science parks, which are considered as tools for increasing national, regional or local competitiveness by the states or the local authorities (Dalton, 2000: 45). Public bodies or the local government become the primary actor in the development.

This model, which was preferred mostly by England, Japan and France, is the model of integrating the science park with the regional development policies (Masser 1990, Longhi 1999). Technopoles, technopolises, science cities are the product of this type of establishment. The negative side of the model is; huge investment should be done by the states most of the times (Çakır, 2001: 35). The government funding for science parks is 60% in England, whereas in France, Germany and Holland it is almost 75% and 100% in Belgium (Porter, 1989: 22). Teukuba Science City in Japan, Sophia Antipolis in France.

University-based Model

The transfer of technology from universities through the industry is the main objective of that kind of developments. The competitive global environment of today necessitates accessing sources of knowledge and technology outside the firm. Thus companies increasingly see universities as potential sources of knowledge and technology, especially in sectors like biotechnology and software. On the other side universities with a specific level of economical welfare, have their own sources, gather important amounts of donation and take place in locations of high land and rental values afford in founding a science park (Westhead & Batstone, 1998: 2200). Capital need for the universities is the major driving force for that kind of developments.

Dalton (2000: 44, 45) lists a university's interests in a science park project as one or more of the following objectives: To increase the commercial exploitation of its intellectual property, its research income, the opportunities of employment for its graduates and undergraduates in the tenant companies, the opportunities for registering part time MSc and PhD candidates from among the staff of, its income from the lease of land and buildings and to enhance its public image, including that of demonstrating relevance, and to gain recognition as a contributor to the economic well-being of its local area (Dalton, 2000: 44, 45).

The advantage of this model for universities is that they can direct the way and pace of development themselves without any intervention from outside (Babacan, 1995: 33).

Private-sector-based Model

In this model which is generally preferred by the newly founded science parks, universities act together with strong financial companies that will undertake the construction of the buildings.

These parks that are located on lands with high prices try to maximize their profit by attracting more investors through attractive design of buildings and space. The company that plays role in the foundation of the park also plays a dominant role in management of the park and is effective in deciding which firms to be accepted to the park or not (Babacan, 1995: 34) (Babacan, 1994: 37).

Profit, which is the main objective of the management, manages the park and chooses the tenant firms. In this model, the science park is seen as a real estate product therefore, the physical development of the park takes its shape accordingly.

Mixed Model

Some science parks may be founded in cooperation of universities, local governments or foundations each of them with differing capital shares (Babacan, 1995: 34) (Babacan, 1994: 37). For example; all science parks in England are established according to this model by partners consisting of the local goverment, the university and finance foundations such as Aston, Warwick, Newtech; In Spain, La Silicon Valles had been established by university, city and regional management, banks and foundation. (Öncül, 1997: 31)

Table-3.2: Advantages and disadvantages of foundation models

Type	Adventages	Disadvantages
Single founder	• Simplicity of ownership and management structure • Sharper focus on a limited number of objectives for the park • More intimate relationships between the tenant companies and the science base.	• Greater possibility of a reduced scale of funding • Greater possibility of the resources being amended or reduced in retrospect • Greater possibility of the project being aborted • Possible change of use at a later date
Joint founder	• Greater possibility of access to larger sources of funding • Greater possibility of stability once the project has been agreed and launched	• Greater ownership/management complexity • Less focus due to need to accommodate a greater number of varying objectives • Greater possibility of a less intimate relationship with the science base Greater possibility of 'mission drift' with time

(Source: Dalton, 2000: 47,48)

3.2.1.b. Defining Actors According to property development models

Although science parks are property based development in one side, their objectives and the model on which the concept of the science park is created differs from many aspects of the usual pattern of property development (Parry, Carver and Baker, 2000: 87). The form of development undertaken by those creating science parks is different in that it centers around creating space for high risk and, very often, high growth companies (Parry, Carver and Baker, 2000: 87). This means that flexible leasing options and flexible planning approaches in every scale is needed in science parks.

There are two models for porperty development in science parks: Selling land, and leasing it. Within the context of these models, new actors with different goals, enter to the physical development process of science parks.

Selling land is a model which means transferring the property rights to buyer. In this model plots which are produced by the plan are sold to companies. This model rarely preferred in property development in science parks, but mostly implemented by and in industrial park where high-tech manufacturing is allowed and companies requiring larger spaces are located.

A lease creates ownership of property for a period of time either to a given date-a fixed tem- or over a regular cycle, often monthly, quarterly or yearly: indeed even the landlord is a trespasser within the property during the term, save where the lease or tenancy expressly permits access or entry (Sankey, 2000: 152). In other word leasing is transferring the right of possession to the tenant for a period of time. There are two models; *leasing of land and leasing of offices*.

Leasing of land

The Leasing Land model for companies is an option that is preferred by the firms, wishing to construct their own buildings (Individual single-occupancy buildings) within the science park property. According to this model, the company obtains the right of shaping the building. Therefore, individual single-occupancy buildings offer tenants more individuality and flexibility than multi-tenant buildings. In this model the inner arrangement of the building can be done according to companies needs.

The size of the building differs according to the needs and the size of the company significantly. To produce a more flexible lay out and provide for these differences, a number of different zones are created in the plan to accommodate. (Parry, Carver and Baker, 2000: 84).

Leasing of offices

The Office Rental Option is the model renting out the office spaces of Multi-tenanted buildings invested by an investor in the science park. Multi-tenanted buildings are the most common type in property development of science parks. In this model the flexibility is mostly related with the architectural design and solutions.

In this model two types of actors affect the development process. First one is the *tenant compan*y, and the other one is the *investor*.

3.2.2.Tools of Intervention and Control of Spatial Development of Science Parks

The high quality physical environment is one of the indisputable assets of science parks. Besides their all other characteristics, science parks property base is an enduring feature of them (Taylor, 2000: 72). Therefore physical planning and urban design process of science parks become crucial subjects in the development of science parks.

Foundation model, development model (spontaneous or planned), locational and conceptual type, and sectoral profile of science parks are the main factors that determine the physical development of science parks. However, Parry, who considers the science park as a customer oriented organization, argues that the physical planning of a science park essentially flows out of the marketing process and all the objectives, those that should have the highest influence on the physical planning and subsequent development of the park, are those that relate to the needs, wants and demand from tenant companies (Parry, Carver and Baker, 2000:75-76). Although, the level and the type of flexibility varies according to the model of the science park, flexibility from flexible offices, flexible plots to flexible leasing options, is mentioned as an obligation in spatial development of a science park by Parry and Russell (2000), Westhead and Batstone (1998).

Master Plans, which can be used as a model or guide for the physical development, are the main tools for urban design process of science parks. Although varying from country to country, for controlling and to guiding the physical development of science parks, legal arrangements such as: urban planning and building control laws, bylaws, regulations, zoning and land use decisions, local plans, and guidelines are the other tools of intervention. The tools, for controlling and guiding the spatial development of science parks, are in line with countries and regions own model.

According to International Science Park Association and Association of University Research Parks data, most of the science parks, the planned ones, have their expansion plan, which is called Master Plan. On the other hand, since they don't have a specific management team, physical development in spontaneously developed high-tech districts (science parks) are mostly controlled by local authorities according to urban planning and building control laws, local bylaws and regulations, zoning and land use decisions and local plans. Also in the preparation of master plans, urban planning and building control laws, local bylaws and regulations, zoning and land use decisions and local plans are taken into consideration as external information, regulations and restrictions (Sankey, 2000: 158-159).

Master Plan

Master Plan is not only documents showing the "end-state" as in the traditional physical planning mentioned in chapter 2 but, is an umbrella or coordinating framework for strategic frame drawn by structure plan, design policies and all kinds of supplementary guidance (Punter and Carmona,1997;317)**.**

Master plan which is the instrument of planning and implementation, seeks to promote control and choice on space. Moreover, master plan also provides for the careful democratization of the site by protecting and enhancing the public rights (Philips, 1993: 14).

Generally master plans consist of; zoning of sites and the layout of these zones on the site, road, footpath and cycle way routes around and through a site, sizes and flexibility of buildings and an understanding of the nature of the letting policy that might be adopted for buildings within the different zones, a Transport Plan that defines the modes of transport that exist or will be provided for any site and how public transport will work for a site, plot ratios and building densities: details of building densities and footprints, building heights and constraints, and building lines (distance from the road), architectural style, infrastructure arrangements, structural landscaping, estate management strategies, and security arrangements (Parry, Carver and Baker, 2000:81-82).

3.3. Structural Characteristics of METU Technopolis

3.3.1. METU Technopolis as the Object of Planning

3.3.1.a. The Development of Science Parks in TURKEY

The idea of establishing science parks in Turkey was emerged in 1980's, and the idea was turned into a concrete form by taking a part in the 5th National Development Plan. In 1990, a programme called "Programme For Establishment of Technoparks in Turkey", was developed by State Planning Organisation and UNIDO representing United Nations Fund of Supporting Technological Development (UNFSTD) (Çakır, 2001: 43-44). After the feasibility study, which funded by World Bank, was prepared, the decision revised and turned to establishing incubation centres (Çilingir 2004: 5). In line with this, together with universities, SMIDO (Small and Medium Size Industries Development and Support Organization-KOSGEB) began to establish incubation centres. In 1991 ITU-Technology Development Centre was established as the first incubation centre. And also in 1991 METU-Technology Development Centre was established, and began to operate in 1992 (Babacan, 1995: 85-86).

In 1998, The Bylaw of Technoparks, which was the first legal study for the development of science parks in Turkey, enacted under the Establishment Law of SMIDO (KOSGEB). In the same year, according to the bylaw, Tubitak-MAM and METU Technopolis were approved as the first technoparks of the Turkey.

In 2001 the current legal framework of science parks in Turkey was established by the enactment of "Technology Developments Zones Law"- Law number 4691. Law uses the term *technology developments zone*, rather than the term *science park*. According to the Law, METU Technopolis was declared as a Technology Developments Zone. The Law, covering the foundation of the Technology Development Zones and the manner of operation, administration and control of these zones, offers some incentives for R&D studies to support the technological development of Turkey. In 2002, Technology Development Zones Application Bylaw was put into force.

Now there are 22 technology development zones in the Turkey approved by the Council of Ministers. But only the 14 of them are operational at the moment (Karabulut, 2006: 19-22). Also SMIDO has 22 incubation centers, some of which are located in science parks.

Since the development process of science parks in Turkey a very new issue, other science parks in Turkey, rather than METU Technopolis, don't have enough physical development structure and background. Therefore, in this study only the structural characteristics of METU Technopolis, the first and the biggest science park in Turkey, is examined.

3.3.1.b. History of the Development of METU Technopolis

The studies on METU-Technopolis project were started in 1987 to support the formation and development of high-tech using-producing firms to ensure the development of technology, and to maximize the university-industry cooperation. In addition to that making contributions to the studies that aim to enable the transmission of the results of university research into economic values and to contribute the improvement of international competitive power of the country by way of increasing the economic and technological level were also targeted.

After investigating some Science Parks in United States, a pre-feasibility study was prepared in 1988, and in 1989 UK Science Parks were visited and a concept design was developed according to these experiences. Following this, METU-SMIDO Technology Development Center (TEKMER- Incubation Centre of METUTECH) was founded in 1992 as an incubator in association with Small and Medium Size Industries Development and Support Organization (SMIDO) (Özgüven, 2006:101).

The successful results attained in METU-SMIDO Technology Development Center had subsequently fortified the idea of forming a technopark (Çilingir, 2004: 5). Under the feasibility report prepared by the World Bank in 1996, coming to a decision that the most convenient place for a science and technology park in Ankara is METU Campus and that such park must be established, with the industry and strong collaboration, Research-Development backlog and METU-SMIDO Technology Development Center experience, by METU had given rise to the acceleration of the studies (Özgüven, 2006:102).

After the preparation of the development plan of METU Technopolis in 1997, the construction process started in 1997. In 1999, the management model of METU Technopolis was prepared. The first two buildings; METU Twins and Halıcı Soft-warehouse, were put into service respectively in 2000 and 2001. In the year 2001, when the Law of Technology Development Zones no. 4691 was issued, METU Technopolis was declared as a "Technology Development Zone" by the law, and there was 20.000 m2 enclosed area in service in METU Technopolis. After the issue of the Law, METU Technopolis Technology Development Region has developed rapidly and by the end of 2005, 60.000 m2 enclosed area was realized in which more than 160 companies conducting Research-Development studies and having activities based on the ultimate technology; innovation, creativity and knowledge.

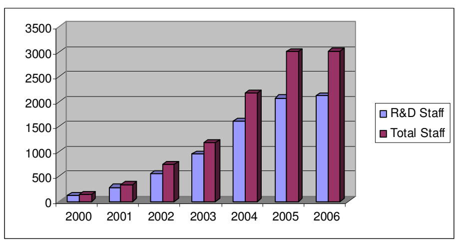
Now together with METUTECH-OSTIM Incubation Centre in OSTİM, the total closed area is almost 65.000 m2 and the studies for the construction of the new building of METU Technopolis, were started by the year 2006. The building will be put into complete service by the year 2007. It is being planned that the total building area will be 80.000 m2, and total number of companies operating in METU Technopolis area will reach a number of 200 with more than 3500 R&D staff by the completion of the new building.

At present, METU Technopolis is not only the largest science park of Turkey but is a model that is appropriated by many newly developing science park administrations and them benefit from the experiences of Teknopark Inc. in their development processes.

3.3.1.c. General Information about METU Technopolis

METU Technopolis is the biggest and the most successful science park of Turkey. Fundamentally, METU Technopolis's existing company profile is mostly based on Information and Communication Technologies (ICT). However, other sectors like electronics industry, aerospace, environment, bio-technology, advanced materials are also the primary sectors of METU Technopolis. METU Technopolis has reached an enormity of 3014 personnel, 2116 of which are the researchers (86 % of the total staff are university graduates, and 20% of which have Ms, Ma, or PhD degrees.) in 169 firms 90% of which are SMEs and including multinationals such as SBS, MAN, Siemens on the 65.000 sq m closed area.

Number of staff working in METUTECH



Number of Companies

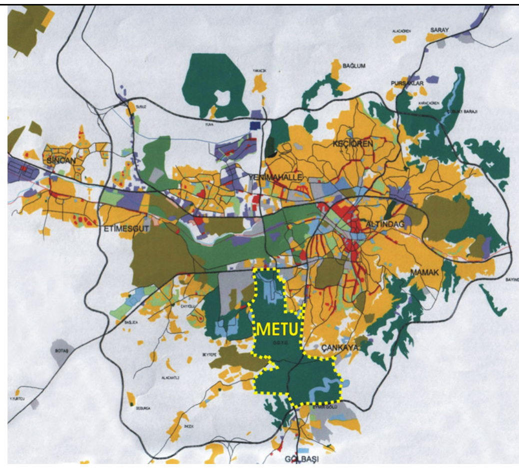
Figure- 3.1: METUTECH in Numbers (Source: Teknopark Inc.)

To promote entrepreneurship and innovation, cooperating with SMIDO, the incubation centre of METU Technopolis serves 38 start-ups and micro sized companies; most of which are the spin offs from METU. More than 25 million Euros have been spent in the last five years for completing the infrastructure and superstructure facilities of the science park.

Ortadogu Teknopark Inc, the management company of METU-Technopolis (METUTECH). Being established in 1991 as a joint stock company, Teknopark Inc., a not for profit organization, provides services to its clients through creating opportunities which enable them to be a part of the global market in a competitive manner by holding their shares in the production of innovative and high value added products.

3.3.1.d. Location of METU Technopolis

METU Technopolis, which covers approximately 113 hectares of land, is situated on the western part, of the METU campus area. METU's campus covering 4200 hectares of land is located about 7 kilometers from the city center of Ankara, in the western corridor designated as city's main growth axis, surrounded by other universities such as Bilkent and Hacettepe.



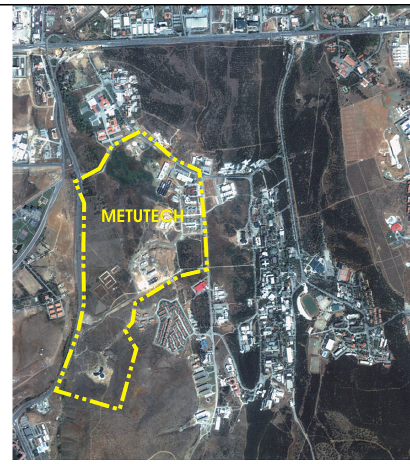


Figure- 3.2: Location METU in Ankara and Location of METUTECH in METU (Source: Teknopark Inc.)

3.3.1.e. Land of METU Technopolis

The land, where the METU Technopolis was established, is the property of the METU. In the beginning of 1990's, only a small portion of existing METU Technopolis's land was dedicated to a technopark development. 1996, while the Urban Design Studio was developing the urban design plan of the park, the coverage zone of the METU Technopolis was considered as 70 hectares of land. After the enactment of the Technology Development Zones, 113 hectares of land was given to the control of the Teknopark Inc. to develop a science park in 2003. In 2003 the borders of the land was approved by the Councils of Ministers.

Another point about this land is that it is the excavation area of METU especially from 1996 to 2003. This has changed the topography of the area; even a hill emerged in time. In spite of all the efforts to prevent these excavations, this habit is still continuing.

Besides some protion of the western part of the area that also forms a boundary with the Bilkent road, has been afforested in 80'ies and 90'ies. After these aforestation works, a part of this area has been proclaimed as forest area in 2001.

Figure- 3.3: Land of METUTECH (Source: Teknopark Inc.)

Finally, the riverbed passing right in the middle of the area has formed a reed bed in the southern part of the area. This area is also one of the most important parts of METU-Technopolis area.

3.3.1.f. The Characteristics of METU Technopolis as a Science Park

As will be mentioned in 3.3.2 in detail, METU Technopolis is founded as a university based science park. This characteristic of METU Technopolis is one of the main elements, which affect the physical development. From the point of view of conceptual differentiation, since R&D and design activities and some high value low volume manufacturing activities are allowed for the companies in the park, METU Technopolis can be considered as a science park or sometimes a research park. This characteristic of METUTECH, affects the planning process and the type of the flexibility.

Since METU Technopolis was established in the campus are of METU, the physical structure of METU Technopolis has been developed as a Suburban/ Periurban Type. The plans have been prepared in away that facilitates the interaction between education, research and technology development, and the plans has tried to combine built-up areas with some green open spaces and landscaping in order to create a pleasant environment.

From the beginning software development is the dominant sector, but it has some other sectors are selected as the primary sectors as well. Therefore, the physical layout of METU Technopolis has to contain such a flexibility that can be sufficient to the needs of companies working in the primary sectors of METU Technopolis.

3.3.2. METU Technopolis as the Subject of the Planning

3.3.2.a. Actors in the Physical Development of METU Technopolis

The actors and their roles are divided into two groups as before and after the law of Technology Development Zones.

Before Law no. 4691

We may say that before the law the only actor active in the physical development was METU with its related units. The university administration is the major decision-maker. The other actors within the university are divided into two groups as academic units and technical units. Department of architecture, department of City and Regional planning and Urban Design studio are the academic units. Office of Aforestation and Landscape Planning, Directorate of Construction & Technical Works, Campus Planning Office and units responsible for infrastructure are the technical units.

Besides there are actors due to the construction model of buildings. METU has the ownership of the property of METU-Technopolis area and there has never been an attitude for selling the land. Within this frame, two models are developed; land appropriation (leasing the land), and constructing the building and renting offices. In the land appropriation model, the land is given to the firm within the frame of long-range renting agreement, and the firm constructs the building due to its own needs. In the second model, the offices are rented after constructed. As renting is a transfer of property rights for a period, the renters should also be appraised as actors within the process. Where in the model of land appropriation the firms are directly active in the formation of the building, in the second model firms indirectly participate to the process.

There is one more actor that participates in the process of office renting; investor. METU Development Foundation participates within this frame in the process by financing the METU Twins. Besides the foundation is the biggest shareholder of the management company of the technopole Technopark Inc. Its primary role in the process is its being the investor. Although Halıcı Software-house seems to be built in the model of land appropriation, as the offices are also rented to other firms, the Halıcı Firm should also be considered as an investor.

