



**BASIC ASPECTS OF ADVANCED  
CONSTRUCTION PROJECT'S  
ORGANIZATION AND MANAGEMENT**

**Fantina Rangelova**



**“This is a major project of utmost importance, but it has no budget, no guidelines, no support staff, and it’s due in 15 minutes. At last, here’s your chance to really impress everyone!”**

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The construction industry has an important place in the Bulgarian economy. Bulgaria has recently developed environmental, sustainable and bio-climatic construction. After the joining of Bulgaria in the European Union in 2007, the country is targeting European funds under the PAHARE, SAPARD and ISPA. During the period 2004 - 2006, the EU increases financial assistance to Bulgaria by 30%. The country receives about 400 million per year, equivalent to 2% of the GDP.

During the period 2004-2009 the sector is evolving rapidly and covers both construction activity - housing, hotels, resorts, offices, road construction, etc., and industries directly associated with the construction and supply of building materials and products, including products indirectly related to the industry. The share of the construction sector in Bulgarian by GDP in the years 2008-2009 is 8%.

Construction project organization and management is a relatively young field, but its impact is quite remarkable. It has become an important practice for improving the efficiency of construction industry around the world.

The Basic aspects of Advanced Construction Project's Organization and Management is addressed to students, studied in English language at the Faculty of Structural Engineering, Faculty of Architecture, Faculty of Transportation, Hydrotechnical Faculty and Faculty of Geodesy of the University of Architecture, Civil Engineering and Geodesy (UACEG), Sofia. It can also be used as study materials for the undergraduate engineering courses and as a reference for project and financial management in construction courses. Besides, project consultants and professional engineers undertaking economic decision analysis would find the textbook useful. This textbook could be used in the preparation of project feasibility and socioeconomic impact analyses.

In the composition of this book on the basis of the generally accepted World theory and practice are used and applied the personal scientific and practical experience and publications of the recognized professionals in the national and international global level, and the experience in the construction industry of various countries around the World, which are represented on the book's body and in the references of this book.

The Basic aspects of Advanced Construction Project's Organization and Management deal with some topics and tools of the large field of project management. This book provides the reader with the main knowledge to organize and manage a construction project from preliminary stages to handover. It includes eleven chapters:

Chapter 1 provides a general introduction to the construction industry and the need of construction project's organization and management; construction project; project goals and scope; major types of construction projects; construction projects participants.

Chapter 2 is dedicated for the contract strategy as presents the contract, the contract type selection, project delivery methods, project delivery methods, types of contracts, contract administration, selecting the contractor, sub-contracting and FIDIC

The organization of construction objects' feasibility study and design are presented in Chapter 3. In this chapter are presented the concept and feasibility study, design assignment, design, compliance valuation, approval and design verification, construction permit, commencement and execution of construction works, completion, permitting the use of completed works and warranty periods, construction project organization and management design, standard project documentation.

Chapter 4 is dedicated for presenting project planning and scheduling. Here is discussed the issues of project planning, project planning steps. project scheduling, network fundamentals, dependencies, slack time, network re-planning, estimating activity time, estimating total program time, total PERT/CPM planning, alternative pert/cpm models, precedence networks, lag, project graphic, Gantt (bar) chart, scheduling of repetitive projects, project management software.

Chapter 5 is dedicated to discuss the resources management. Here is discussed the issues of resource definition, resource management, resource allocation, resource aggregation (loading), resource leveling (smoothing), scheduling with limited resource, resources' consumption norms.

The project control is presented in Chapter 6. Here is discussed the issues of understanding control, problems that may arise during construction, schedule updating, delays analysis, cost control, earned value management.

Chapter 7 is dealing with construction site & safe and healthy management. Here is discussed the matters of construction site layout facilities, provision of site layout facilities, site layout, construction facilities and construction planning relationship, effective project solutions, characteristics of the temporary facilities, design of the construction site layout, design and managing health and safety plan in construction.

The organizational structures are presented in Chapter 8. The Chapter discussed the matters of modern theories of organization, design organization, principles of organization structures, organization structures, line organizational structure, functional authority organizational structure, line and staff organizational structure, committee organizational structure, divisional organizational structure, project organizational structure, matrix organizational structure, hybrid organizational structure, the informal organization.