Besides all the actors mentioned above, we may count the METU public opinion as an actor with its students, academic staff and other employees.

After Law no 4691

We see proliferation of actors after law has been enacted. Basically we may count three more actors.

The first actor is the Ministry of Industry and Commerce. The law defines the ministry as the primary administration responsible for the implementation of the law. According to the law it is compulsory for Technology Development Zones to get their development plans made. The General Directorate of Industrial R&D enters the process as the general directorate of the ministry that is responsible for the Technology Development Zones. On the other hand General Directorate of Small Craftsmanship is the general directorate of the ministry that is responsible for examining the development plans.

Ankara Greater Municipality enters the process as another actor where development plans are sent for opinions and the plan is announced for a month. Another actor is the Municipality of Çankaya with the responsibility of giving licences-permissions to the buildings according to the development plan.

According to the law no 4691, the management of the Technology Development Zones will be under the management companies, that are joint stock companies. These companies are defined as responsible for the control and development of the zones including the physical development. Ortadoğu Teknopark Inc. is the management company of METUTECH. Although Ortadoğu Teknopark Inc. has been founded in 1991, after the law has been enacted it was no more a unit of METU, and started to be managed by a professional staff.

The Role of Property in the Process

As mentioned in Chapter 2, all the struggles and conflicts occurring in an arena of citizens, politicians, land developers, other planners, administrators, pressure groups or as simply called - the actors, the property relations in urban space holds a critical position. Most permanent element of the urban space is the patterns of ownership. Therefore, property boundaries, which shape the physical development, are the most “inflexible” elements among the others that constitute the urban space.

Within this context, when we examine the physical development of METUTECH, we may easily say that the pattern of the property has not affected the development. The reason why the property pattern did not effect the physical development of METUTECH is that all the lots are under the property of METU. Thus we may take METU as a single lot.

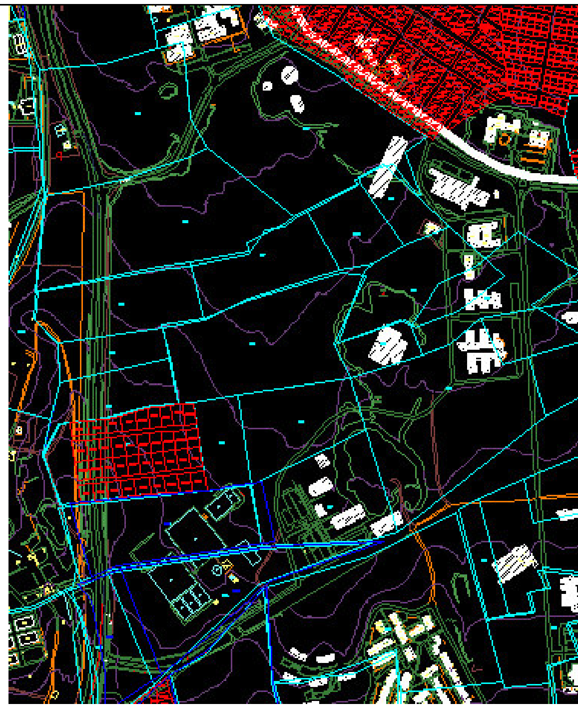


Figure- 3.4: Pattern of Property in Land of METUTECH (Source: Teknopark Inc.)

When viewed from the point of property relations, urban space becomes a focus where actors struggle in order to control and dominate in their own interests. With the words of Günay,

> "Property is a rights relationship between the property subjects, which is owners or possessors, and property objects, that is, things or goods. In this relationship, property subjects have the right to occupy, possess or dominate the things by using, collecting the fruits of and exhausting them." (Günay, 1999b)

Within this context, METU is the most determining actor in the physical development process as the owner of the property. The President's office responsible for the management of METU is the major decision-maker.

Besides, METU Development Foundation and firms in METUTECH that construct buildings due to office renting have been active actors even temporarily with the power of having the ownership in their lots.

The Role of Actors in the Process

President's Office is the main decision maker in the development process of METU Technopolis. Faculty of Architecture as an academic unit of the university acts as an advisory board in the physical development of the university. The two departments of the faculty are included in this process: Department of Architecture and Department of City and

Regional Planning. Where Department of Architecture pays attention to architecture of the buildings and intervenes in the process in evaluating the buildings, Department of City and Regional Planning pays attention to the structure and unity and intervenes in the process in both physical and conceptual relation of the METUTECH with the university. There is also the Urban Design Master Programme under the Department of City and Regional Planning. This programme has been an important actor in the process of guiding the physical development by preparing the development plan under the coordination of Assoc. Prof. Baykan Günay.

Directorate of Physical Development is a technical unit tied to general secretariat, responsible for planning the physical development of the university, related implementations and control. As METU-Technopolis has developed as a unit of METU before the law 4691 has been enacted, this unit has played an active role in this period. The sub-units of this unit is shown in Figure 3.5. However especially after a planner has been employed in the management company, the directorate has entered the process as a consulter. Campus planning office- one of the sub-units of the directorate- has been actor that guides development especially before the UD plan has been prepared. After the plan, this unit has been in the process in coordination with the UD Studio. The other sub-units of the directorate have intervened in the process in supplying the infrastructure and control of the building constructions.

Office of Forestation & Landscape Planning as another technical unit, had indirect effects on the process for it carried out forestation work as well as landscape arrangements of the buildings.

The most important actor that intervenes to the process as a result of the model of building constructions is METU Development Foundation whose primary aim is to support research and knowledge infrastructure. This foundation is important as it has financed the foundation of METU Technopolis. Both before and after the law, Foundation provided the financing of all the buildings that are rented to more than one firms, except for Halıcı Software-house.

Halıcı Software Firm has been the actor that started the physical development of METU-Technopolis by being its first firm with the construction that started in 1997.

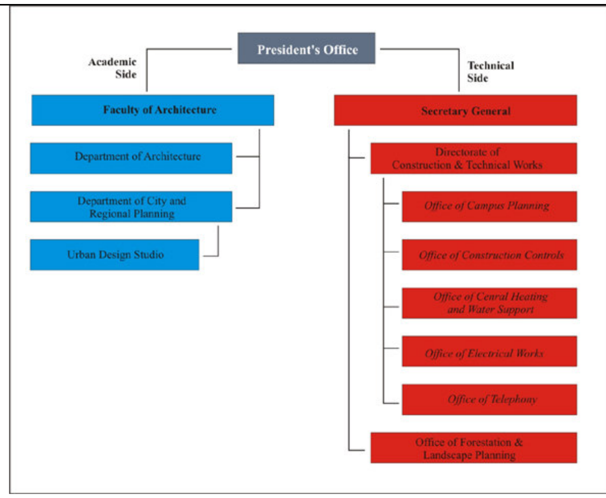


Figure- 3.5: Organizational Scheme of METU–Units related with the physical Development of METUTECH

Especially after 2003 the other firms that produced buildings with the model of land approaporiation, have formed a possession in these areas and considered these areas as their areas of sovereignty. Thus they have huge effects in the production process of buildings.

As the sectoral profiles, growth processes of firms and when they will demand offices are uncertain; the firms play a significant role in the planning process, shaping the physical structure and the design of the buildings.

As will be discussed in detailed, in Turkish planning process, for buildings to be legal, they should be constructed due to the development plan that has been approved by the municipality and they should be given the permission by the municipality. However as there is the Department of City and Regional Planning to guide the development within the university, and in order not to let the municipality have control within the university boundaries, there was no effort to legalize the development process by producing a development plan. Although 1994 Regulatory plan of METU is a step for legalizing the next steps did not follow.

On the other hand the Master plan developed by the UD Studio was not prepared to be a legal document, but to found the basis of the structure of development and guide it. Thus it is not, and not aimed to be a legal document.

Table 3.3: Actors In The Physical Development METU Technopolis and Their Role In The Process - Before Enactment of Law no 4691

Actors			**Role**
METU	President's Office		Decision Maker
	Academic Units	Department of Architecture	Act as an Advisory Board
		Department of City and Regional Planning	Act as an Advisory Board
		Urban Design Studio	Planning and coordinating the development of METU Technopolis
	Technical Units	Directorate of Construction & Technical Works	Planning and Construction
		Office of Campus Planning	Planning the development of METU
		Office of Construction Controls	Controlling Constructions
		Office of Central Heating and Water Support	Water, Sewage and Drainage Systems
		Office of Electrical Works	Electric Systems
		Office of Telephony	Communication Systems
		Office of Forestation & Landscape Planning	Landscaping and Forestation
	Public Opinion		
METU Development Foundation			Investor
Halıcı Yazılım			Investor-METU Technopolis Company
Companies of METU Technoplolis			

After the Law No. 4691

According to the law no. 4691 techno parks should get their development plans prepared and their development should be according to the plan. This law had deep impacts in the development process of METU-Technopolis which will be handled in detail in the next chapter.

Ministry of Industry and Commerce appears as an actor after the law. General Directorate of Industrial R&D is involved in the process by approving the development plans. General Directorate of Small Craftsmanship on the other hand enters the process with its role of examining the development plans due to its related staff.

Where Ankara Greater Municipality enters the process by giving opinions on the plan, Municipality of Çankaya enters the process by both giving opinions and licensing the buildings. However although the plans are prepared for METU Technopolis, the process of licensing the buildings has not started yet.

After the law has been enacted the management company; Teknopark Inc. became the primary actor in the development process of METU-Technopolis. Even President's Office has the power of decision-making, the management company has been the unit that has guided the process. Especially after 2003, when a planner has been employed by the company, nearly all the actors began to give only consultancy services.

Table 3.4: Actors In The Physical Development METU Technopolis and Their Role In The Process - After Enactment of Law no 4691

Actors			**Role**
METU	President's Office		Decission Maker
	Academic Units	Department of Architecture	Act as an Advisory Board
		Department of City and RegionalPlanning	Act as an Advisory Board
		Urban Design Studio	Act as an Advisory Board
	Technical Units	Directorate of Construction & Technical Works	Act as an Advisory Board
		Office of Campus Planning	Act as an Advisory Board
		Office of Construction Controls	Act as an Advisory Board
		Office of Cenral Heating and Water Support	Act as an Advisory Board
		Office of Electrical Works	Act as an Advisory Board
		Office of Telephony	Act as an Advisory Board
		Office of Forestation & Landscape Planning	Act as an Advisory Board
	Public Opinion		
METU Development Foundation			Investor
Halıcı Yazılım			Investor-METU Technopolis Company
Companies of METU Technoplolis			
Ministry of Industry and Commerce		General.Directorate of Industrial R&D	Approval of Development Plans
		General.Directorate of Small Craftsmanship	Examination of Development Plans
Ankara Greater Municipality		Directorate of Physical Development	Examination of Plans within the context of whole City
Municipality of Çankaya		Directorate of Physical Development	Ex. Of Plans within the context of Municipality and building permissions
Management Company of METU Technopolis			Responsible for all physical development Process

3.3.2.b. Tools in the Physical Development of METU Technopolis

The tools that have guided the development process of METU-Technopolis will be discussed under two headings as before and after the law no 4691 as this law brought definitions, limitations, and the obligation of making plans.

Before the Law No. 4691

Before the law, as there was no other law related to science parks in Turkey, the law no 3194 which founds the legal frame of planning system in Turkey also provided the conditions for physical development of science parks. However, for the control of urban form, since this law itself does not include any specific rules it assigns several bylaws or regulations for specific issues.

In this legal frame, the development planning (imar planlaması) system in Turkey has a two leveled structure. The first level is the regulatory plan, which aims to determine the general physical structure of the planned area. The second level is the implementation plan, which has to be prepared according to the decisions of the regulatory plan as a specification of upper scale, more detailed decisions.

General land use decisions, main zone types, density of zones according to a projected future, development directions and proposed boundaries of settlements, transportation systems and if necessary construction conditions are determined in 1/5000-scaled *regulatory (nazım) plan* (Baş, 2003; 65). Actually, they might be considered flexible tools for planners to state and represent their principles, policies and guidelines about various planning and design issues that constitute a framework for implementation plans, since there is not a strictly predefined function of plan reports and plan notes in the law no 3194 (Baş, 2003; 68).

1/1000-scaled *implementation plan* (uygulama planı), which has to be prepared in accordance to regulatory plan, determines roads and pedestrian ways, urban blocks, construction density and order in urban blocks, location and size of common uses, and the application stages that is fundamental to development programs. Also, organization and formation of public and private spaces, mass-space relations, orientation and interrelation of buildings, landscape, infrastructure, organization of pedestrian-vehicular traffic can be considered in the framework of implementation plans, which are the most determinant level of planning process in terms of formation of urban space. (Baş, 2003; 68).

The Standard Development Bylaw (SDB) defines the tools that are used in the control of construction conditions and building order (Baş, 2003; 70). According to Ünlü (1999; 90) Standard Development Bylaw can be described as urban codes and design guidelines of planning system in Turkey. It is valid where implementation plan does not point out the rules about construction and subdivision order. Thus, the place of it in the legislation shows a necessity to be used as a complementary mechanism to development plans.

After Law no 4691

The Technology Development Zones Law defines the legal framework of physical development of science parks. According to the Law, the development and construction plans are prepared or had it prepared by Management Companies of the science parks according to the Law of development and Construction no 3194. However, within the overall area to be planned, the overall enclosed construction area may not exceed 40%, but there is no limitation for the building height. Furthermore, while the management company has obligations to utilize the area designated as the science park according to the conditions of the law, the company may utilize up to 30% of development rights of the area to further the capacities of the science park in terms of academic, economic and social infrastructure by building, operating or renting necessary buildings and installations.

However if we evaluate these tools within the case of METU-Technopolis, as mentioned before, as there is the Department of City and Regional Planning to guide the development within the university, and in order not to let the municipality have control within the university boundaries there was no effort to legalize the development process by producing a development plan. As will be discussed in the next chapter the only legal document for physical development of METU is the Regulatory plan of METU of 1994. No other tools have been utilized for the control of the physical development till the development plans approved in year 2004. However the Plan of METU Technopolis that has been prepared by UD Studio in 1997 has become the Master Plan of METU-Technopolis by defining the major structure of physical development, and providing definitions and limitations in both architecture and landscape, although it is not and not meant to be a legal document. The development plan prepared in 2004 also takes this master plan as the basis, but the development plan can not be considered as a master plan.

3.4. Evaluation of Chapter 3

In the process of planning, planner as one of the subjects of planning, should know in detail the object of planning that is the structure and the inner dynamics. This is a prerequisite for a proper approach of planning.

Obviously flexibility is one of the most emphasized points in any arena together with economic and social restructuring. In High-tech districts, no matter of which label as they emerged as an outcome of Post-Fordizm, since flexibility is the part of economic and social restructuring; fast changes and uncertainty always occur in the process.

Both the planning process and design approach should be responsive to the uncertainties and change embedded in science parks. In general we see different typologies of science parks under various headings. In the first part of this chapter the effects of these typologies to the process of physical planning are defined. This will provide defining the inner dynamics of METU-Technopolis which will make up the frame for the evaluation of planning and implementation processes in the next chapter.

METU-Technopolis may be labeled as a *science park* since as well as software development and R&D, there is also a high-tech production even in small amounts. This should be taken into consideration in the process of planning. Besides although firms specialized in software development make up a big portion, there are also firms of some sectors of priority. This is also an element that will effect the planning and design processes.

The location of the science park also appears as an important factor. The location of the science park in METU brought it to be a suburban type of science park. Besides as its university based, METU as the owner of property, has been active in determining many aspects.

METU-Technopolis, until the law no 4691 was enacted, has developed as a unit of METU and guided by the related units. After the law has been enacted, new actors such as Ministry of Industry and Commerce and Teknopark Inc. - the management company- as the primary responsible organization of METUTECH have entered the process. As the management company employed a planner in 2003, it has also become the primary responsible organization in the physical development process, too. After 2003, the units that were responsible for the development of METU-Tech participated in the process as consultants. However the President's Office- responsible for the administration of METU- had kept its power of decision-making.

The tools active in the process of physical development are also divided into two as before and after the enactment of law no 4691. The law no 3194 makes up the legal frame of physical development in Turkey. However there was no effort to legalize the development process through preparing a development plan partly because there was the department of city planning within the university and partly not to let the municipality have control within the boundaries of the University campus area. This has been the situation before the law no 4691 has been enacted. After law no 4691 has been enacted it has been made compulsory by the Ministry of Industry to get the development plan prepared on the basis of this law.

The plan of UD Studio prepared in year 1997, has been the Master Plan of METU-Technopolis, and provided the major structure of development, defined conditions of construction, and brought architectural and landscape definitions and limitations. However it is not a legal document. On the other hand the development plan of METU Technopolis, which is a legal document and was prepared based on the plan of UD Studio, as will be handled in detail in the next chapter, was not in the characteristics of a master plan.

CHAPTER 4

THE ROLE OF FLEXIBILITY IN THE PHYSICAL DEVELOPMENT OF METUTECH

In this chapter, the spatial evolution of METU Technopolis will be studied in detail and the role that flexibility plays in this evolution will be questioned through the above mentioned questions about the concept; *flexibility*. For this purpose, since METU-Technopolis established by Middle East Technical University (METU) and located in the Middle East Technical University campus area, to evaluate the development process of METU-Techopolis properly, the physical development process of METU will firstly be analyzed briefly. Then, different planning studies and phases for physical development process of METU Technopolis will be determined and each planning study will be analyzed according to the flexibility concept. After evaluating the plans, the development of superstructures, and then the development of elements, which affect the physical development process of METU Technopolis, types of interventions in each case and the roles of actors in the process will be revealed in the same framework. Thus, different kinds of solutions and problems that the dilemma of flexibility produces in the planning and decision-making processes will finally be shown. We should mention here that, some events have been re-explained from different points of view, in order to build the relations, and better comprehend the process. We should mention here that, some events have been re-explained from different points of view, in order to build the relations, and better comprehend the process.

4.1. Physical Development of METU

Since the establishment in 1956, the development of METU went through different phases. Until 1963 the education was continued in temporary buildings in the city. In 1963 the school moved to current campus, which was designed upon a diagram procured through an architectural competition. But the competition covered only a small portion of total land (almost 42 km2 of land including a small lake) given to universities possession. Rest of the land other than the built-up area was either afforested or preserved as natural domain (Günay, 1997:186-187).

Between 1963 and 1980, METU grew within the guidance of its architectural diagram, which was developed by Behruz Çinici, but the construction of originally designed campus area, which was designed according to an assumption that the school would serve a population of 12,000 students, came to its limits in 1980s. Since the initially designed campus area became full of buildings, newer buildings and departments began to be located coincidentally in the campus area (Günay, 1997:187).

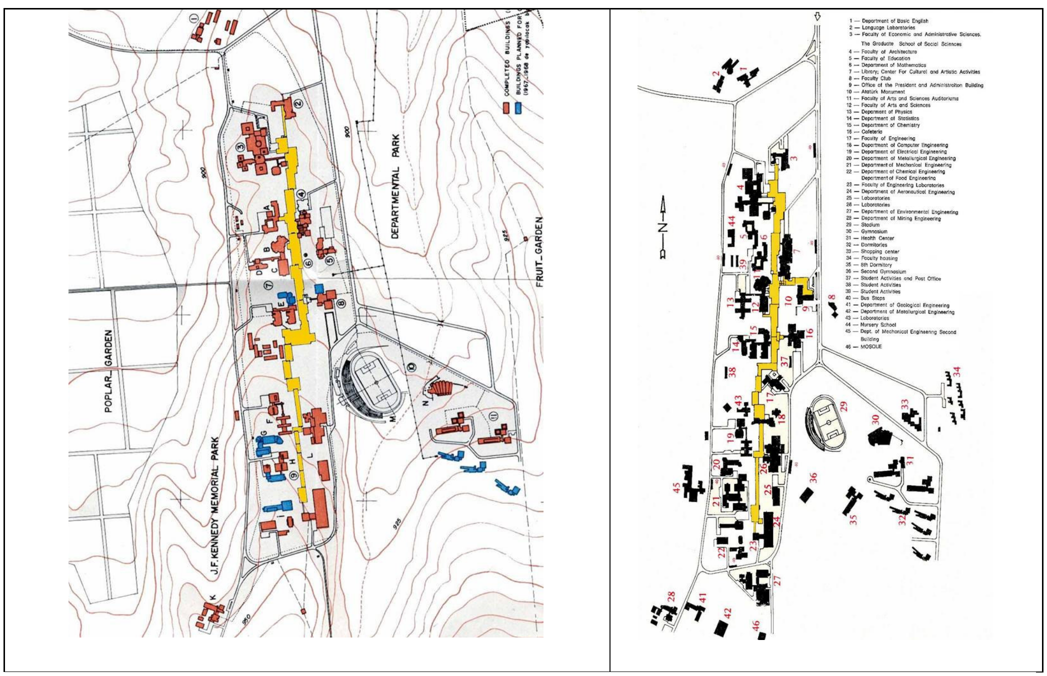


Figure- 4.1: METU in 1966 – METU in 1982 *(Source: Archive of Baykan Günay)*

In the first part of the 1980's, to guide the construction of newer buildings and departments, a new administrative unit called Office of Campus Planning was established under Directorate of Construction and Technical Works, which was working under General Secretary. The duty of the Office Campus Planning has been to regulate and to guide the physical development of the campus. Within this context, the department began to prepare the Regulatory Plan (Nazım Plan-1/5000) of METU. Nevertheless, the plan guides the land use development, but neither offer any guideline in building scale, nor for the interrelations of the buildings.

After 1980, internal and external factors began to create a pressure on the built-up area off the campus. METU, once a fringe development became a part of Ankara metropolitan city, consequently has been meeting many problems, but at the same time gaining new potentials for its further development. The new primary distributors of the city and the increase in private car ownership have been the main problems of the campus development. On the other hand, METU has been standing in an accessible position, which makes the campus area a strategic location. Moreover, the new metro line of the city will be running very close to the university campus area with two stations in very new future (Günay, 1997:187).

Reconsidering its position in the city, to promote research and the development potential of the school and to establish more efficient relations with government and industry, in 1990's administrators of METU have concentrated their efforts on creating an efficient infrastructure, well-educated man-power, laboratories, all sorts of sports and social facilities in an afforested environment and finally on developing a science park (Günay, 1997:187).

4.1.1. Evaluation of METU Campus Development

4.1.1.a. The Diagram of Behruz Çinici

METU campus's current eastern part was designed upon a diagram procured by Behruz Çinici through an architectural competition in the beginning of 1960's. The diagram, which was designed for 12.000 students, consisted of three main parts; education units, residential units (residences for academicians and dorms) and recreational areas. In the zone of educational units, the plan designed as a superblock; the pedestrian path constitutes the main spine, and the vehicular roads surrender the blocks. The junction of pedestrian ways and vehicular traffic was minimized in the diagram. Although the recreational zone connects both the zone of education units and zone of residences, it also establishes a buffer between these two zones.

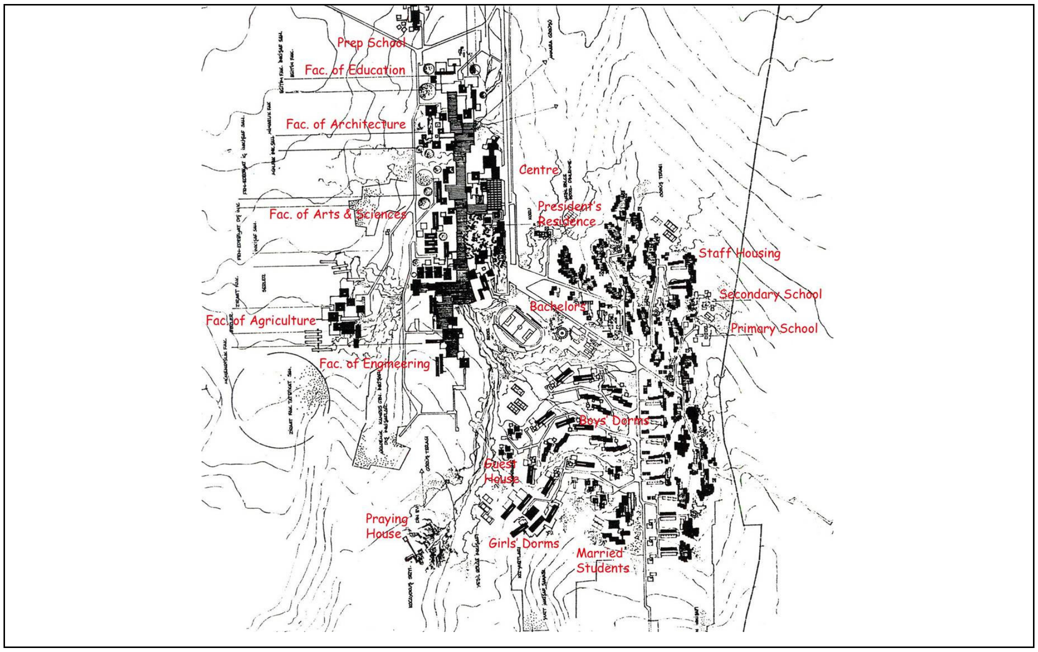


Figure- 4.2: Diagram of Altuğ & Behruz Çinici *(Source: Archive of Baykan Günay)*

Evaluating the overall structure of the diagram and the unique buildings in this structure, the relations between unity and variety are in balance, far from monotony, and also far from chaos. However, the diagram can be criticized in some ways. One is; after the construction of campus area of this diagram came to its limits, growth of the campus was not planned, patterns of development are not known; newer buildings and departments began to be located coincidentally in the campus area. The diagram wasn't able to reproduce itself and could not guide the newer development. The second one is; continuity of pedestrian network was not clear. The connection between education units, and the residential units was weak. And finally the last one is the campus has its own architectural style reflecting the modernist approach, which was mostly criticized as senseless. As a reaction to the architectural style of the campus, METU Technopolis, which can be considered as a part of campus development of METU, was developed without having a strict architectural style moreover, the architectural styles of the existing buildings of METU Technopolis are far from the modernist approach.

4.1.1.b. Regulatory Plan (Nazım Plan-1/5000) of METU

Since Behruz Çinici's diagram could not lead the campus development; the study of preparing a new plan was started in the first part of the 1980's. The Regulatory Plan (Nazım Plan-1/5000) of METU was developed in this context by Office of Campus Planning; to guide and to legalize the physical development of METU.

When we examine the plan, we see that it has a very flexible frame for guiding development which is brought only through land-use decisions. As there are no lower scale plans, codings on form for different areas or any written documents; the plan lacks a structure that guides relations between buildings and development in the scale of architecture.

The implementation process of the plan, which has a flexible structure to over come the uncertainties, has also been flexible where decisions of the plan are not taken into consideration and new solutions are put forward. As a result, by the end of the 90'ies, a new plan evolved out of the regulatory plan (nazım plan), although it did not have the legal basis as the regulatory plan. Besides, forestation which is one of the most significant elements of not only this plan but the development of METU as a whole was practiced disregarding the plan, and became an element which prevents the development at the end of the 1990'ies.

Figure- 4.3: Regulatory Plan (on the left) & the updated Regulatory Plan (on the right) *(Source: Archive of Directorate of Construction)*

METU Technopolis in the Regulatory Plan

In the Regulatory Plan, a few parcels -that were near the expansion area for education- were reserved as science park area, According to the plan the road to METU Village is both a service road for technopark buildings and a boundary between education expansion area and technopark. As it was foreseen that technopark would consist of no more that a few buildings in the Regulatory Plan, the technopark area of 5-6 ha was extended to 70 ha in the plan prepared by the Urban Design Studio, and reached 113 ha in 2003 according to the boundaries approved by the Council of Ministers.

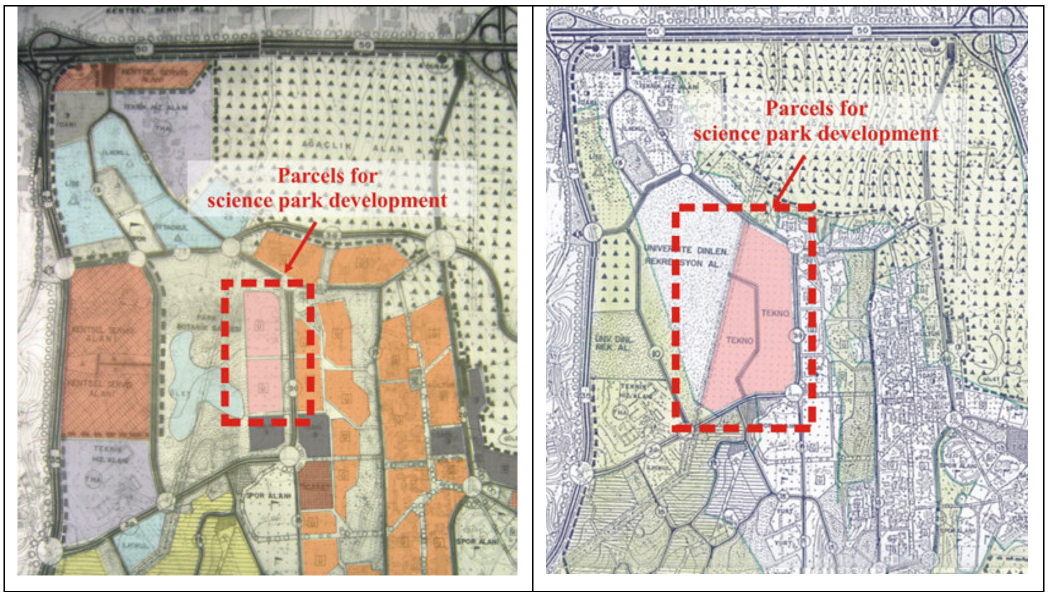


Figure- 4.4: Parcels for Science Park Development in the Regulatory Plan *(Source: Archive of Directorate of Construction)*

4.2. Physical Development of METU Technopolis

Physical development process of METU-Technopolis was started in the second part of the 80's by the Office of Campus Planning within the context of establishing a science park in METU. While preparing the Regulatory Development Plan of METU, a specific zone was determined for the science park development. In the beginning of the 90's, the building of METU-SMIDO Technology Development Center (ODTÜ TEKMER) was constructed as the first building of METU Technopolis. The building was under use as the Incubation Centre of METU Technopolis since 1992. Also, close to the Incubation Centre, the Continuing Education Centre of METU was constructed before 1997.

In 1995, Semra Teber, who has a MS on science parks, was asked to prepare the conceptual design of the technopark. Teber developed her diagram within the framework of Regulatory Plan of METU, but she enlarged the scope of the planning area of the technopark by adding the residential zone, educational zone, technical zone and urban service zone of the Regulatory Plan of METU to the scope of her study. In 1996 while Teber was developing the architectural design of the Halıcı Software-house, the Urban Design Studio, coordinated by Assoc. Prof. Baykan Günay, was started to develop the development plan-guideline of METU Technopolis.

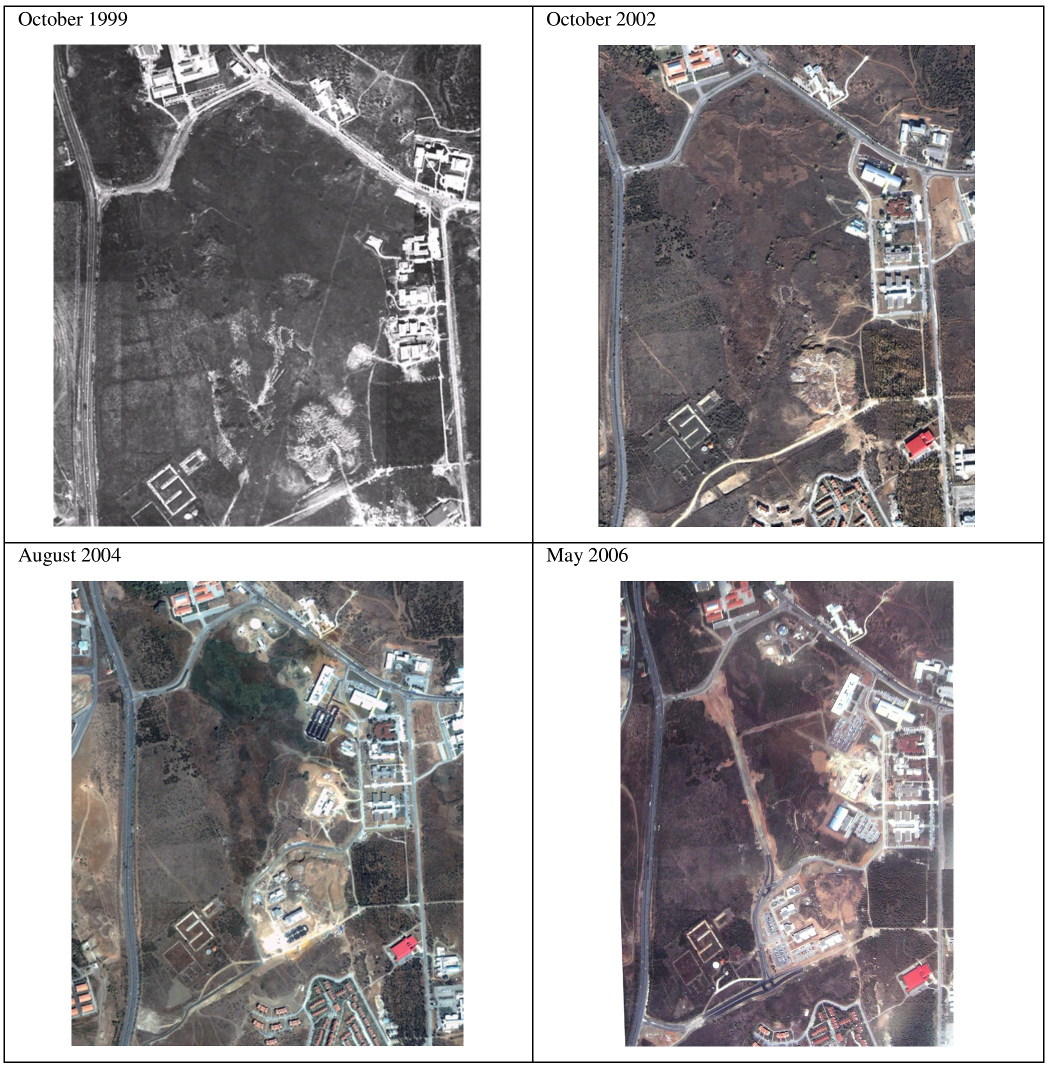


Figure- 4.5: Aerial Photos of METUTECH *(Source: Archive of Directorate of Construction)*

After the preparation of the development plan of METUTECH in 1997, the construction process started in 1997 and the first two buildings (excluding Incubation Centre and Continuing Education Centre); METU Twins and Halıcı Software-house, which were designed by Semra Teber, were put into service in 2000 and 2001.

In year 2001, when the law of Technology Development Regions no. 4691 was issued, METU Technopolis was declared as a "Technology Development Region" by the law. According to Law, the management company has to get prepared the Regulation and Implementation Development Plans of the region. Therefore, in 2003 the preparation of the Development Plans of METU Technopolis were started, and the plans were approved by the Ministry of Industry and Commerce in 2004.

Before the enactment of the law, total constructed area of METU Technopolis was less than 20.000 m2. However, after the issue of the Law, METU Technopolis (Technology Development Region) has begun to develop rapidly. In 2002 Silver Blocks, in 2004 Silicon Block and in 2005 Milsoft R&D Building were constructed. Also in 2003, the design works of SATGEB sub-region, consisting Havelsan R&D Building, TAI-1 and TAI-2 R&D Buildings, Aselsan R&D Building and Common Building of SATGEB, was started. In 2005 construction of SATGEB, together with 5 buildings was completed. By the end of 2005, more than 60.000 m2 enclosed area was realized in which more than 160 companies conducting Research-Software Development studies and having activities based on the ultimate technology; innovation, creativity and knowledge.

The studies for the construction of the new building of METU Technopolis were started by the year 2006. The building will be completed and put into service in 2007. It is being planned that the total building area will be almost 75.000 m2, and total number of companies operating in METU Technopolis will reach to a number of 200 with more than 3000 R&D staff by the completion of the new building.

Within this study physical development of METU Technopolis will be evaluated through first the planning practices, then the development of the physical structure and lastly changing process of elements that are effective in the physical development such as infrastructure and environmental elements within the frame of flexibility concept.

4.2.1. Evaluation of Planning and Design Studies of Metutech

As we mentioned above, planning process of METU Technopolis has started with the Regulatory Plan of METU, studies on which was started in the mid 80'ies but has been approved in 1994. Following the regulatory plan the process has underwent 3 stages that directly or indirectly affected each other.

The first one is the conceptual design study prepared by Semra Teber in 1995. Although this study was not a plan, Twins and Halıcı Buildings were constructed according to this study.

The main structure of the METUTECH was formed by the second study, which was prepared by the Urban Design Studio in years 1996-1997. This plan not only played role in the construction of Milsoft R&D Building, Silver Blocks and Silicon Block but also founded the structure of METUTECH as it exits today.

The study prepared by Urban Design Studio under the coordination of Assoc. Prof. Dr. Baykan Günay, has been revised in the light of current data of the day. In year 2003 by the force of Technology Development Law, it became inevitable to employ a planner within the management company of METU Technopolis to get development plan prepared and control the physical development process.

The studies on the development plan (imar planı) began in 2003, under the control of the planner employed by the Management Company, in coordination with the related units of the university, and with the consultation of Baykan Günay. The plan-prepared in line with the structure formed by Urban Design Studio- was consisting of a single plot in order to provide flexibility for the future uncertainties. However it has changed due to objections of the Ministry and the Ankara Greater Municipality and been approved finally in 2004.

These planning studies consisting of 3 stages will be handled more deeply below within the framework of flexibility.

4.2.1.a. Diagram of Semra Teber

The development process of the Diagram was started in 1995. Semra Teber, who has a MS on science parks, was asked to prepare the conceptual design of the technopark. Teber, who developed the METU Technopolis concept, also developed her diagram within the framework of Regulatory Plan of METU, but she enlarged the scope of the planning area of the technopark by adding the residential zone, the southern part of the diagram, educational zone, the northern part of the diagram, technical zone and urban service zone of the Regulatory Plan of METU to the scope of her study.

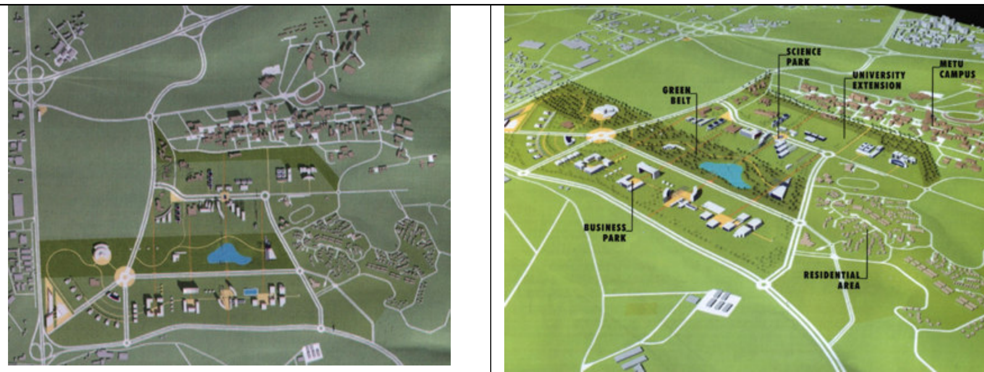


Figure- 4.6: Diagram of Semra Teber *(Source: Teber, 1995)*

R&D Centres of Public and Semi-Public Organizations, Small and medium-sized local firms and branches and liaison offices of various national and multi-national companies are seen as the potential tenants of the park. Targeted activities determined for the park are high-tech and information-intensive activities such as;

- Software Development
- Information Technologies
- Telecommunications
- Biotechnology
- Advanced Materials Sciences
- Robotics, mechatronics
- Microelectronics
- Geographic Information Systems

According to the diagram, the METU-Technopolis Complex is located on the west of the METU Campus on 210 hectares of land, surrounded by Eskişehir Highway and future Metro line on the North, Bilkent-METU boundary on the west and future residential area, METU-Village on the south.