Chapter 9 is dedicated for the quality management. The Chapter is discussed the issues of quality management concepts, the seven quality control tools, international organization for standardization (ISO) ISO 9000, construction quality management, construction quality management (CQM) program.

The Chapter 10 is dedicated for trends and public procurement in construction. Here is presented the issues of Bulgarian public procurement (BPP), public procurement award.

Chapter 11 is dealing with building information model (BIM) and project management. The Chapter discussed the matters of building information model, what it is?, BIM design, BIM model, BIM and construction management, design visualization, design assistance and constructability review, site planning and utilization, 4d scheduling and sequencing, 5d cost estimating, the subcontractor and supplier data integration, systems coordination, layout and site-work prefabrication, operations and maintenance, implementing BIM, BIM implications for the future.

Finally are presented glossary and references.





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## CHAPTER 1: INTRODUCTION

### THE CONSTRUCTION INDUSTRY AND THE NEED OF CONSTRUCTION PROJECT'S ORGANIZATION AND MANAGEMENT

#### *Construction Industry*

*Construction industry* is a major factor in the social and political integration of the society and ranks as one of the major budgetary areas of economies. The construction industry is proven to be the corner stone and bedrock of rapid economic growth of any nation. The products of construction industry are desired mainly for the services which they help to create as most business, social, religious, economic, industrial activities etc operate on building infrastructure. The construction industry is likely to remain a major area of development activity as the need for the provision and replacement of infrastructure become more important in the years ahead. The building and infrastructure development sector of the construction industry is a catalyst, a rock, and the strongest base for rapid economic growth, it therefore becomes very imperative that building and infrastructure projects are project managed efficiently to succeed. The success of a building and infrastructure project is very important in a developing economy if critically is analyzed the quantum of resources wasted and its negative impact to the Gross Domestic Product (GDP) of the nation's economy. For the fact that building and infrastructure development process employs both professionals and non-professionals from all the fields of life, is an indication that this sector has a geometric progression financial impact on the economy. This means that success will reflect the sector as an engine of growth but failure, abandonment and collapse a catastrophe to nation building and infrastructure economically.

#### *Construction industry developments in last decade in European economies*

Given the deterioration in macro trends in the second half of 2012 growth forecasts for the construction industry became more bearish given its cyclicity and dependency on GDP trends. The European construction confidence indicator (see graph below) has shown a deceleration towards the end of 2012, with a slight uptick in January 2013. Nevertheless, the severe and extraordinarily long winter season 2012/2013 puts even more pressure on the industry which faces a very difficult start into this year. In the second and third quarter of 2013 we will probably see catch-up effects on construction work which was postponed due to weather conditions. It is to be expected that only a small part of construction works will face longer delays or cancellations.

Individual countries show a wide variation in growth trends. On the one hand, Germany, Austria and Switzerland are considered as safe havens, with very stable trends over the last years. Switzerland has even issued restricting regulations to prevent an overheating of residential housing markets. In Germany, residential renovation works contributed substantially to the overall sector performance in the

last years. For 2013, a revival in new residential housing activity is expected. On the other hand, construction industry in countries like Bulgaria, Hungary, Spain or Ireland has been in recession for years. A return to positive growth rates is not being expected for the next future. Major sports events as well as available EU funding were a substantial driver for construction (especially infrastructure) in the last years. Poland and Ukraine benefited from the UEFA EURO 2012, and Russia has seen huge construction projects related to Sochi Olympic Games 2014. However, most of the projects have been completed and as for now, the outlook for infrastructure construction in 2013 remains subdued.

Prospects for the US construction market are more positive. Residential housing which is considered as leading indicator for the overall construction industry has shown improving trends over the last months (albeit from very low base levels). The improvement is helped by positive GDP growth rates and increasing new borrowings. Nevertheless, the situation for civil engineering and infrastructure remains very difficult due to the constraints in federal and state budgets.