The diagram of Semra Teber consists of three main parts; a Science Park, a Business Park, a Residential Area and a natural-like Green Belt unifying all three parts of the diagram.

- Science Park, is the component where University's R&D centers, specialized laboratories, incubation centre, telecommunications center, innovation and technology transfer offices, design and geographic information center, university's patent office, light assembly lines are situated.

- Business Park, acts as a connector of scientific activities with outer business world and houses mainly office activities together with value-added services of the firms.
- Residential Area, is planned for the housing requirements of academicians of the METU and highly qualified R&D staff and managers working either in the Technopolis or in the University (Teber, 1995).

The Green Belt, located between these three parts, is a transition space and also houses cultural and recreational activities.

The Science Park

The Science Park is located on the west of the existent METU Campus, next to the University's future extension zone and covering 42 ha of land. According to the study, The Science Park is planned to house advanced technologies requiring a sophisticated telecommunications infrastructure and has spaces for warehouses, office and even light assembly-lines. The Innovation Center, the Incubator, R&D centres of university and other governmental or semi-governmental organizations and the specialized laboratories are located in the park as well (Teber, 1995).

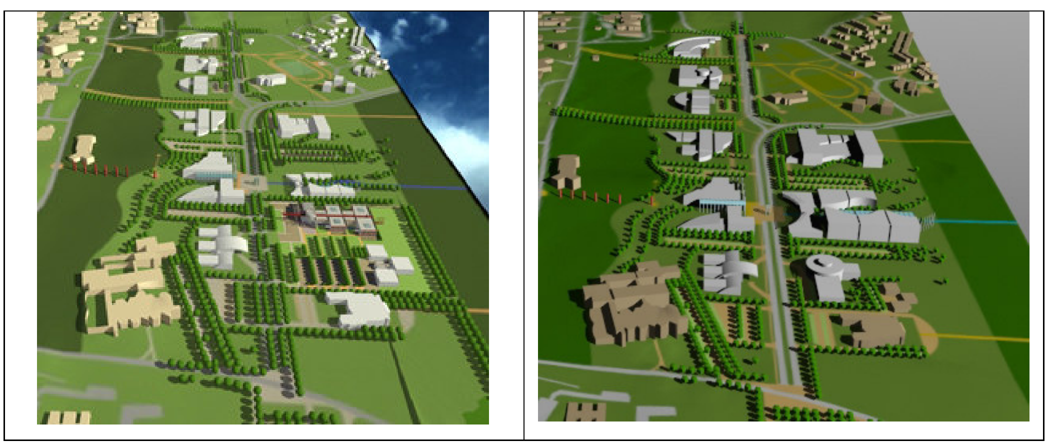


Figure- 4.7: Alternative Design Studies For Science Park Zone Of The Diagram *(Source: Archive of Semra Teber)*

The Park is subdivided by grouping the buildings around "plaza"s in a campus-like setting. The green main axis, which constitutes the spinal cord of the linear development of the park, divides it in two at the same time providing access to the cluster of buildings. Eastern part of the park which is close to the Campus settlement is reserved for the future extension of the METU, especially for joint R&D programs with Park's companies, requiring special infrastructure and services. Entrances to the park are marked by gates to the image of entering the next century, another age (Teber, 1995).

The buildings of the Science Park are designed to give the image of the future and technology with its specialized laboratory buildings, its transparency of functions reflecting on forms and materials of the built environment and a particular inner and outer space quality, to be the sign of a new world, a new age (Teber, 1995).

The Business Park

The Business Park, which is located at the western edge of the site, at the proximity to the Eskişehir Highway, Bilkent-YOK Intersection and the future Metro Station, is designed to respond to the office requirements of companies and institutions which would be in relation with the activities located in the Science Park of METU Technopolis (Teber, 1995).

The Business Park, covering 25 ha of land, is designed as a business park of the future. Park is developed to offer mainly office space in a green landscaped setting, together with high-tech telecommunication infrastructure which has emerged from the latest developments in communication and computer technologies. The park also contains a shopping center, restaurants, cafes, a gas station, a post office, banking facilities, future metro station. And also residents of the park have the chance of using the utilities of the large Green Belt which mainly houses cultural and recreational activities (Teber, 1995).

To mark the transition from the Business Park to future extension of Science Park and to meet the requirements of both parts of the Technopolis, The Hotel and Conference Center is located on the south of the Business Park in the diagram. For unifying the three components of METU Technopolis symbolically, a visual axis is tried to be created, passing through hotel Complex, the Green Belt and the Science Park (Teber, 1995).

Like Science Park, the Business Park is designed to have a deliberately 'high tech' look, but with wide green areas around the buildings, to be an intelligent business park, the interface of the Technopolis with the economic world (Teber, 1995).

The Residential Area

The Residential Area, METU village, which is designed by another group, is on the south edge of the diagram, and is added to the scope of the study to support the concept of technopolis. Total area of the residential area being surrounded by METU's protected green recreational area, is 95 hectares. There are three parts each of which consists of neighborhoods with varying features.

Nature-oriented environment, located near the resident's place of work, enhanced with several special services (such as sports and leisure complexes, cultural facilities) has been the predominant advantages of the Residential Area having 600 housing units. The Area is designed as a seaside resort with little lanes, "cul de sacs", walks, jogging and cycle tracks, which are the important elements in the overall design principles (Teber, 1995).

The green belt system running through the each village of the Residential Area as the main feature of the external planning of the district and joins the major Green Belt, the spinal cord of the Technopolis (Teber, 1995).

The Green Belt

The green belt, which houses mainly cultural and recreational activities in an intense green environment, is designed to act as a transition zone between different sectors of the diagram. Moreover, this large green area includes botanical gardens, giant greenhouses, zoological museums, invention museums, planetariums, etc (Teber, 1995).

The Green Belt, which has an area of 48 ha, is just in the middle of the Science Park, the Business Park and the residential area. This Green Park penetrating sometimes amongst the buildings located there, constitutes a transitional area and acts as a buffer zone between different activities such as Science Park, Business Park and Residential Villages (Teber, 1995).

4.2.1.b Evaluation of the Diagram of Semra Teber

Diagram of Semra Teber is the first study for the physical features of the METU Technopolis. In this study, METU Technopolis is developed as a Green Type of science park, which is defined in Chapter 3. Main aim of the diagram is combining built-up areas with some green open spaces and landscaping in order to create a pleasant man made environment with a very low density and a freer lay out.

The Science Park, the Business Park and the Residential Area are the three main parts of the Diagram. However the science park concept developed by the diagram matches with the development of the R&D centres that is at the eastern part of the road that connects METU village and education faculty rather than current identity of METU Technopolis. The present structure of METU Technopolis is more like a business park conceptually, however business park in the diagram is more business oriented. The housing project made to strengthen the concept of "technopolis", on the other hand has developed in a way to accommodate only university staff.

If we examine the diagram from the perspective of flexibility we see that there is not a clear pattern for development. The building groups are connected to each other by linear pedestrian and vehicular roads. We may suppose that this study did not effect the development of the METU-Technopolis as it was conceptual. However the study has been effective in building the image and concept of METU Technopolis and started to define the boundaries of the frame.

Semra Teber developed the buildings of Halıcı Software-house and METU Twins, the first buildings of METUTECH with regard to her own diagram while the studies of Urban Design Studio were continuing. Thus the back of the buildings were fore heading the service road of urban design studio's plan. Anyway these buildings have played important roles for the shaping of the architecture of METUTECH and formed examples with regard to inner arrangements and flexible solutions at the architectural scale. Besides they settled the idea that the concept of technology should exist in the architecture.

4.2.1.c. Plan of Urban Design Studio

In 1996, the Urban Design Studio of the Department of City and Regional Planning in METU was commissioned to study the development problems of the METU Campus, and to plan the physical arrangement of the Technopark, in order to restructure the METU Campus and to integrate the Technopark with the existing system. METU Campus and Technopark Urban Design Project, aiming to produce a guideline for the physical development of METU Technopolis, was developed in this context (UD, 1997: A3).

Umbrella organizations such as; foundations, associations, University Spin-offs, Start-ups graduated from the incubator, small and medium-sized local firms and branches and liaison offices of various national and multi-national companies are seen as the potential tenants of the park (UD,1997: D1)

Targeted activities determined for the park are high-tech and information-intensive activities such as

- Electronics
- Software Development
- Information Technologies

• Telecommunications

• Biotechnology

• Advanced Materials Sciences

• Robotics, etc (Günay, 1997:190)

As mentioned in the feasibility study of ISMERI that has been prepared in 1996, these activities are both in parallel with the know-how of METU and includes the sectors that industry in Ankara is or potentially strong at.

Figure- 4.8: Plan of UD Studio *(Source: UD, 1997)*

In the plan, it is expected that the METU Technopolis, covering an area of nearly 70 hectares, will house both public and private software development companies, R&D firms as well as those which would be engaged in the high-tech production to utilize the infrastructure of the Technopark, and the research and manpower potential of METU (Günay, 1997:192).

Since the sectors, types and the scales of companies or organizations which would tend to locate themselves in the technopark are not exactly known, there are many indications, and it is a complex task to design the physical space of the technopark. Therefore the planning and design team of UD Studio initially made extensive analysis, called in the administration for brain-storming sessions, presented alternative solutions and finally developed a "structure plan" capable of adapting itself to changing demand. In the study, it was expected that the demand would be a determining factor for the size and the type of the development (Günay, 1997:192).

In the analysis on technoparks, it was observed that technoparks housed many different functions related to software, production, research and development, etc. Within this context, the main components of the Technopark were determined and specific locations and different space qualities for each component were developed. In the plan, the areas were designed to include functions with different size context and architectural quality. The plan consists of 7 main parts such as;

- Software Park;
- R&D Park;
- Model Production Areas;
- Area for High Rise Office Buildings;
- Administration and Management Centre;
- Social and Cultural Centre;
- Nature Museum and Park (UD, 1997: D1).

The Software Park

The Software Park, the construction of which has already started, is the first area to be developed in the physical structuring of the plan. The Software Park is designed to house firms working on software development.

Since software development companies tend to work with university, the Software Park is situated at the eastern part of the technopark, adjacent to the extension area of the university. Moreover, the reason that the initial requests were received from software companies had accelerated the construction of these units. Existing infrastructure conditions were also effective for the choice of the location. (UD, 1997: D1).

The car park in the middle of Software Park was kept wide as much as possible considering potential demand but it has been isolated by a green area. Along the major axis of vehicles and pedestrians, a perspective was provided with high-rise buildings. The spatial continuity is provided as such starting from the administrative center till the ending of R&D units. Software Park is over an area of 16 hectares grossly. However the area that software firms cover is 11.2 ha. The population to be employed in this area is projected as 1600-2500 when evaluated with various criteria. Software Park is over an area of 16 hectares grossly. (UD, 1997: D1).

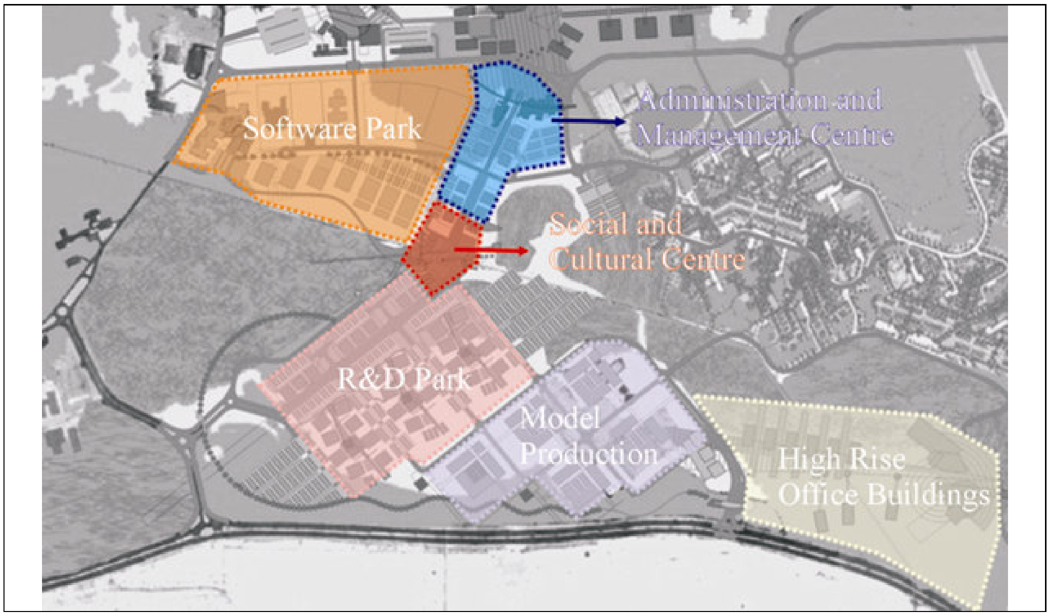


Figure- 4.9: Zones of the Plan of UD Studio *(Source:UD, 1997)*

The R&D Park

R&D park is defined as the area hosting the firms that aim at transforming scientific studies into economic values within the frame of research and product development activities. These studies involve researchers, experts, technical equipment, laboratories and common projects.

R&D park of nearly 16 ha covers rectangular development blocks, starting from Museum and Park of History of Nature till Bilkent Road. There are green wedges of 40 m. between each development block, which start from Museum of History of Nature and extend to Model Production Areas. These wedges get integrated to the major transport system of the Technopark with the secondary pedestrian way and roads that surround the R&D unit. An infrastructure module is located that includes a large car park as well as different infrastructural requirements within the sub-zone that includes the Meeting building. Nearly 1250-2250 people are supposed to be employed and a car park of 700-1300 capacity is proposed. (UD, 1997: D1).

Model Production Areas

In Model Production Units, studies will be carried out in relation with prototype vehicle-devices produced within the scope of the Research-Development, in certain numbers and quality, to be used in industrial field.

The Model Production Units were designed to be away from the main vehicle and pedestrian flow due to the functions they will have. The secondary pedestrian way that passes from the middle of the R&D units, turn into a pedestrian way that is not so strong. Model production areas will consist of low-rise buildings that surround a courtyard for service purposes some parts of which are planned as green area as buffers between each other and R&D units. The Model Production Units having a gross area of 8 hectares will cover a net area of 5,6 hectares. A car park of 700-1300 capacity is separated for this area which is proposed to house 450-800 employees. (UD, 1997: D1).

Area for High Rise Office Buildings

This area is designed near Bilkent Road. As demands for the Technopark are not clear, this area had the role of balancing the demands. Besides, this area is aimed to have a complementary effect of general technopark view. The car parking areas for these buildings are solved in the basements and around buildings. (UD, 1997: D2).

Administration and Management Centre

The administrative centre, is designed such as to face the best area with the connection of the pedestrian way in a best way, and together with its square, it combines the existing METU campus and its development area to Technopark, while at the same time connecting these two areas with METU village and new sport areas. Within this centre there are the Technopoark's management office and incubation units. The building defines the entrance square with its main wall of new moon shape. The main principle behind this design is integration with METU. It also symbolizes the entrance of METUTECH with the huge hole on the wall. Incubation units are designed as temporary modules to host for new firms. The building also includes social and recreational units for the employees. The management unit consists of 6000 m2, incubation centre 3000 m2 and social and recreational units and service units 1500 m2 of closed area. (UD, 1997: D2).

Social and Cultural Centre

The social and recreational centre, which is to form one of the most important focal point of METU Technopolis is designed with the supposition that Technopark and METU development area will require a new conventional centre, as the existing one will probably remain insufficient against the potential demand in the future, and it won't be much attractive as its far from technopark. For this reason the centre includes units of concert and meeting halls, permanent a temporary exhibition halls, a shopping, accommodation and a little fitness centres, all of designed in a flexible way, consisting of modules that can be combined or divided due to needs. (UD, 1997: D2-D3).

The Socio-cultural Centre and the Nature Park with the Nature Museum are located between the Software Park and R&D Park as a green belt.

Nature Museum and Park

Nature and Museum Parks are organizations that preserve living beings and geological formations due to international standards, and make scientific research on them and open them for visit to introduce the biological and geological formation of the country and the world. The botany garden around this museum will exhibit endemic plants especially of the country, and they will also be cultivated as they are faced with extinction. (UD, 1997: D2-D3).

The area of the building of nature museum is 20500 m2 together with closed area requirements of Botany Garden. The botany garden will be formed on a land of 10 ha and also a land for its expansion is allocated. (UD, 1997: D2-D3).

Table-4.1: Construction Area of the Plan of UD Studio

		Gross Area (hectares)	Net area (m2)	Floor area ratio	Floor space (m2)
1	**Software Park**	15 Ha	120.000.	0,5	60.000
2	**R&D Park**	12,5 Ha	100.000	0,5	50.000
3	**Model Production**	11 Ha	80.000	0,4	32.000
4	**Popular Science Park**	4,2 Ha	40.000	0,75	30.000
5	**Adm. & Soc. Cent.**	3,5 Ha	30.000	0,5	15.000
6	**Nature Museum**	16 Ha	160.000	0,125	20.000
	TOTAL	73 Ha	600.000		197.000

(Günay, 1997:193) (UD, 1997: D4) (UD, 1997: F2)

To sum up, by the completion of five development stages of the plan, it is aimed to achieve 500 firms with 4000 qualitative human resources working in 200.000 m2 closed area. The areas covered by the components of the Technopark, the floor spaces and estimated employment values are given in the following tables.

Table-4.2: General information of the different Zones of Plan of UD Studio

ZONE	# of Staff	Area for Car Parking (ha)	# of Cars	Green Areas (ha)	Ratio of Green Areas
Software Park	1600-2300	19-28	950-1400	3,8-5,5	0,34-0,49
R&D Park	1250-2250	1,4-2,6	700-1300	3-5,4	0,27-0,48
Model Production	450-800	0,15-0,25	70-130	1,4-2,6	0,25-0,46

(UD, 1997: D4)

4.2.1.d. Evaluation of the Plan of Urban Design Studio

The Urban Design Plan prepared by Urban Design Studio in years 1996-1997 has a significant role in the physical development of METU Technopolis. This plan has founded the main structure of the Technopolis Development plan and played an important role in shaping of the Silver Blocks, Silicon Bloc and Milsoft R&D building.

The plan will be evaluated within the frame of flexibility in form and flexibility in process as discussed in Chapter 2.

Flexibility in Form

The plan proposes zones for each function, and develops design guidelines for each zone. A unity is achieved both in 2nd and 3rd dimensions and architectural scale (materials used and proportions) and in order to break the monotony of the whole movement is also a part of this unity.

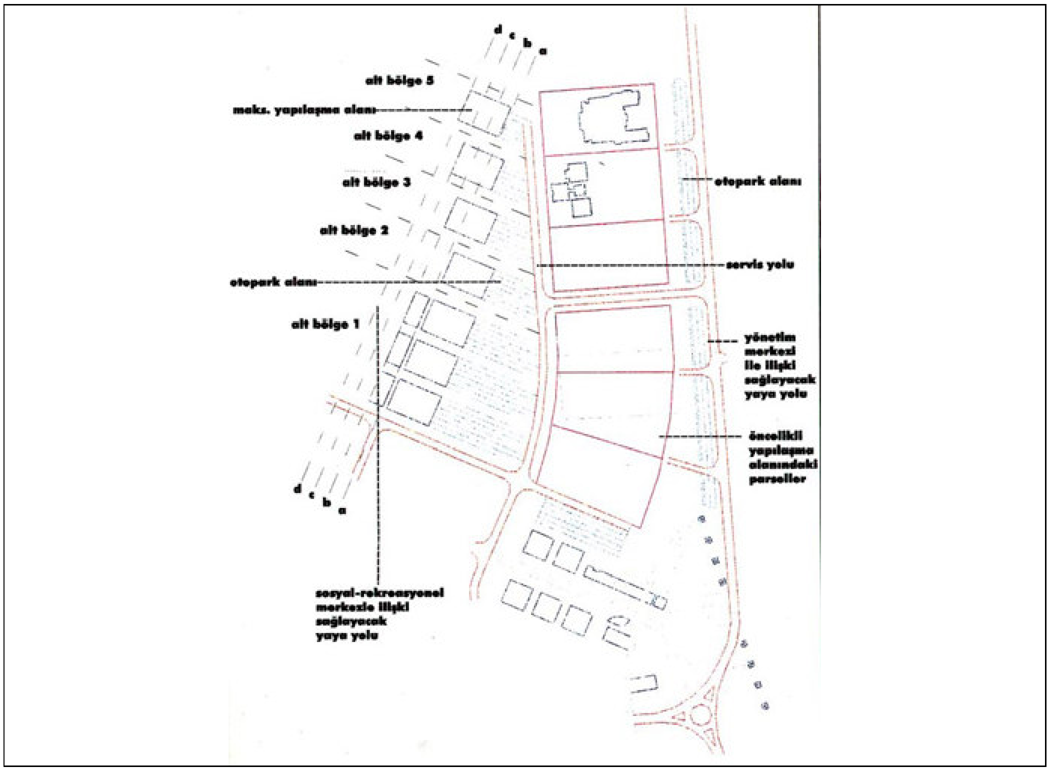


Figure- 4.10: Design Guideline for Software Park of the Plan of UD Studio *(Source:UD, 1997)*

As the architectural design of Halıcı Software-house and METU Twins has started, the plots in the eastern side of the road, aligned in north-south, are left as flexible lots. The eastern part of the road is divided into 7 sub-zones of nearly same area of construction. However the development guidelines for this area with the aim of a designed motion are not flexible enough to accommodate the development of buildings of different sizes.

This is also valid for the R&D Park and the Model Production Areas. Conditions of development in these zones also are not flexible enough to let buildings of various sizes to be constructed. However the implementation process has shown that the single firms demand various sizes of offices and even buildings of up to 1500- 10000 m2. The process has shown that there is a need for a flexible design approach that will both provide for these demands and keep the unity of plan.

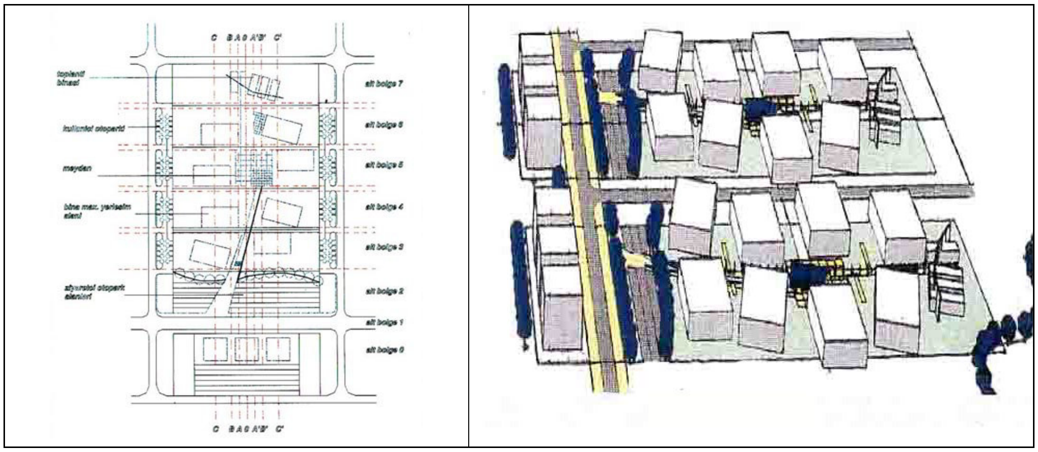


Figure- 4.11: Design Guideline for R&D Park of the Plan of UD Studio *(Source:UD, 1997)*

The High Voltage Electric Line that makes an angle of 30 degrees with the road that connects the education faculty in the west and the METU village had a significant role in determining the boundaries of the software park and shaping its geometry. The road and the energy transfer line determined the boundaries of the design. Where the reed bed has been effective in R&D Park, topography, the alignment of the waste water treatment pools, and especially the hill have shaped the geometry of both R&D Park and Model Production Areas.

Figure- 4.12: Elements affect the design of the Plan of UD Studio *(Source:UD, 1997)*

Flexibility in Process

Since the sectors, types and the scales of companies or organizations which would tend to locate themselves in the Technopark are not exactly known, the Plan of UD Studio was developed as a "structure plan" capable of adapting itself to changing demand. Thus, it was expected that the demand would be a determining factor for the size and the type of the development.

In the study the technopark area is divided into four major zones of nearly the same area; the Software Park, the R&D Park, the Model Production Areas, and Areas for High Rise Office Buildings. The fact that software firms demanded space from the technopark first brought that Software Park area has been determined as the one closest to the university buildings and infrastructure.

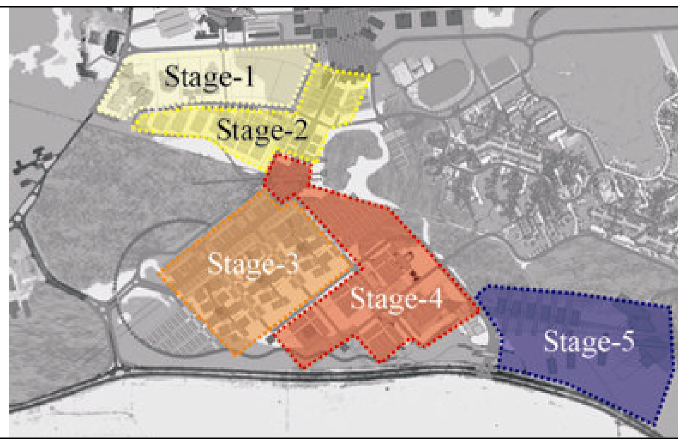


Figure- 4.13: Phasing of the Plan of UD Studio *(Source:UD, 1997)*

It was planned that the technopark would be developed in five stages and at the end of the second stage the administrative unit and Software Park would be constructed. In the third stage the R&D park, in the fourth stage, Model Production Park and in the fifth stage Area for High Rise Office Buildings would be developed. The development process of the plan was to be started in 1997 and be completed in 2005.

The planned stages was inconsistent to the implementation, the programming of the stages have been reconsidered to last in 2020, Nature Museum and Park has been removed from the programme, social and cultural complex and administrative center have been united in a new complex, and the left side of the green area that totally divides the technopark into two have changed due to forest boundaries to resemble the road structure planned in 1994. On the development of the buildings, we may say that Silicon Block have been constructed in a way that was not preconceive, and codings developed by UD studio for architectural unity have not been taken into consideration, and buildings that do not give any reference to the whole have emerged as a result of consultants from department of Architecture and Presidency.

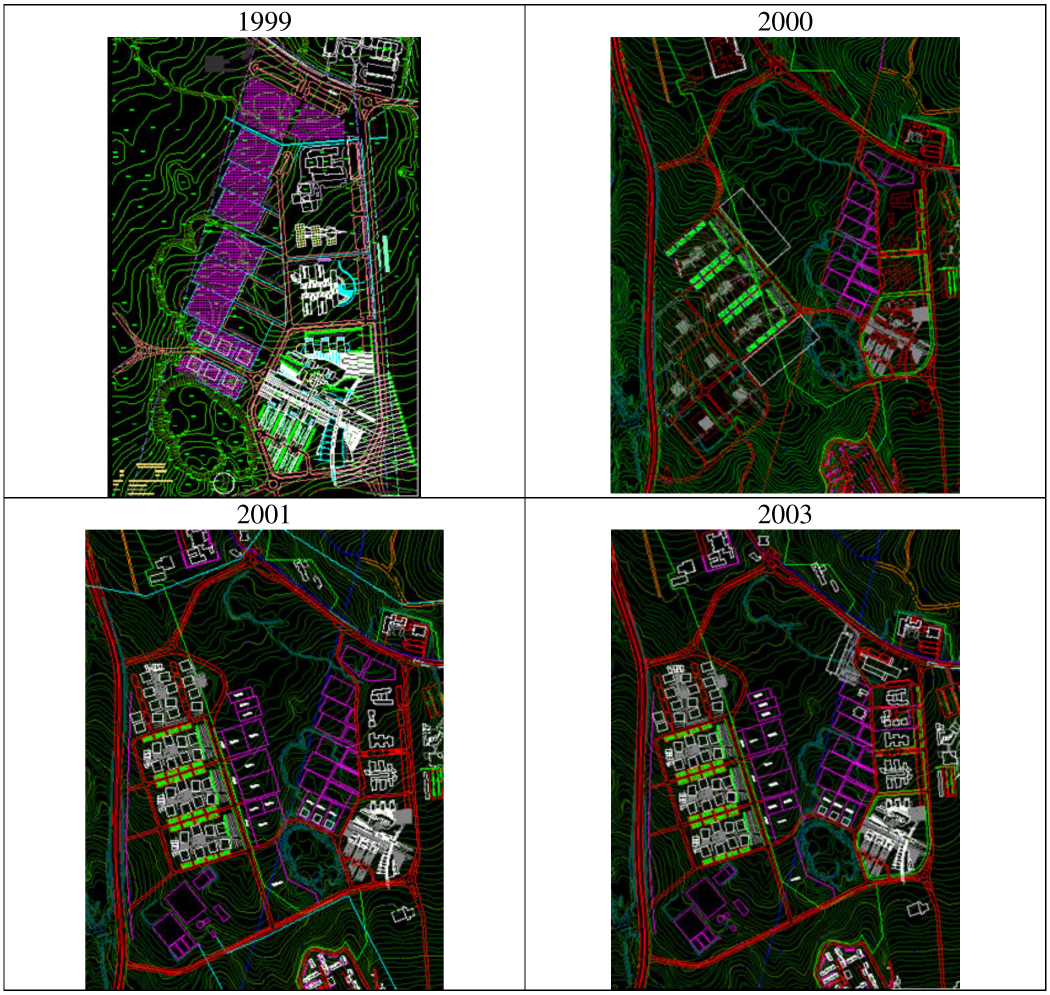


Figure- 4.14: Evolution of the Plan of UD Studio from 1999 to 2003 *(Source:Archive of UD Studio)*

The study developed by Urban Design Studio has been revised in the light of new information by its research assistants under the consultancy of Baykan Günay until 2003. In 2003 it was necessary for someone to be employed who will be responsible for guiding the development process of METU Technopolis.

4.2.1.e. Existing Plan of METU Technopolis

The existing plan of METU Technopolis is based on the plan of UD studio, and is transforming since 2003 due to changing circumstances. The area of METUTECH, which was 70 ha in plan of UD has been enlarged to 113 ha with the boundaries that have been approved by Council Ministers.

Figure- 4.15: Existing Plan of METUTECH *(Source: Archive of Teknopark Inc.)*

According to the experiences, the goals of the development plan has renewed again. As regards to the existing Plan, the full establishment of METU Technopolis, located on 113 ha with 50 ha construction area and approximately 260.000 m² closed area, will be completed in three main stages. As Plan of METU Technopolis shows, Software Houses, R&D Buildings, Incubation Units, Social and Administrative Centre, Multi-storey Office Buildings, Laboratories, Clusters and Centres of Excellences, Model Production Buildings and Science and Technology Museum will be built until 2015. By the completion of three development stages, in METUTECH, it is aimed to achieve 500 firms with more than 10.000 qualitative human resources.

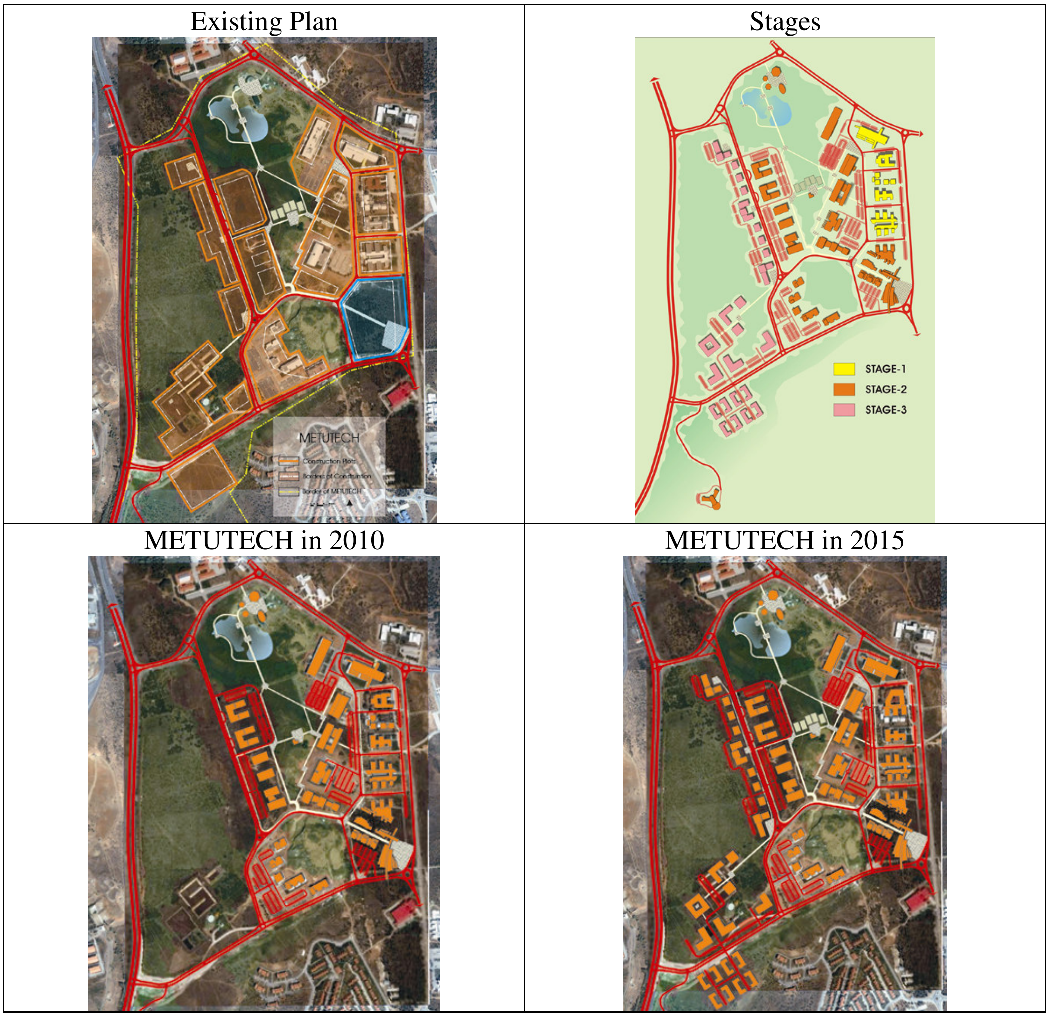


Figure- 4.16: Phasing of the Existing Plan of METUTECH *(Archive of Teknopark Inc.)*

Stage 1: The first stage that is the western part of the road that METU village and Education Faculty and includes software-house buildings (Halıcı Software-house, METU Twins and Silver Block) and incubation centre (Tekmer). It covers nearly 25.000m2 of closed area.

Stage 2: In this stage which includes Science &Technology Museum, the second part of software-house buildings, the first part of R&D buildings and Social, Cultural and Administrative Building, a closed area of 160.000 m2 will be constructed. At the end of the stage all infrastructure and road construction works will be completed.

Stage 3: In third stage, which includes multi-storey office buildings, Centre of Excellence, Model Production Units and Research Laboratories, METU-Technopolis will reach a closed area of 260.000 m2 and will be a science park in a global scale with 500 firms and 10.000 skilled labours.

Stage 1 comprises the years 2000 to 2003, Stage 2 comprises the years 2004 and 2009 and Stage 3 comprises the years 2010 and 2015.

Tabel-4.3: The change of Construction Area in METUTECH (m2)

	2003	**2004**	**2005**	**2006**	**2007**
Closed Area-m2	26.928	46.393	59.905	59.905	73.873

Tabel-4.4: Construction being produced in each stage

	Stage 1	**Stage 2**	**Stage 3**	**Total**
Total Closed are (m2)	26.928	158.841	80.000	**265.769**
Total open area (ha)	8	44	61	**113**

The design of the science park is based on the idea of the integration of all parts of METU Technopolis with the educational and social institutions on METU campus. The necessity for an informational exchange between the software-houses, the R&D units and the educational units is greatly influenced by the physical layout of the science park.

As there is no prediction on sectors and scale of the firms that want to take place in Technopolis, within this plan, the grouping is based on production models of buildings rather than groupings such as Software park, R&D Park as was in UD plan. The buildings that include multi tenants are located at the place which was allocated for software park in UD plan while the buildings produced according to build- operate- transfer back are located on the boulevard. It is seen that people do interact much in common spaces in multi-tenant buildings that include more than one firm. The reason for this, zoning is that the firms that build their own buildings develop a possession and do not want other people to enter their territory. Besides the firms that utilize this model are mainly defense industry firms and they want a safer environment for the process of developing their projects behind fences.

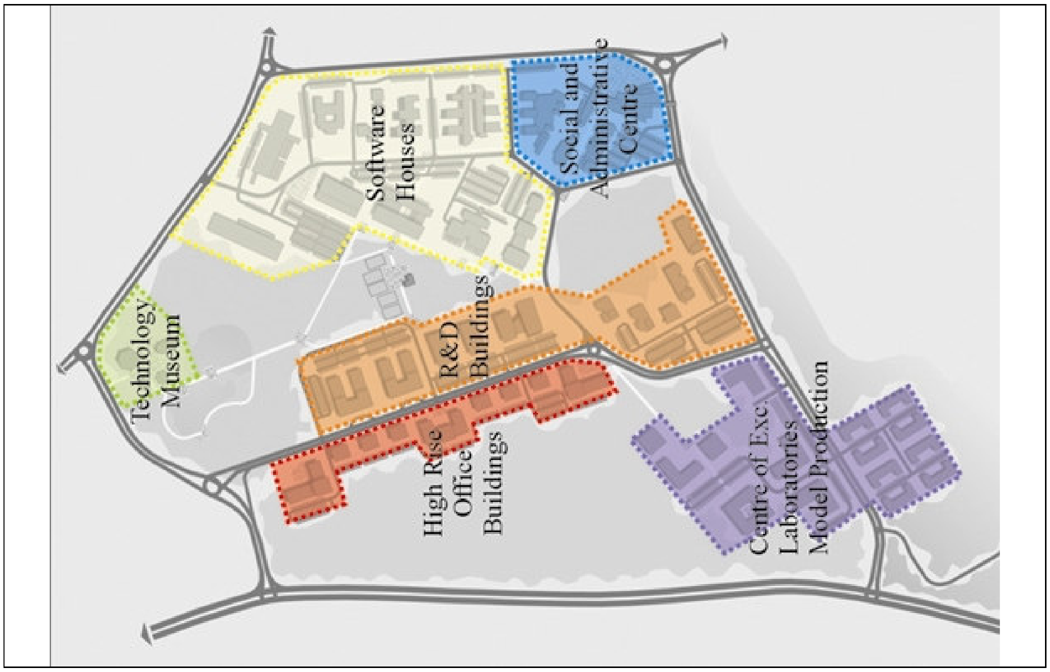


Figure- 4.17: Different Zones in the Existing Plan of METUTECH *(Source: Archive of Teknopark Inc.)*

The main elements of the development plan are defined briefly below.

Software Houses

These buildings, which have multi offices for different companies, include offices allotted to R&D activities, but not limited with the software development. Software houses are situated on the part of METU Technopolis that is the closest point to the university. One of the reasons affecting the choice of place is the ability to provide the interactions between the companies and companies and companies and academic environment. Moreover, another reason affecting the site selection of software houses-multi-tenant buildings- is that the existing this type of buildings, such as Halıcı Software-house, Silver Blokes and METU Twins Building were also constructed in this zone. Existing infrastructure conditions were also effective for the choice of the location.

R&D Buildings

These are the buildings that are allocated as a whole to only one firm. A range of different sized plots is designed in order to cover the demands of various sized firms. Their parking lots are proposed mainly in their own plots.

Incubation Units

For an entrepreneur starting-up a business, access to office space together with professional and expert business advice is critical. Incubation centre is the most important one to start with. Incubation Centre provides both space and business development support for start-up businesses to successfully develop their projects.

Clusters and Centre of Excellences

These areas are designed as groups of buildings to form sectoral clusters and centre of excellences in order to achieve a close relationship between different firms working in synergy. Some uses and services are provided commonly in central buildings. Also special laboratories will be constructed in these centres.