**European construction confidence indicator**



Source: Bloomberg, Raiffeisen RESEARCH

#### *AUSTRIA: CONSTRUCTION SECTOR IS TEMPORARILY SLOWING DOWN*

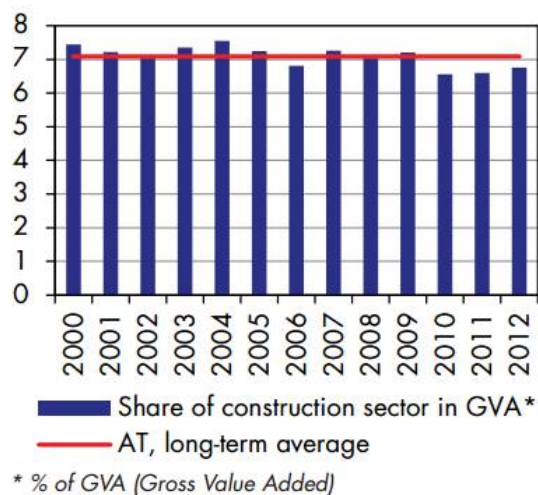
The economic development in Austria slowed down considerably in 2012. While in 2011 real GDP grew by 2.7%, growth amounted to merely 0.8% last year. The slowdown was especially pronounced with respect to goods exports and gross fixed capital formation. The latter was particularly affected by a marked slowdown of equipment investment. Even though the next few months are not expected to be a boom period for the Austrian economy and more significant acceleration is only expected for the second half of 2013, it is quite likely that the decline in real GDP in the last quarter of 2012 (-0.1% qoq) was the low point. Private consumption is only expected to pick up more strongly during the second half of 2013. In the industrial sector, sentiment has clearly improved in recent months, but confidence has still not yet returned to the long-term average level. Following subdued developments at the beginning of this year, we expect investment activity to pick up in the second half of

the year, which also applies to exports. For 2013 as a whole, we expect GDP growth of 0.5% in real terms, followed by 1.5% next year.

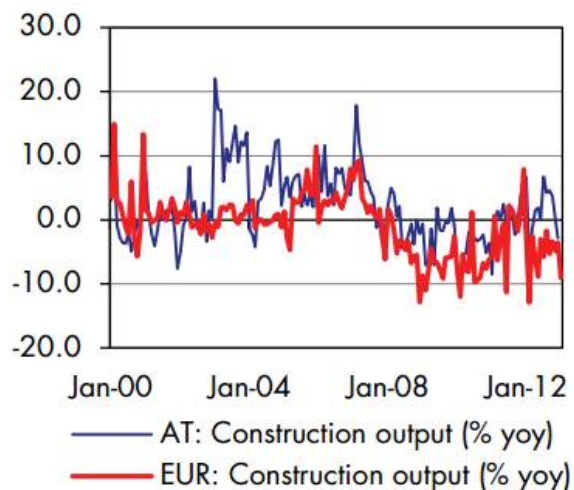
Growth of overall construction output – reflecting the economic environment – declined to 1.5% in 2012 after 4.4% in 2011, thereby still outperforming other sectors. While construction is expected to post a similar growth rate in 2013 as in 2012, 2014 should see more pronounced construction sector growth.

Residential construction growth accelerated in 2012 (4.0%, 2011: 1.4%), supported by private non-subsidized construction amid increasing residential real estate prices especially in Vienna, thereby outweighing cuts in subsidies owed to the need for budget consolidation. Non-residential construction (building construction, civil engineering), on the other hand, performed rather poorly (2012: -0.1%), especially given the strong increase in 2011 (6.5%). Construction confidence in Austria is on an above average level, which contrasts with most other Euro-zone countries. The same holds true for the assessment of the current order book by construction firms.

Share of construction sector in GVA\*



Construction output: AT vs. EUR

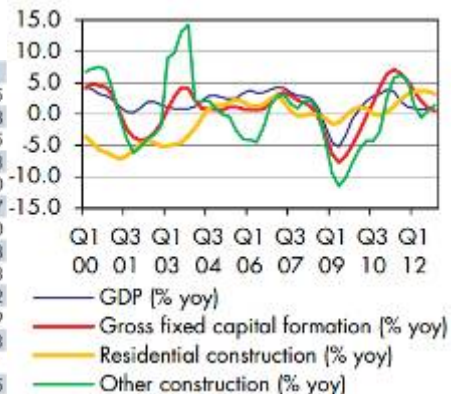


Source: National sources, Eurostat, Raiffeisen RESEARCH

### Forecasts Germany

	2010	2011	2012e	2013f	2014f
Nominal GDP [EUR bn]	286.4	300.7	309.9	318.3	329.5
Nominal GDP per capita [EUR]	34,144	35,710	36,675	37,518	38,678
Real GDP [% yoy]	2.1	2.7	0.8	0.5	1.5
Gross fixed capital formation [% yoy]	0.8	7.3	1.3	0.9	3.3
Industrial output [% yoy]	6.7	6.7	1.8	1.0	3.0
Construction output (real, % yoy)	-2.7	4.4	1.5	1.3	2.7
Consumer prices (avg, % yoy)	1.7	3.6	2.6	1.9	2.0
Unemployment rate (%)	4.4	4.2	4.4	5.0	4.8
General budget balance (% of GDP)	-4.5	-2.5	-2.5	-2.6	-1.8
Public debt (% of GDP)	72.0	72.5	73.4	75.6	75.2
Current account balance (% of GDP)	3.4	1.4	1.8	1.0	0.9
EUR/USD (avg)	1.33	1.39	1.29	1.34	1.33
Population (eap, in mn)	8.4	8.4	8.5	8.5	8.5

### AT: Construction investment, real



Source: Thomson Reuters, Raiffeisen RESEARCH

## GERMANY: NEW RESIDENTIAL CONSTRUCTION STILL GROWING

Germany entered a period of strong economic growth after the crisis. This development has now slowed down significantly. Nevertheless, the economic activity remains at a sound level. The situation for households and companies remains supportive.

Residential construction has benefitted from a revival of building activity starting in 2010. The circumstances are very favorable: low mortgage rates, lack of tightening of credit standards for home loans, as well as a declining number of vacant housing units. Besides, an increasing number of households, price increases in residential real estate, low unemployment and rising inflation fears serve as additional drivers for new residential construction. The increase in building permits which was observed in the years 2010 and 2011 slowed down slightly in 2012. Nevertheless, there is ongoing demand especially for multi-family dwellings. The majority of construction measures within residential housing are on existing buildings. Renovation activities have reached an elevated level, therefore further growth rates will slow down.

Non-residential construction showed a pick-up in demand starting from 2011. Financing conditions remain favorable. Construction activity in industrial buildings should continue to grow also in the next years, albeit at a slower pace. Permits for new projects remained at an elevated level and serve as a good leading indicator for future investments. However, buildings for education and health are expected to face declining demand which is mainly caused by budgetary problems of public bodies.

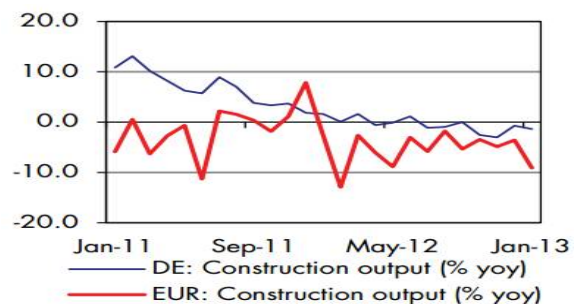
In recent years, civil engineering enjoyed a strong tailwind from economic stimulus packages. The majority of those programs already ran out. The difficult budgetary situation of many municipalities will dampen further growth prospects for infrastructure construction. Within the transport sector, the main focus will lie on maintenance works of existing networks (in roads as well as in rail). Due to the shift in German energy policy away from coal-fired and nuclear power plants, huge investments in the power grid as well as alternative plants are urgently needed, although a substantial lead time for planning and authorization of those projects will be required.