Social and Administrative Centre

It is a building complex that includes administrative offices of METU Technopolis, incubation units, social and cultural functions such as cinema, theatre, concert and seminar halls, exhibition units, meeting rooms, restaurants, shopping and accommodation units and the units which meet the needs of R&D companies such as institutions and companies working and expert on financial, legal and IPR services. The center will be one of the fundamental elements of METU-Technopolis social life. It was planned that Social and Administrative Centre will be spread out over an area of 40.000 m2.

Multi-Storey Office Buildings

These Buildings, which will be constructed in the third stage, are planned to house mostly companies which commercialize the R&D results of the companies, or the marketing departments of the companies working in the METU Technopolis. This area is created to be the gate of METU Technopolis to the global economy.

Model Production Units

These are designed to be away from the main pedestrian flow due to the functions they will have. In Model Production Units, studies will be carried out in relation with prototype vehicle-devices produced within the scope of the Research-Development, in certain numbers and quality, to be used in industrial field.

Science and Technology Museum

The Museum includes open and enclosed exhibition areas for science and technology products that have historical value in chronologically.

The Triangle

The triangle, which consists of recreational facilities, sports areas, and a lake, is the one of the most important parts of the METU Technopolis. Also it a botanical park may be established in it.

The Hill

It is a recreation area, which will be formed on a hill, and it will include vista points, a promenade and a café,

Forestry Zone

These areas will be afforested and some recreational activities will be arranged in the area such as tracking, running paths.

Development Plan of METU Technopolis as a Legal Document

The studies on current development plan started as a result of the request of Ministry of Industry and Commerce for a development plan in 2003. In that year under the management of the planner employed in Teknopark Inc. and with the consultancy of Baykan Günay the studies on the plan started. The development plan consisted of a single parcel in order to response uncertainties and prevent the municipality intervene in the campus area. The plan is presented to the ministry in May 2003 for approval with the Site Plan, the attachment of the development plan, and which is prepared based on the diagram developed by UD studio in order to guide development. The development plan has changed, in line with the objections of Ankara Greater Municipality about the forest zone, was approved in July 2004, as floor area ratio %40 and hmax free.

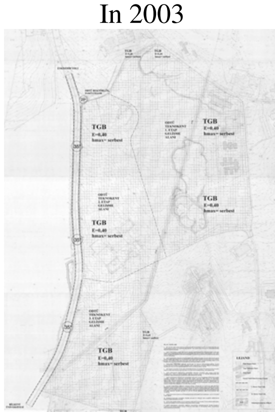
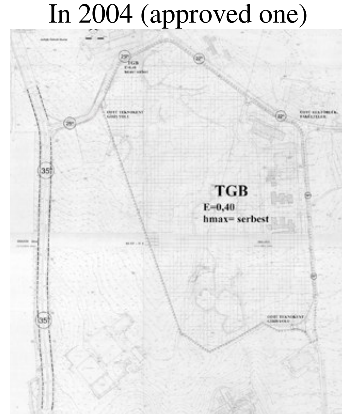
In 2003	In 2004 (approved one)
	

Figure- 4.18: Development Plan of METUTECH *(Source: Archive of Teknopark Inc.)*

Site Plan of METU Technopolis as the Attachment of Development Plan

Where the plan as prepared in 2003 by UD Studio kept the lot pattern same as the Software part of the first plan, especially the area covering R&D park has been changed due to new developments and been divided into lots as in the figure 4.19. During the preparation of the plan it was noticed that lots were much too small this would be a handicap for buildings of large floor area. For this reason the lots have been kept as big as possible with large construction rights and boundaries to consist a flexible frame. As the approval process of the plan lasted a year, it has been kept changing due to changing circumstances.

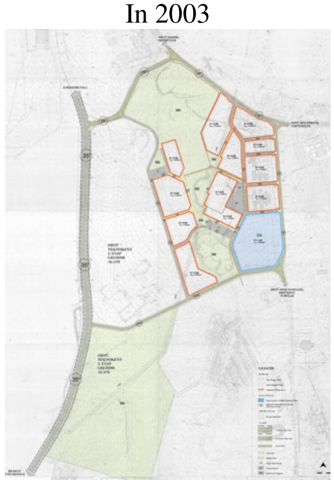
In 2003	In 2004 (approved one)
	

Figure- 4.19: Site Plan of METUTECH *(Source: Archive of Teknopark Inc.)*

Although it is similar to the existing plan to a large extent, we may not count them as same documents as it had to cover only the areas other than forest and the existing plan has been changed since site plans approval in 2004.

4.2.1.f. Evaluation of the Existing Development Plan of METU Technopolis

The existing plan that emerged from the evolution of the UD plan is the major document guiding the development of METU Technopolis. It is prepared to serve as a structure plan to define development areas, relation of recreational areas and building areas, the circulation structure, and its relation with other elements.

Flexibility in Form

In the METUTECH's existing plan that is developed based on UD plan, there is no sectoral zoning. Instead zoning is such as zone of R&D buildings, zone of software buildings. It seems as if there is no difference between the zoning of UD plan and existing plan. However for example software buildings define buildings of firms without sectoral differentiation, not buildings of firms only specialized on only software development but other companies as well, and the zone of software buildings defines the totality made up of these buildings.

The aim of this approach is reduction of the uncertainty in demand and process to that of architectural form. So that basic principle of architectural design is to make a flexible architectural form suitable for all R&D and software firms regardless of sectors. The concern of UD plan on the other hand has been not to change the settled concepts. The fact that most firms work on software development and ICT make these concepts unquestionable.

There are two main reasons for allocation different zones for R&D buildings and software-house buildings. One is, social relations are stronger in software buildings, since there are more than one firms. The other one is, the firms in R&D buildings develop possession on land and R&D buildings are preferred by defense industry as they demand higher security.

For the development both software-house buildings and R&D buildings the lots are kept as big as possible to make a flexible frame for different size of buildings.

Within this flexible frame, we can say that unity is achieved in 2 dimensions with regard to mass relations except for the area that includes SEM buildings and TEKMER. However whether you call it development plan, existing plan or site plan, the lack of a design guideline that guides especially building materials, some architectural and landscape issues, prevents a unity to be achieved and leaves the process to the initiative of the actors.

Flexibility in process

Existing plan of METUTECH, has been changing due to changing circumstances with the condition of keeping its structure. This approach even legitimizes not obeying the site plan- a legal document- which is an attachment of the development plan. Even it is mentioned in the report of development plan that the site plan can be changed parallel to the changes within the frame of development plan. This actually shows that planners see flexibility as a weapon against uncertainty. However if flexibility reaches to a point where even legal documents are neglected, and if there are no codes defining some boundaries of development at various levels, the faith of the physical development leaves to the personality of planner.

Within the context of METU Technopolis, this means that the development control is taken from the hands of the planner and left to all the other actors within the process; Office of President, departments of architecture and city and regional planning, Directorate of Construction, Office of campus planning, Management Company, managers of METUTECH companies, METU Development Foundation, architects, and is leaded where the pressure is most intense.

4.2.2. Development of Superstructure in METUTECH

The first building of METU Technopolis is the METU-SMIDO Technology Development Center (ODTÜ TEKMER), the incubation centre, which was put into opreration in early 90's. Also, close to the Incubation Centre, the Continuing Education Centre of METU was constructed before 1997. These two buildings were located with in the context of Regulatory Plan of METU.

It was decided to establish a Software Park as the first phase of METU Technopolis, as a result, the construction of HALICI Software-house was started in June 1997. In 2000, METU Twins Building, whose construction was started in 1998, put into service as the first software-house of METU Technopolis. Together with the second part of the METU Twins building, the HALICI Software-house was completed in the beginning of 2001. These two buildings were designed by Semra Teber according to the Diagram of Semra Teber, which was developed according to the Regulatory Plan of METU.

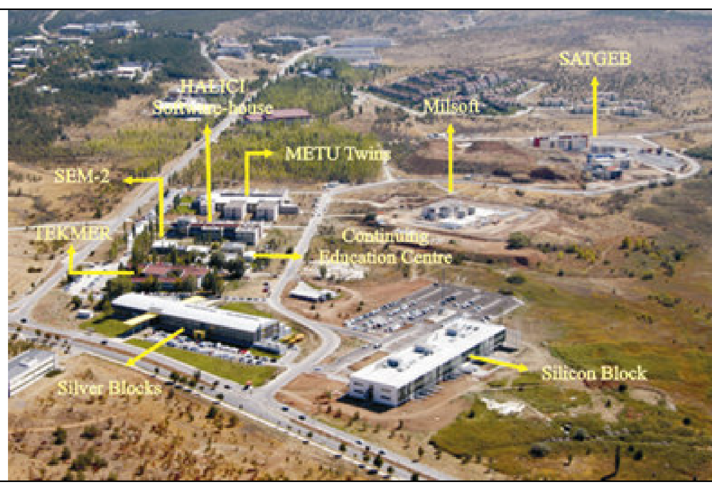


Figure- 4.20: Buildings of METUTECH *(Source: Archive of Teknopark Inc.)*

Semra Teber was the architect of the METU Twins and Halıcı Software-house as she already made a conceptual study on METU Technopolis and science parks are her area of specialization in her academic work. Except for these two buildings design process have been through architectural contest. The jury of the contests consisted of 5 academicians, four from department of architecture one from dep. of city and regional planning. There was also a jury of high-level administrators of presidency as consulters. The architects and the architectural designs of Silver Blocks, Silicon Bloc and Gallium Block, which is under construction, and SATGEB-2 sub region, which is composed of 4 buildings, were selected within the context of architectural contests.

Within this section the development of the superstructure will be discussed over the concept of flexibility.

4.2.2.a. TEKMER Building and Continuing Education Centre Building

Although we may see different dates in different sources for the construction of METU-SMIDO Technology Development building, based on aerial photos we may say that contraction started at the end of the 80'ies and even some sources do not say so it is the first building of METU Technopolis. It is serving as the incubator of METU Technopolis since 1992 in collaboration with SMIDO (Small and Medium Sized Industry development Organization-KOSGEB). The architect of the building is unknown but is located based on regulatory plan of METU. The criterion for the selection of its site has been proximity to gallery of METU, which shelters infrastructure lines. Thus it is fed by the central system of METU.

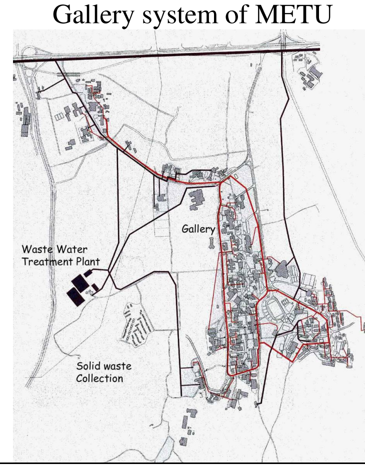
METU in 1986	Gallery system of METU
	

Figure- 4.21: Location of TEKMER Building *(Source: Directorate of Construction)*

The construction of Continuing Education Centre Building' the second building of METUTECH, was completed before 1997. Proximity to infrastructure was the main factor in locating this building also.

These two buildings have been one of the most important barriers to the flexibility of development with the chaotic environment they create.

4.2.2.b. Halıcı Software-house and METU Twins Building

An agreement was made with Halıcı Inc. for constructing a building with build- manage-transfer back model, in 1996 while planning studies were continuing. Semra Teber was the architect of the building.

In June 1997 while the construction of the building was continuing the construction of METU Twins- again designed by Semra Teber- started in 1998. METU Twins Building was put in service in 2000, where as Halıcı Software-house was put in service in beginning of 2001

Flexibility in Form

As there was not a design guideline for architecture, Semra Teber defined her own boundaries in both choosing materials and inner division of buildings. The approach of Teber may be summarized as creating the image of the future and technology with its specialized buildings, its transparency of functions reflecting on forms and materials of the built environment and a particular inner and outer space quality, to be the sign of a new world, a new age (Teber, 1995).

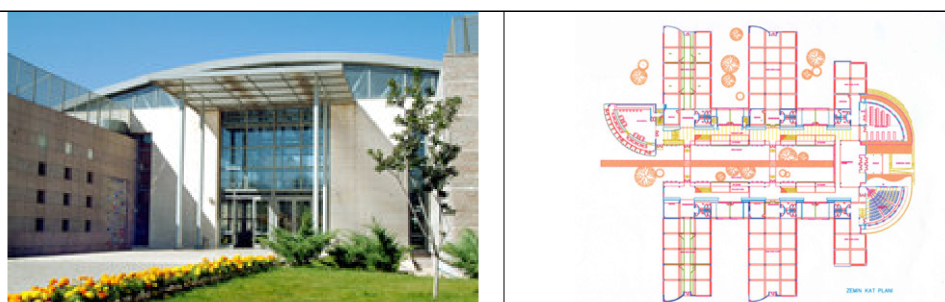


Figure- 4.22: METU Twins Building *(Source: Archive of Teknopark Inc.)*

In both buildings the offices designed can be extended both vertically and horizontally. These modular offices bring a flexible inner division. Office areas can change in the range of 30m2 to 900 m2 in Twins and with the separate entrances, of Halıcı Software- house the range of office areas change between 33 m2to 1200 m2. The two wing structure of Twins brought flexibility also in the process of construction.

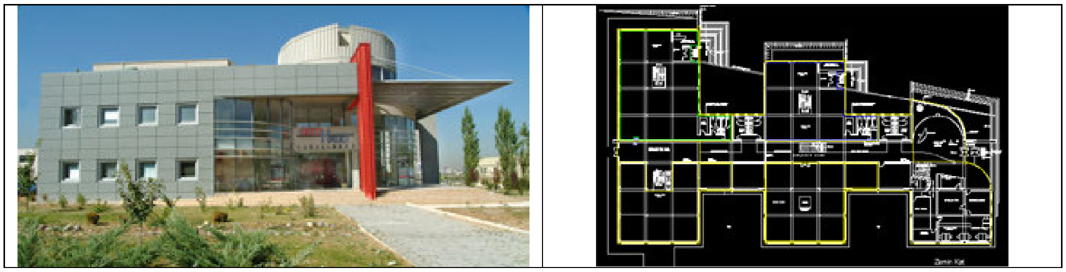


Figure- 4.23: Halıcı Software-house *(Source: Archive of Teknopark Inc.)*

There is a unity between these two buildings although they have very motional structures as they are designed by the same architect. As they were designed for software firms they are not suitable for special firms that require laboratories of wet floor. The buildings are problematic for those software firms focused on computers as the buildings are aligned in east-west direction and there is no element for the control of sunshine.

Lastly as they are the first buildings of METUTECH, they have acted as references in architectural image, materials and inner divisions for the evaluation of unity.

Flexibility in Process

Halıcı Software-house was located depending on proximity to existing infrastructure and university. The area was named as Software-houses zone and designed accordingly as both Halıcı Inc. and many other firms that want to take place in METUTECH were specialized in software development. This decision was the main reason why this area was developed as Software park in UD plan and therefore software-houses zone in the existing plan of METUTECH.

METU Twins Building and Halıcı Software-house were designed according to the Diagram of Semra Teber, which was developed according to the Regulatory Plan of METU. For this reason the buildings face the road from education faculty to METU village which was taken as a boundary in UD plan, and they turn their backs to the inner road in UD plan.

4.2.2.c. Silver Blocks

Silver Blokes, is the first building determined from a contest. The construction started in 2001 and ended in 2002. It shows appropriateness with the UD plan on its mass, location and relations with its environment. However we see that it is not compatible with the guidelines in terms of material selection.

Flexibility in Form

The architects were asked to create a genuine architectural language in terms of form, building technology, function and harmony with environment within the context of the contest. “Technology, flexibility, quality and social interaction” were the keywords of the contest. As there was no limitation for martial selection, a building of very different look from that of Twins and Halıcı appears.

As most firms in METUTECH are specialized in software development, the offices are designed considering their requirements. As in Twins and Halıcı R&D firms that need laboratories were not considered. However the alignments of the offices are suitable for the requirements of software firms.

It is possible to make office spaces ranging from 40 m2 to1500 m2. Heightened flooring is used for facilitating the move of infrastructure which brings flexible office solutions.

Flexibility in Process

In the first architectural drawing a car park was designed in the basement of the building. However there was a pressure from the university administration and especially METU Development Foundation- the financer of the building- for turning this area to offices. Thus the car park area was changed to offices.

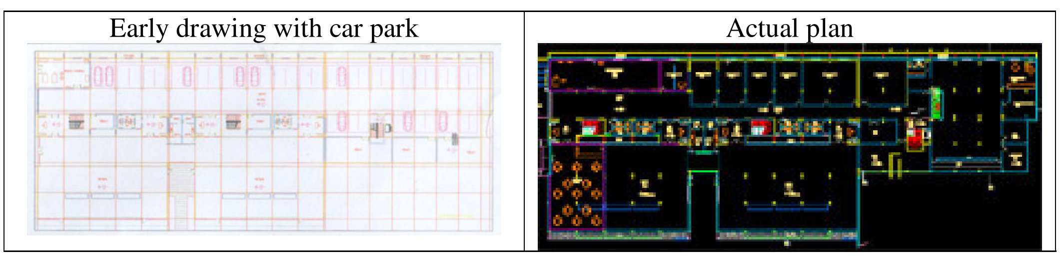


Figure- 4.24: Plans of Silver Blocks *(Source: Archive of Teknopark Inc.)*

Besides after the construction of the building was completed, as there was a criticism from some academicians that the building had a cold look, the sun protectors of the building were painted in yellow.

Silver Blocks building constitutes an important example to see the management of production process and what actors are involved in this process to what degree.

4.2.2.d. Silicon Block

Silicon Block is another building as an outcome of a contest. The architect of the building is Boran Ekinci. The construction started in July 2003 and was completed in June 2004.

Flexibility in Form

The contest document and the keywords of "technology, flexibility, quality and social interaction" as was in the contest of Silver Block were valid for Silicon Block also. There were no other limitations. Thus the architect is totally free. As a result the outcome was incompatible not only with METU Twins and Halıcı but also with Silver Block in terms of materials and architectural language.

In chapter two we mentioned the conflict between planners and architects. Where the emphasis of planners is more on unity, architects put emphasis on diversity. In conformity with this, the academicians of the department of architecture want the METUTECH to be a museum of architecture, which includes buildings of different architectural languages and styles. In this context, although Silicon Block has an aesthetical quality of its own, in the conflict between planners and architects, it may be considered as an arena where architects win.

Figure- 4.25: Silicon Block and Silver Blocks *(Source: Archive of Teknopark Inc.)*

In order to evaluate Silicon Block with respect to form-function relations, we should consider that most of the firms in this building are software firms. The facade of this building is made up of glass for the whole length. Software firms wishes to control sunlight, whereas concept of the building, which was determined by the architect, was transparency. Thus the design of the building is not compatible with the function. Besides the fact that the windows cannot be opened brought dissatisfaction of inhabitants. The only flexibility that this building brings is that with the wet floors at the basement, it becomes suitable for firms that require laboratories.

The areas of offices change between 72 m2 to 1100 m2. However as most firms that apply METUTECH are small firms, 72 m2 is much too big for them. Besides the thin and long form of these offices are not suitable for separations.

Flexibility in Process

Although Silicon Block was developed when UD plan was being implemented, it is located to where UD plan did not propose development. Here flexibility goes to the fore of planning. The location choice was for not to move the Siemens and Modsim prefabricated buildings, and to be close to infrastructure (see figure 4.14).

In UD plan, high voltage electric line is considered as a boundary and the west part of the line is not allocated for development. However the line is moved because of the fact that the building is located just near this building and also passes right in the middle of SATGEB area as will be mentioned later.

4.2.2.e. Milsoft R&D Building

Misoft R&D Building is the first R&D building, dedicated for one company, whose agreement was signed within the context of Land Appropriation Option. Although the architectural design study of Milsoft R&D Building, developed by Hüseyin Bütüner- the architect of Silver Blocks, was started in 2002, the construction of the building was merely started in 2004 and was completed in 2005.

Flexibility in Form

The Milsoft Building was shaped according to its own requirements as it was developed in the model of build- operate- transfer. Thus the relation between form and function could more easily be acquired.

Besides as the architect of the building is the same as Silver Block's made the building which is also compatible with the geometry of the UD plan, made the building not contrary to the unity.