**Share of construction sector in GVA\***



\* % of GVA (Gross Value Added)

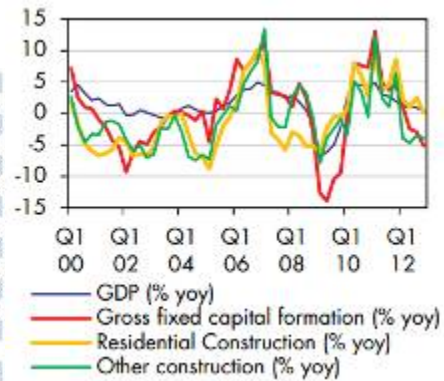
**Construction output: DE vs. EUR**



## Forecasts Germany

	2010	2011	2012e	2013f	2014f
Nominal GDP (EUR bn)	2,496.2	2,592.6	2,643.9	2,697.8	2,792.9
Nominal GDP per capita (EUR)	30,500	31,700	32,300	32,900	34,100
Real GDP (% yoy)	4.0	3.1	0.9	0.5	1.8
Gross fixed capital formation (% yoy)	5.8	6.4	-2.0	0.6	3.0
Industrial output (% yoy)	11.6	8.1	-0.5	-0.1	3.4
Construction output (real, % yoy)	-2.1	17.4	-2.4	3.0	3.5
Consumer prices (avg, % yoy)	1.2	2.5	2.1	1.5	1.5
Unemployment rate (%)	7.1	5.9	5.5	5.7	5.6
General budget balance (% of GDP)	-4.1	-0.8	0.1	-0.5	0.0
Public debt (% of GDP)	82.5	80.5	81.7	81.0	78.7
Current account balance (% of GDP)	6.0	5.7	5.8	5.5	5.5
EUR/USD (avg)	1.33	1.39	1.29	1.34	1.33
Population (eop, in mn)	81.8	81.8	81.9	82.0	82.0

## DE: Construction investment, real



Source: Thomson Reuters, Raiffeisen RESEARCH

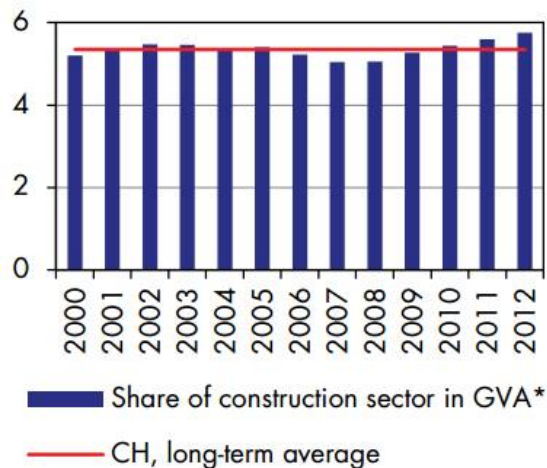
## SWITZERLAND: STAGNATION OF RESIDENTIAL CONSTRUCTION IN 2014

The Swiss construction market is barely influenced by the turbulences in various other European countries. Low unemployment, population growth helped by immigration and a stable domestic economy are positive drivers for the construction industry.

Residential construction has been growing strongly over the past years, helped by low interest rates. Real estate prices have risen correspondingly. Recently, Swiss banks agreed on a self-regulating contract which tightens mortgage approval criteria. The target is to prevent an overheating of the residential market and to prohibit the creation of an investment bubble. Besides, granting of building permits for vacation homes has become much stricter since the beginning of 2013. This has led to an increased number of applications in 2012. Both factors will have dampening effects on residential construction from 2014 onwards. For 2013 positive growth rates in residential construction are expected as full order books provide visibility for the coming months.

Within non-residential construction subsidies in favor of improving the energy efficiency of buildings are in place and create a higher activity level. Besides, the strong immigration wave of recent years led to an increased demand for education buildings (schools, infant care etc.). Also, construction activities into higher education and health care have expanded rapidly and will continue to grow in the next years. In the longer term, an increased interest in sports facilities might be created through the 2017 ski world championships in St. Moritz and a possible application for the Olympic Winter Games in 2022. The outlook for civil engineering is positive and indicates increasing investments for the next years. Due to already very high capacity utilization rates of the Swiss roads and rail infrastructure different government agencies have announced large construction projects to enhance the existing networks. After the incidents at Fukushima the Swiss government has declared intentions to withdraw from nuclear energy. The implementation of those plans would require huge investments in alternative power plants as well as the transmission and distribution grid.

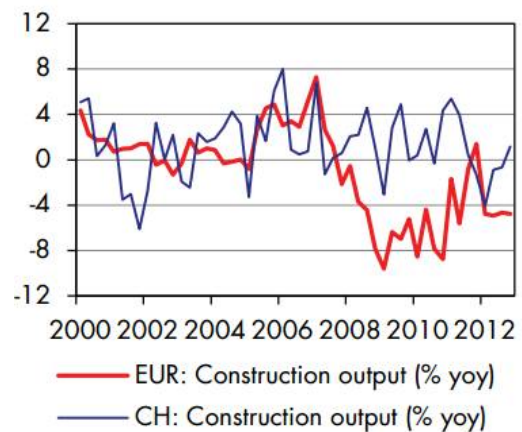
### Share of construction sector in GVA\*



\*% of GVA (Gross Value Added)

Source: State Secretary for Economic Affairs, Thomson Reuters, Raiffeisen RESEARCH

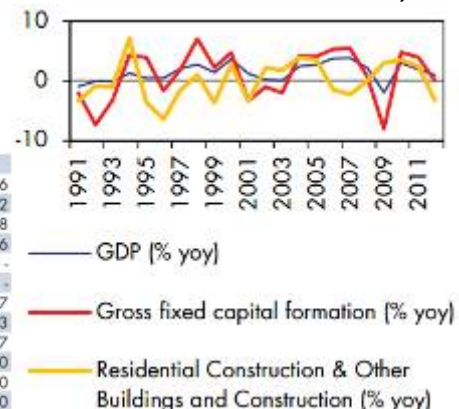
### Construction output: CH vs. EUR



### Forecasts Switzerland

	2010	2011	2012e	2013f	2014f
Real GDP (% yoy)	3.0	1.9	1.0	1.0	1.6
Nominal GDP (EUR bn)	434.8	480.7	482.1	487.9	499.2
Nominal GDP per capita (EUR)	55,245.2	60,432.2	60,244.0	60,606.9	61,459.8
Gross fixed capital formation (real, % yoy)*	4.8	4.0	0.1	2.1	3.6
Industrial output (% yoy)	6.5	1.5	2.4	-	-
Construction output (real, % yoy)*	6.9	3.0	3.0	-	-
Consumer prices (avg, % yoy)	0.7	0.2	-0.7	0.1	0.7
Unemployment rate (avg, %)	3.5	2.8	2.9	3.1	3.3
General budget balance (% of GDP)	0.3	0.5	0.7	0.5	0.7
Public debt (% of GDP)	40.6	40.2	39.5	39.0	39.0
Current account balance (% of GDP)	14.3	8.4	13.0	12.0	13.0
EUR/CHF (avg)	1.38	1.23	1.21	1.24	1.30

### CH: Construction investment, real



Source: National sources, Raiffeisen RESEARCH

### POLAND: INFRASTRUCTURE BOOM FADES

Poland has undergone a considerable infrastructure boom with hundreds of kilometers of highways, expressways and ring-roads constructed in the recent years. Poland had seen the construction output increasing by over 12% yoy in 2011 and by more than 10% yoy in the first 5 months of 2012, yet the expiration of the EU funding has substantially dragged down the output dynamics, which have actually turned negative in mid-2012.

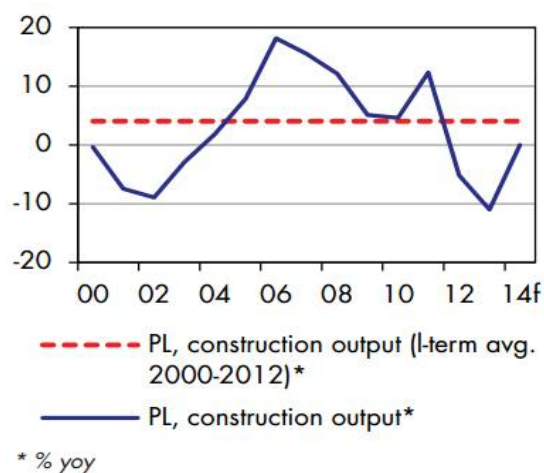
There's expected the trend to continue until 2014, with the construction output falling by over 10% yoy in 2013. First signs of rebound should occur not earlier than in the second half of 2014 when the new EU budget (2014-2020) as well as power engineering projects materialize. Obviously, an improving macro environment is likely to cause an acceleration of residential as well as private non-residential investments.