Flexibility in Process

As most of the firms in METU- Technopolis, Milsoft also works on software development. However what is important is that this software is developed for defense industry. For safety criteria the firm has to develop some software behind fences. Thus the firm requested a building, covered with fences with the model of build- operate- transfer, of its own. And the process of flexibility starts with the site selection for the building.

Baykan Günay as the coordinator of the UD plan claimed that it was not appropriate for a building covered with wire fences to be located within the METUTECH, but if it is necessary the building should be located not in the zone of software park, but somewhere where development is proposed near to Bilkent road.

However the building was located in the software park in spite of obligations of Baykan Günay, as road and infrastructure was not available in the area near to Bilkent Road, and especially not to refuse the company; Milsoft.

For a firm to construct a building due to the model of land appropriation, the architect of the building should be approved by the university administration. Furthermore, the architectural projects prepared by the approved architect, should first get a positive opinion from the Department of Architecture and then be approved by METU Technopolis management and also by university administration.

However, since UD studio and Baykan Günay lost their motivations and attention on subject, besides, since the academicians dealing with the subject from the Department of Architecture did not find it appropriate for Hüseyin Bütüner who is also the architect of Silver Block to design a second building; the approval of the project took more than 6 months. Within all these conflicting circumstances the construction of the building started in the beginning of 2004 and ended in the beginning of 2005.

4.2.2.f. SATGEB Sub-Region

SATGEB is a centre of excellence of defense industry that aims to bring together 4 important defense industry firms; Havelsan, Aselsan, Tai and Tusaş in a special site established in METU Technopolis, so to enhance the collaboration between public institutions, university, Turkish Army Force and defense industry firms.

In 2003, the design works of SATGEB sub-region, developed by Hüseyin Bütüner was started. In 2004 Havelsan and TAI-1 R&D buildings were opened to use, and in 2005 by the completion of TAI-2 (in the beginning of 2005, the company Tusaş was closed, and the building of Tusaş began to called as TAI-2 since then) and Aselsan R&D buildings, construction of SATGEB except landscape arrangements, together with 5 buildings was completed.

SATGEB, established on an open area of 40.000 m2 is composed of 4 R&D Buildings and a common building. The site is designed according to the security needs of defense industry. Total construction area of SATGEB is 17.500 m2 and 13.120 m2 of it constitutes the R&D Buildings. "The Common Building" is designed with the aim of providing the common services of 800 personnel in the sub-region. These services are a cafeteria and a kitchen of 400 people, central air conditioning system, central electric systems (transformer, generator etc.), VIP Room and administrative offices.

SATGEB Project will be evaluated in detail as an example in which flexibility is utilized most in the planning approach in every dimension.

Flexibility in Form

SATGEB is constructed with the land appropriation model as Milsoft R&D Building. However with the aim of creating a center of excellence made up of more than one firms, with the condition of getting ten years of rent cash, the management company of METUTECH undertook the management process of construction of buildings.

Hüseyin Bütüner was selected as the architect regarding the quality of the job he did before in METUTECH, for dealing with the uncertainties due to unknowing whether firms will come or not, the size of the buildings they demand.

The fact that he has designed for METUTECH before brought that the buildings are compatible with the unity. Moreover, one architect to produce all the five buildings was a positive aspect especially because there were no codings.

The architect is left free as he knew the process from his previous experiences. However there were requests from the architect due to functional concerns. The buildings would have a modular structure to be adaptable for other firms that may follow after 10 years of rental. Besides as the land and buildings belong to METU it should be designed in such a way that it may be utilized for METU not only METU Technopolis.

As the form function relations are solved due to the requirements of the firms, we may say that a harmony was achieved in that manner.

Flexibility in Process

As mentioned before the firms in SATGEB are specialized in defense industry, although they also work on software development, electronics and aeronautics. Thus it is designed to be surrounded by fences.

Shape of the plot in 2003	Modification

Figure- 4.26: Location of SATGEB *(Source: Archive of Teknopark Inc.)*

The selected site has been approved by the university administration and Teknopark Inc. in line with the parallel opinions of Baykan Günay and Göksal Cülcüloğlu- director of campus planning unit, as infrastructure was not available there and high voltage electric line was passing right in the middle of the area. In this line, considering that the firms in SATGEB region are the chief ones in their sector and there may emerge reactions from the public agenda of METU, the site is selected as the western part of the hill, which is not seen from the campus.

The process of physical development of SATGEB related with form will be discussed under this heading as it is more accurate to take the design process as a whole. As it is mentioned in chapter 2 flexibility in form may also be evaluated under flexibility in process.

The area chosen has many physical thresholds such as the artificial hill, sloping topography and high voltage electric line. Besides there is uncertainty in which firm will stay at the sub-region and the size they require for the buildings. Within this condition of uncertainty the first agreement was signed for the construction of Havelsan Building of 2300 m2. Where meetings with other firms were continuing it was decided that Aselsan building's size would be same as Havelsan's, and that of TAI's and TUSAŞ's would be half of the size of Havelsan building. The first alternatives both in architectural and site plan were changing, the floor area of Havelsan building was increased to 3000 m2 first and then to 4600 m2. Besides, TAI and TUSAŞ told that they required buildings of 1800 m2 area and 900 m2 respectively. At a time Roketsan also mentioned that they wanted to take place there but later they changed their mind.

As space requirements of the project have increased in time, it was seen that it was not possible to solve the site plan within the chosen site. As the process of preparing the development plan was also continuing at that time, the area was enlarged by shifting the part of the main boulevard that corresponds to the SATGEB sub-region to west in the site plan. As the enlarged area remained in the boundaries of forest, construction was kept in the eastern part of the boundary, where the enlarged part was defined as the car park as there were no trees.

When the construction of the Havelsan building started, high voltage electric line was passing right near the building and the site plan of the zone is not clear yet. The site plan became clear in a meeting when the excavation of the construction was continuing. The solution of the site plan came in the meeting by the site chief when he wanted commitment that the site plan and projects would not change and turned the Havelsan building which was facing west in the plan 90 degrees and said “how do I know that the building will not sit like this but like this?” So it was seen that a better diagram would be achieved by facing the building to south and thus emerged the current site plan of SATGEB.

Figure- 4.27: Site Plan of SATGEB *(Source: Archive of Teknopark Inc.)*

During the constructions, high voltage electric line has been moved, infrastructure was brought to the zone and some portion of the hill was removed for buildings to fit.

Tusaş building was enlarged from 900 m2 to 1800 m2, Havelsan Building from 2300 m2 to 4600 m2, Tai Building from 1200 m2 to 2250 m2, Aselsan Building from 2000 m2 to 4400 m2 and the common building from 1200 m2 to 2250 m2.

As a result SATGEB sub-region has been produced in a very flexible process however this resulted in too much extra costs.

4.2.2.g. Gallium Block

As a result of increasing demands from firms for a software building in 2004, a new building would be constructed. Within the context of a contest made in 2005, the project of Alişan Çırakoğlu was chosen. The construction of the building started in 2006 and is planned to be completed in the summer of 2007.

Flexibility in Form

The production of the Gallium Block is not very different from the others. The basic difference is that the major conditions due to the structure of the plan were more defined. Anyway there was the lack of guidelines that would provide for unity of the buildings. However it was requested from the architects that the building should be compatible with the other buildings. However this concern was not noticed in any of the projects brought.

When we examine the form-function relations, we may say that form is suitable with function as it takes the sunlight in a controlled way, which is important for software firms. Besides it is also suitable for R&D firms as well even the ones that require wet floor with the shafts.

The building consists of office spaces whose sizes change between the ranges of 40 m2 to 450 m2. Moreover, the offices can expand both vertically and horizontally up to 1700 m2 by merging. However the electricity network of the building does not have the character to keep up with the flexibility of the building.

Flexibility in Process

What is important about Gallium Block is that it is situated in a way that does not fit with the site plan. The site plan is produced based on the plan of UD however the design of UD was considered as a given without considering development in 2^{nd} and 3^{rd} dimensions. However just in time when development plan was approved it was noticed that buildings that would be produced due to the lot divisions in the development plan, would be incompatible with each other both in 2^{nd} dimension and in mass relations. For this reason lot arrangements were changed during the contest and architects were requested to develop a building that would have nearly the same floor area as Milsoft and that uses the topography well. As a result the implementation is contrary to the site plan.

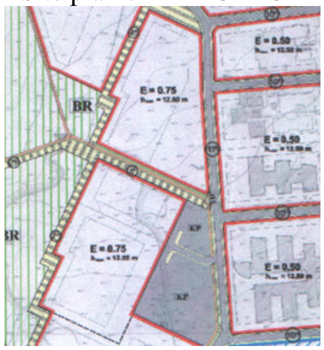
Site plan of METUTECH	Location on the Site Plan
	

Figure- 4.28: Location of Gallium Block *(Source: Archive of Teknopark Inc.)*

4.2.2.h. SATGEB-2 Sub-Region

As the buildings in SATGEB sub-region began to emerge one by one, other defense industry firms requested to construct buildings in METU Technopolis due to Land Appropriation Option. Within this context an area of 20.000 m2 were allocated to these firms as SATGEB-2 zone. No restrictions on height are defined in the site plan, as it is hard to change later as it is a legal document. However in the existing plan of METUTECH that does not have a legal binding, more strict conditions are defined. The construction area is defined as 20.000 m2 and height as 4 stories including terrace.

As there is no implementation yet, the project will be evaluated only in terms of flexibility in process.

Flexibility in Process

The first firm that wanted to construct a building with Land Appropriation Option was Vestel. The southern part of SATGEB-2 sub-region was allocated for them, as it is near existing road network and infrastructure.

The next firm that wanted to construct a building was Koç Sistem Firm. In the beginning, considering each firm may work with different architects, to provide unity for this sub-region, a coding study has begun.

The project prepared for Koç Sistem firm was found insufficient by the management company. Thus it was decided that the best thing would be to make a contest for the SATGEB-2 sub-region as a whole. The scope of the contest has been determined when later Gate and Siemens firms also wanted to build buildings. In the contest, which was evaluated depending on the requirements of the firms, the project of Cem İlhan was chosen that it had the most flexible structure and it united best with the existing plan.

However after the finalization of the contest, Gate and Koç Sistem firms gave up from their will to make a building. It was requested from Vestel and Siemens firms to get their projects prepared with the architects that were selected at the contest. However at a time when the projects of the building were being completed, Siemens also gave up the idea of having a building in METUTECH. On the other hand, Vestel wanted to work with another architect not the one selected at the contest. And Vestel also proposed the new projects to the university administration.

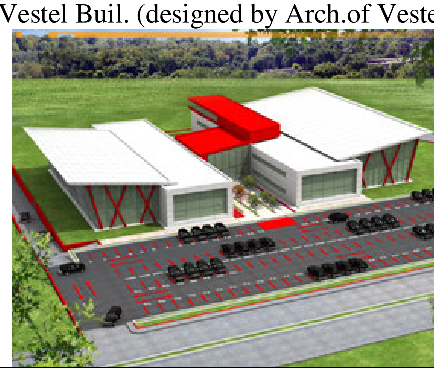
Desing of Cem İlhan (winner of the contest)	Vestel Buil. (designed by Arch.of Vestel)
	

Figure- 4.29: Conceptual Designs of SATGEB-2 Buildings *(Source: Archive of Teknopark Inc.)*

Now it is the time for decision to define the limits of flexibility for both university administration and the management company. Will developments be according to what firms want or will the management insist on the architect and the project at the expense of the probability that the firm may give up.

4.2.3. Evaluation of the Elements Affecting the Physical Development

Both in planning and implementation processes roads are taken seriously as they make up the structure, but generally infrastructure networks are neglected and incremental solutions are brought in problem times.

In the areas of METU which have been developed according to the diagram of Behruz Çinici with a comprehensive approach, the infrastructure network was taken seriously and a gallery system was constructed which was unusual for Turkey especially in those times. So that, a more effective and less costly infrastructure network was constituted.

However this approach was left especially in 1980's because of attitudes of administrators, and infrastructure was constructed in a way to minimize costs. This approach also shaped the infrastructure of METU-Technopolis, especially till 2003. However this approach is much more costly when considered in the long-run as most incremental investments in a short time period become idle or sometimes as not considered together with the superstructure act as barriers to development.

Until 2003 the development of infrastructure was in a haphazard way to answer the daily needs. The routes of most systems got lost, and emerged as a result of damages during constructions. Starting from 2005 a study to determine the networks and enter them in computer has begun. However, still some lines could not be found in spite of all the work that has been carried out. With the construction work that started in 2005 and still continuing the infrastructure of METU-Technopolis is completed to a large extent.

As the infrastructure, the development of the natural environment is also neglected in planning studies. METU Campus that is built in the middle of a steppe, with the artificial forest and natural environment even the appearance of Ankara has changed, a new natural environment has been created. However this environment created disregarding the superstructure in time became barriers for the development of university. This is also valid for some part of the METUTECH area. Besides the fact that METUTECH area has been an area for excavation has been another fact effecting the development of it.

In this part of the study the development of road, infrastructure and environment and their effects on the physical development of METU Technopolis.

4.2.3.a. Effects of Road Network in the Development of Physical Structure of METU Technopolis

Both Twins and Halıcı Software house are designed to be served by the road that connects education faculty and METU village. However in the plan of UD Studio the area that includes these buildings are allocated to research park and a inner service road is proposed for this sub-zone that passes behind these buildings and ends in front of Silver Blocks.

Together with Silver Blocks, with a revision in UD Plan, the route of above mentioned inner road changed and connected to METU's Bilkent road connection. Thus removing the METU village road connections that also served Twins and Halıcı buildings, METUTECH became independent from METU. Actually the arrangement is a temporary solution that will be utilize till the major connection road of technopolis is opened.

In 2003, together with development of SATGEB sub-region, there was a requirement for road and infrastructure. Thus road projects have been prepared depending on revised UD plan. However during implementation as the hill that emerged as a result of excavations widened in time with new excavations, the route of the road had to be reshaped in time of implementation. The development plan has been revised according to this new form of the road (see figure-4.30).

Figure- 4.30: Implementation of a road in METUTECH *(Source: Archive of Teknopark Inc.)*

Besides the route of the main boulevard had been changed by shifting to west as during the development of the site plan of SATGEB sub-region the buildings did not fit the area (see figure-4.26).

It brings a great flexibility in form for the roads not to have been constructed. Within the frame of the studies that started in 2005, by 2007 all the major roads of METUTECH will be completed. So that roads will be elements that limit flexibility.

4.2.3.b. Evolution of infrastructure and effects to the Development Process

In this part infrastructural elements that have affected the development or adversely have been affected by the development will be examined.

High Voltage Electric Line

The High Voltage Electric Line that feeds Bilkent University, Bilkent dwellings and YÖK passes over the land of METU and some part over METUTECH. In the plan of UD Studio, as the removal of the line was not assumed, the line was taken as a threshold and western part of the line was not allocated for development.

Figure- 4.31: High Voltage Electric Line *(Source: Archive of Teknopark Inc.)*

In 2003, the line which had a significant role in the shaping of the geometry of the METUTECH, has been removed as it was near Silicon Block and passing over some buildings within SATGEB sub-region.

Electricity Lines

Until 2003, METU Twins and Halıcı Software house have been served by the electricity lines of METU in the western part of the road leading o METU village. In 2003 a new line that passes in the western part of the inner road has been laid down, and disconnected from METU network and connected to BEDAŞ. METU Twins, Halıcı Software house and Silver Blocks has been connected to this new line and the former lines have remained idle.

Figure- 4.32: Electric Lines *(Source: Archive of Teknopark Inc.)*

Sewage System

Both the main sewage system and the secondary one that comes from METU village passes from METU Technopolis as the waste water treatment plant is within METUTECH area. Some part of the route of the main line has been changed as it remained under the Halıcı Software-house during its construction. As the depth of this line was not as required by Twins and Halıcı Software-house, a new line has been constructed passing between the two lots with regard to the allotment structure in UD plan. The route of the main line has been changed once more during the construction of the Milsoft building connecting to the main line passing parallel to the line serving Twins and Halıcı Software-house.

The line coming from METU Village has been changed during the SATGEB project, as it remained under Aselsan R&D Building.

As Gallium Block was placed onto the pedestrian road disregarding the site plan, the line serving Twins and Halıcı Software-house and the maim line whose route has been changed in construction of Milsoft R&D building both have been remained under the sitting area of this building. For this reason there was again the necessity of changing the routes of the lines. However this was necessary even if the sitting area of Gallium Block has not been changed. Because the buildings in SATGEB-2 area and its northern part and in area where Gallium block sits, the buildings had to be constructed with basements due to geological formation. However the depth of METU's existing system was insufficient to serve these buildings. Thus new projects of both rainwater and sewage system have been prepared in 2006 and they will be put into service by the end of the year.

Figure- 4.33: Sewage System *(Source: Archive of Teknopark Inc.)*

Water System

During the construction of METU Twins and Halıcı Software-house, considering the costs, the buildings have been connected to the nearest line of water system, disregarding the future developments. During the construction of Silver Blocks, the water system has been extended till Silver Blocks through the eastern part of the inner road with regard to UD Studio plan.

However during the construction of the Silicon Block as it was not pre-planned this system has been extended to Silicon Block by making a twist and cutting the asphalt. During the construction of SATGEB a new line has been constructed parallel to the previous one and connected to the main water line of METU. Finally in 2005 a water system project has been prepared for connecting METU Technopolis line to the ASKI line.

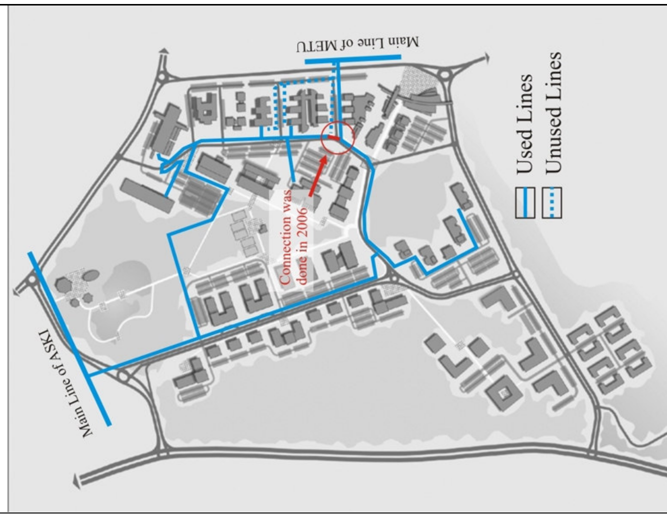


Figure- 4.34: Water System *(Source: Archive of Teknopark Inc.)*

Natural Gas System

The lines of natural gas are one of the most unplanned infrastructure of the METUTECH like water and sewage systems. The connections of METU Twins and Halıcı Software house are incremental solutions, and their places still could not be determined. A new line that passes from the eastern part of the inner service road has been created during the construction of Silver Blocks. However in the infrastructure that was put out to tender in 2003 , a new line has been laid out passing from the western part of the inner road. Silicon Block has been fed not from the line that passes nearby but from the new line.

Figure- 4.35: Natural Gas System *(Source: Archive of Teknopark Inc.)*

4.2.3.c. The effect of environmental factors on the physical development of METU-Technopolis

Excavation Hill

METU-Technopolis area is the former excavation area of METU. Since its foundation all the excavations of the constructions are thrown here. The hill within METU-Technopolis has emerged as a result of this process as an artificial hill, and it has been considered as a potential area for recreation in all the planning studies.

Even fugitive, as a result of the continuing excavations the hill has widened and the road to SATGEB had to be changed accordingly (see figure-4.35, figure-4.30). Besides it has been a threshold in the development of SATGEB, and some part of it has been removed in spite of the extra cost (see figure-4.27).

The hill also determined the alignment of the main road in the plan of UD Studio. However, the real factor that has been effective in shaping the road has been the forest boundary.

Figure- 4.35: Hill *(Source: Archive of Teknopark Inc.)*

Forest Boundary

The forest that has been formed as a result of forestation studies has become an important element of METU. However this work has sometimes gained too much emphasis, even sometimes propose development areas in planning studies that have been neglected and these areas have been afforested and this has become one of the most important barriers ahead of development of METU.

This is also valid for the development of METU Technopolis. The area that has been allocated as service area in the 1994 regulatory plan, and joined to the area of METUTECH in the plan of UD Studio in 1997, continued to be afforested , and in year 2001 declared as forest area. The boundary of the forest has been drawn haphazardly, as it neither follows the property lines nor matches with the forest area. Moreover it passes over some existing buildings. The case on this boundary is still continuing. There are rumors that some academic staff of METU who are against the development of the METUTECH have been affective in drawing this boundary.

In neither METU, nor METU-Technopolis the development takes place by cutting trees. Where development is necessary the trees are carried to somewhere else. The forest boundary has been a barrier, a threshold for the development of the METUTECH. The third stage development area of METUTECH is within this boundary where there exist no trees. The development of this area will be due to the continuing case.

Figure- 4.36: Boundaries of the Forest Zone *(Source: Archive of Teknopark Inc.)*

4.3 Evaluation of Physical Development of METUTECH

The physical structure of METU Technopolis is the outcome of the second period of planning approach developed by METU. Where METU has developed in the first period within a more comprehensive planning approach, especially after the 80'ies the concept of flexibility that appeared on the fore has also effected the development of METU.

Regulatory plan of METU -studies on which started in 80'ies and ended in 1994- is the first study on the physical development of METU Technopolis. Semra Teber in her conceptual studies took this Regulatory Plan as the basis of her work. On the other hand Teber has been effectual in shaping of the Software Park in the plan of Urban Design Studio, which forms the basis of the current plan.

In general we may say that the planning process of METU Technopolis was going simultaneously with the process of implementation in such a way that sometimes plans guide development, sometimes developments guide planning.

The forest boundaries formed as a result of unplanned forestation studies, the hill made up of construction leftovers and the high voltage electric line have been important factors in the formation of the structure and form of METUTECH. Some infrastructure elements that have been constructed without plans just as a solution to day's problems have either been put out of use, or rebuilt. As the construction of the roads was not considered together with infrastructure, each infrastructure construction has also meant the reconstruction of roads. By the year 2007 all the main roads and infrastructure will be built according to the METU-Technopolis development plan. This will bring some limitation to the flexibility of the development process of METU Technopolis, whose physical structure has developed in a much too flexible way.

The balance between unity and variety forms a major area of conflict between architects and planners. Neither the plan prepared by UD Studio nor the current development plan brings conditions that may prevent variety. Actually this has been and is also a handicap for providing unity.

Although the UD plan of 1997 brought coding for guiding the development, it has not been supported by the University Administration and get off being a student project. Even the plan -revised by the research assistants under the consultancy of Baykan Günay in 2003- had brought significant changes, and most coding studies developed in the first study were not used, which were by the year 2003 totally forgotten.

The existing plan of METU-Technopolis is based on this revised form of UD plan. These planning studies that aimed at providing unity in 2 dimensions remained insufficient in developing decisions and coding that would provide for architectural unity.

The plan of METU-Technopolis has been and is still being developed within a frame that is revised due to ever-changing circumstances. The flexible planning approach appears as planner sees flexibility as a weapon to fight with uncertainty. Where results of this approach have sometimes been positive sometimes it also lead to serious problems.

When we evaluate the physical development of METU-Technopolis within this flexibility approach, we may say that unity is provided to a large extent, regarding 2nd dimension and mass relations if we don't count Sem buildings and the area that includes TEKMER. However the lack of a design guideline that will guide development in especially issues such as building materials, architectural image, landscape architecture; has prevented the achievement of a unity in more general terms, and been shaped under the initiative of other actors. This situation sometimes led to unrelated buildings, and developments without the consent of the management company of the METU-Technopolis such as Sabuncu Life Centre, Technology Museum. This even led to a high level administrator who brings car park design solutions.

However it still seems not so much possible for the unity to be achieved. One reason for this is that the built areas are not enough yet to make a structure be read. For this reason there is a need for a comprehensive study which will guide the new developments and take the existing ones as parts of a whole which is named as globally master plan in science park literature. The backbone of this study is made up of guidelines for landscape as an important part of urban design as well as architectural ones. The realization of this is possible only if all the actors in the process and first of all management of METU-Technopolis and University administration are persuaded and support the plan.

CHAPTER 5

CONCLUSION

When criticisms against comprehensive planning approach have intensified, significant shifts occurred both in planning and design theories. As a result of socio-political and economic changes and transformations, importance of ‘flexibility’ concept has increased in planning. Moreover, flexibility as a solution to the crisis of understanding and predicting the complex and indeterminate social processes has become a key concept not only for planning and design but also for the organization of the social production as a whole. Flexible production, flexible planning, flexible control has become core concepts within local and national development policies.

Although flexibility has gradually been accepted as a definite rule in the planning field, there are still serious uncertainties and problems in defining it for concrete problems and carrying it into practice. Moreover, some solutions provided by flexible control may become problems at the same time. This brings us to the point that flexibility is not an undisputable principle but rather it is a contradictory attitude.

The most important part of this Thesis is studying flexibility concept in physical development of science parks, which reflects the general characteristics of the Post-Fordism, where flexible production and flexible use of space should go hand in hand and therefore which house uncertainty as a natural part of it. As technology development and innovation became the basic determinants of competitiveness between nations, regions and firms; science parks have become one of the most important tools for politics of development and spread rapidly all over the world. Appearance of this new spatial unit means also the appearance of new problem areas for planning and design due to their development dynamics. The specific characteristics of science parks require different criteria for physical planning, different control mechanisms and different approaches for the control of spatial development.

In this study, the physical development of METU Technopolis is examined within the context of two concepts, ***Flexibility in Process*** as the subject of planning and ***Flexibility in Form*** as the object of planning. The questions, *what is flexibility?, Why flexibility?, Flexibility for whom?, Flexibility of what?, How much flexibility?,* and finally *How is flexibility applied* make up the axis of examination for the whole of the thesis.

As mentioned in chapter 2, flexibility in process is a two dimensional concept of reciprocal relations. The first one corresponded to conflict- compromise attributes of relations between actors in a planning process. The second one expressed the flexibility of planning approaches and tools utilized by the planner who tries to determine or steer this process. If we use the frames Günay uses in defining planning action, we may say that while the former is within the frame of game theory, the latter is within the frame of choice theory.

We can define the flexibility in form as the capacity of physical space to respond to different needs and functions. Thus we proposed it as a concept related with the object of planning that is designed physical space. Here flexibility is an aim or a principle that will be realized when the production of space is completed.

Therefore, we can handle flexibility in form in three ways. The first one is the flexibility in the control of individual designers who design partial units that make up the urban space-architects. This flexibility is important for providing formal variety in urban space. Consequently, here flexibility will play a role in a tension created between unity and variety. The second one is about the capacity of the space which is produced through plan to respond to different functions and needs. This flexibility is important for the physical space to adopt itself to changing needs and reveals itself as a tension between form and function. As an extension of this the third one is related with the flexibility of the elements that form up the physical space.

As a result, while flexibility in process is about the interrelations between the actors playing role in the production of a space, formal flexibility is about characteristics of the physical elements that belong to the produced space and the design approaches that aim at creating these characteristics. Within this frame, we can say as an abstraction that flexibility in process is a characteristic of urban planning process and the formal flexibility is a property of urban design. We may comment that flexibility in process covers and determines flexibility in form through property relations just as planning process covers and determines urban design process.

When we examine the three main planning approaches: comprehensive planning, incremental planning and structural planning, these three approaches correspond to three different attributes towards flexibility.

Through detailed and comprehensive analysis, Comprehensive Planning, which develops long-term goals and depends on positivist, scientific knowledge, deals with uncertainty by eliminating it. In comprehensive planning approach, it is believed that, predictions, calculations and optimization can be done without any error. Thus there is no need for a flexible attribute in decision-making. In other words, the deterministic approach of comprehensive planning leaves no room for uncertainty and this lets flexibility to be kept in a minimum level.

Incremental planning, which focuses on explicit conditions of existing problems, avoiding from long-term wholist goals, can be defined as non-planning. In this approach the problem of uncertainty is overcome with the compensation of long-term predictions, calculations and policies. Because in a process which operates with immediate interventions to immediate problems, and new situation will signal the beginning of new decision-making process. This means a very flexible decision-making process indeed.

Structure planning can be defined simply as the combination of the deductive method of rationalist-comprehensive planning and the inductive method of incremental planning, while eliminating their negative aspects. Thus, structure planning is an attempt to create a flexible decision making process without loosing long-term goals and directions. The Structure planning controls the structural and the essential elements while leaving the control for others to incremental decisions that will be given in changing circumstances, instead of controlling the whole as a totality as does comprehensive planning. Structure planning appeared as a flexible planning approach to direct the processes of conflict-compromise lived between multiple actors with different demands and goals and to cope with the uncertainties resulting from the dynamic nature of market.

To compose the changing design approaches with new flexible, strategic approaches of planning, urban design emerged as a new concept and field between urban planning and architecture. With this redefinition of the relation between planning and design, urban coding, which would function as an integrating mechanism between planning and design processes gained a new role (Baş, 2003; 124).

Thus, planners attempted to develop urban coding tools in a way that they provide flexibility for individual designers in expressing their design understandings, while maintaining an overall harmony and achieve a unity. In this task, flexibility has appeared as a dilemma between planner and individual designer, and between variety and unity. So, urban codes of the comprehensive planning turned into design codes which are called as design guidelines. The advantage of these guidelines is that they don't prescribe a standard solution and leave flexibility for creativity of individual designers.

As a result, it is possible to consider the problem of flexibility as a dilemma between rigid control and flexible control, between public control and private design, between planners and architects, between deduction and induction, or between homogeneity and diversity on the basis of readjustment of property pattern and the development models.

Uncertainty is an inevitable problem both for the planning approach that is utilized in decision- making and choice processes and in implementation of the planning decisions. Then we may say that we will adopt a flexibility attribute in any planning process in order to cope with uncertainty. How the degree of the flexibility will be determined, how it will be implemented and fore what elements flexibility will be utilized are other areas of problem. In order to cope with these problems, the roots of uncertainty should be determined. This can be done through understanding the nature of the object of planning and analyzing the essential elements and structural relations. Obviously these elements and relations will differ in any planning process due to the dynamics producing the planned space.

In science parks, no matter of which label as they emerged as an outcome of Post-Fordizm, since flexibility is the part of economic and social restructuring; fast changes and uncertainty always occur in the process. Both the planning process and design approach should be responsive to the uncertainties and change embedded in science parks.

In general we see different typologies of science parks under various headings. METU-Technopolis may be labeled as a *university based, planned, generalist and suburban type science park.* These are important characters of METUTECH that will affect the planning and design processes.

METU-Technopolis, until the law no 4691 was enacted, has developed as a unit of METU and guided by the related units. After the law has been enacted, new actors such as Ministry of Industry and Commerce and Teknopark Inc. - the management company- as the primary responsible organization of METUTECH have entered the process. However the President's Office- responsible for the administration of METU- had kept its power of decision-making.

The tools active in the process of physical development are also divided into two as before and after the enactment of law no 4691. The law no 3194, which was not taken into consideration before 4691, makes up the legal frame of physical development in Turkey. After law no 4691 has been enacted it has been made compulsory by the Ministry of Industry to get the development plan prepared on the basis of this law.

The planning and design studies of METUTECH can be seen as design in one property, but designing the physical development is a hard task, since there are to many actors, and every time, there is the probability for changing the needs of actors and the demand to the park.

The physical structure of METU-Technopolis is the outcome of the second period of planning approach developed by METU. Where METU has developed in the first period within a more comprehensive planning approach, especially after the 80'ies the concept of flexibility that appeared on the fore has also effected the development of METU.

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Within the frame developed above, in general we may say that the planning process of METU Technopolis was going simultaneously with the process of implementation in such a way that sometimes plans guide development, sometimes developments guide planning. This brings its own handicaps to the flexibility of the development process of METU Technopolis, whose physical structure has developed in a much too flexible way.

The balance between unity and variety forms a major area of conflict between architects and planners. Neither the plan prepared by UD Studio nor the current development plan brings conditions that may prevent variety. Actually this has been and is also a handicap for providing unity. Although the UD plan of 1997 brought coding for guiding the development, it has not been owned by the University Administration and get off being a student project.

The existing plan of METU-Technoplis is based on the revised form of UD plan. The plan of METU-Technopolis has been and is still being developed within a frame that is revised due to ever-changing circumstances. The flexible planning approach appears as planner sees flexibility as a weapon to fight with uncertainty. Where results of this approach have sometimes been positive sometimes it also lead to serious problems.

When we evaluate the physical development of METU-Technopolis within this flexibility approach, we may say that unity is provided to a large extent, regarding 2nd dimension and mass relations. However the lack of a design guideline that will guide development in especially issues such as building materials, architectural image, landscape architecture; has prevented the achievement of a unity in more general terms, and been shaped under the initiative of all actors in the process.

'İmar planlaması' (development planning) in Turkey with the approach of deterministic understanding of physical planning- determines in detail the form that space will take in a long period of time. This makes the plan conflict with the new situations that occur in the future. Therefore, the contradiction between the static-comprehensive approach of development planning that sees the city as a controllable physical object in a long term and the weak control of the state on production of urban space has been the major deficiency of planning system. So the *inflexibility* of the development planning practice is the mostly emphasized criticism by the authors discussing about urban design and development planning (Baş, 2003;7). However, inflexibility of Turkish planning system does not simply arise from a technical deficiency resulting from the legislation, but from the way legal tools are used by planners.

Besides, it will be insufficient to explain the reason of plans not to be realized as a result of inflexibility if we consider that planning mechanism is not only a legal mechanism but at the same time a political mechanism. On the contrary we may say that planning in Turkey is very 'flexible' if we evaluate the planning process as a whole. According to PhD study of Ünlü (2006), 'plan modifications' have become essential elements of planning system. Most of the plan modifications are made in order to increase building permissions on private properties. The outcome of such a process is an urban space produced by spontaneous dynamics of market rather than planning mechanisms. According to Ünlü the reason why the mechanism of plan modifications is used such effectively by the actors of the market is that the system of development planning is not conceived to form up a *context* on the space rather it is designed specifically to produce development plots 'imar parseli'.

Then we may say that the development planning system which looks comprehensive, wholist and rigid, is indeed incremental and much too flexible. Moreover, this too much flexibility that market actors acquire, make up much too inflexible conditions for planners to shape space.

To sum up, this study shows us that flexibility as a tool to overcome the problem of uncertainty has itself an uncertain, obscure and contradictory character and is much too case-dependent. Moreover, flexibility in the control of the spatial development is not an indisputable solution, but rather it is a dilemma.

One of the main problems of flexible planning approach is controlling or managing the flexibility. The problem is that, strategic planning, the derivative of structure planning, is one of the most accepted planning approach currently. Flexible planning, or controlling the flexibility is the main feature of strategic planning. However, flexibility is such a concept that, most of the times, while developing strategic plans, the planners or the decision makers couldn't realise that they are producing incremental solutions, which distort the structural decisions, therefore, mostly cause new problems. In other words, flexible planning approach turns into a reflexive attitude, which mostly affects the structural elements of a plan or a process. Thus, the strategic planning may turn into an illusion which masks the incremental character of the development process and flexibility plays a primary role in this process.

Suggestions

Therefore, while doing a planning study, in our case planning and designing a science park, there must always be some borders, limiting the flexibility. Long-term, mid-term and short term objectives and goals can be the essential elements of these borders. Sometimes these borders are established by ethical values, sometimes are built by aesthetical or formal values, or sometimes by economical issues. However, in a physical planning process of a science park each actor must have a different border for flexibility and this border must be related with the role of the actor. In this context, the planner should have the larger area, which is defined by the borders of the general structure of the plan, for flexibility. Since the planner is the person who tries to establish the structure of the plan and who tries to optimize the relations between the economical side of a development, the physical side; balance between unity and variety, and form and function, sociologic and psychological sides of a development etc. The boundaries of other actors should be shaped within the borders of the structure, which is established by the planner. Other actors such as architects, engineers, users, property owners, or decision makers should have their own flexibility borders which are restricted within the borders of the general structure. The wider is this space the more chance the individuals have for maximizing their own interests, while this also increases the conflict between private actors.

As seen in the Figure 5.1, there are always some blank areas which shouldn't be dominated by any other actors, which are left for public good, environmental issues etc. But if the decision areas of certain actors dominate the structural frame, the boundary that control the whole, that is the structure of the plan, is distorted into a shapeless, incremental character, which is mostly couldn't be observed by the actors. In other words, on the one hand too little flexibility may create a resistance against the plan and this may result in the collapse of the plan, and on the other hand too much flexibility may result in the problem of loss of unity, therefore planning mechanism to loose its reason for being.

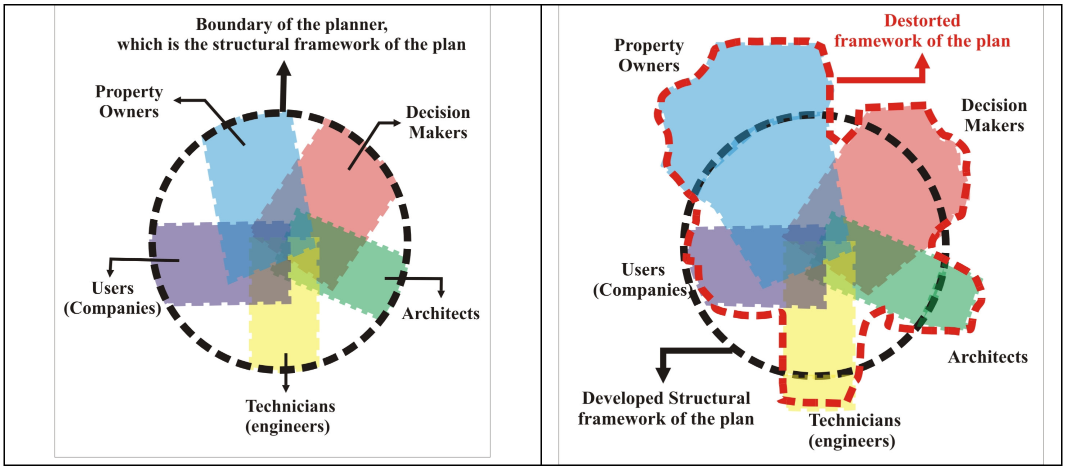

Figure- 5.1: Proposed Scheme which shows the boundaries of the actors

Although the aim of this study is not to evaluate the *planning system in Turkey,* if we make some inferences, we firstly emphasize that, Turkish planning system must be re-structured to enable flexible solutions without distorting the general structure. By proposing new tools, new methods and new mechanism, property owners can be controlled and persuaded for different kind development types rather than small-scale developments. For example, a new type of property can be defined in order to enable the mutual interaction of multi owners on the block scale. In this way, planners can design clusters, streets and common spaces for the users in a block. Also some incentives can be provided for owners which take part in this kind of development. In this new structure, planners and designer will have the chance of producing new physical environment in large scale rather than producing development plots.

Flexible planning and design approach is the most proper approach in guiding the *physical development of a science park*. Since, it contains too many actors and too much uncertainty in its inner structure. In order to overcome such a distortion in the structural decisions, the peculiar dynamics of them, resulting from uncertainty of demand to the park and uncertainty of needs of companies, necessitates reduce the flexibility in process to flexibility in form. Design guidelines, as coding of urban design, can be used as a mechanism to control the flexibility in process by means of interventions in the formal flexibility. Moreover these guidelines can also be used to define the border of flexibility in form.

Considering the *physical development of METUTECH*, since located in the land of METU, the planning and design studies can be seen as design in one property. But designing the physical development of METUTECH is a hard task, since there are too many actors (although one property owner), and every time, there is the probability for changing the needs of actors and the demand to the park. So there must be a flexible planning attitude. For the actual situation, it still seems so much possible that a high quality physical environment to be achieved. For this reason there is a need for the re-preparation of a design guideline, which gives flexibility to the actors, but limits the level of flexibility. This design guideline will guide the new developments and take the existing ones as parts of a whole which is named as globally master plan in science park literature. The backbone of this study is made up of guidelines for landscape as an important part of urban design as well as architectural ones. However, the realization of this is possible only if all the actors in the process and first of all management of METU-Technopolis and University administration are persuaded and they support and defend the plan.

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