For the next two years, the prospects of power engineering, industrial engineering and railway construction will be the most promising as they are either financed with

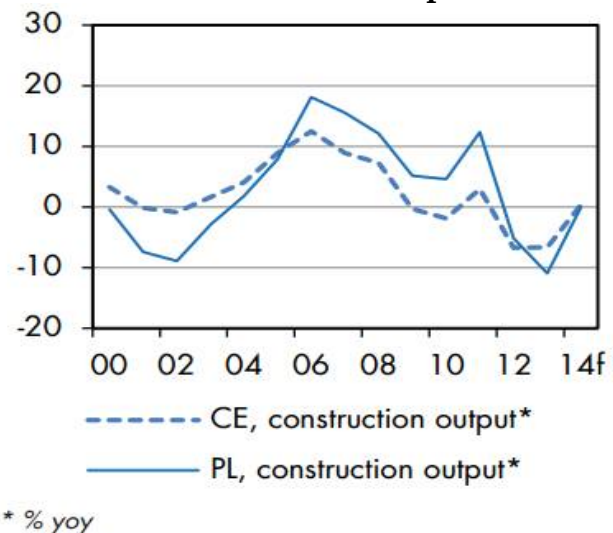
private money (power engineering) or with EU funds which so far have been underutilized and have to be spent until the end of 2015 (railway construction).

There's not expected the residential construction to rebound any time soon following the weakening of the Polish consumer (still increasing unemployment, falling real wages), expiration of the government subsidies (a new program should be launched in 2014, though) and oversupply of condominiums observed in the larger cities of Poland. There's not seen much potential for the roads construction to materialize before the new EU money commences flowing into Poland. Hence, 2014 can be seen as a year of tenders and 2015 as a year of actual construction kicking off.

### Construction output: PL



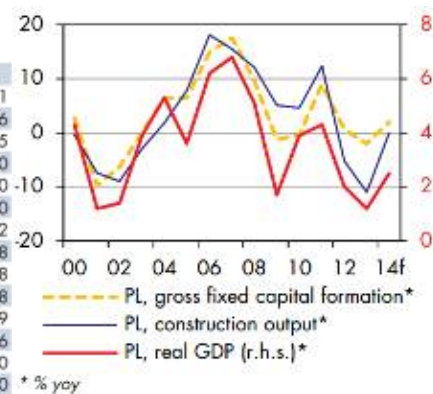
### Construction output: PL vs. CE



Source: National sources, Raiffeisen RESEARCH

### Forecasts Poland real

	2010	2011	2012	2013e	2014f
Nominal GDP (EUR bn)	354.7	369.3	381.7	401.8	431.1
Nominal GDP per capita (EUR)	9,206.4	9,582.3	9,903.9	10,429.2	11,202.6
Real GDP (% yoy)	3.9	4.3	2.0	1.2	2.5
Gross fixed capital formation (real, % yoy)	-0.4	9.0	0.6	-2.0	2.0
Industrial output (% yoy)	9.0	7.7	1.4	0.5	3.0
Construction output (% yoy)	4.6	12.3	-5.2	-11.0	0.0
Consumer prices (avg, % yoy)	2.6	4.3	3.7	1.6	2.2
Unemployment rate (avg, %)	12.1	12.4	12.8	14.0	12.8
General budget balance (% of GDP)	-7.9	-5.0	-3.5	-3.4	-2.8
Public debt (% of GDP)	54.8	56.4	56.1	56.1	53.8
Current account balance (% of GDP)	-5.1	-4.9	-3.5	-3.0	-3.9
Gross foreign debt (% of GDP)	66.9	67.2	71.3	70.9	69.6
EUR/LCY (avg)	4.0	4.1	4.2	4.1	4.0
USD/LCY (avg)	3.0	3.0	3.3	3.1	3.0



Source: National sources, Raiffeisen RESEARCH

### HUNGARY: NO TURNAROUND IN SIGHT YET

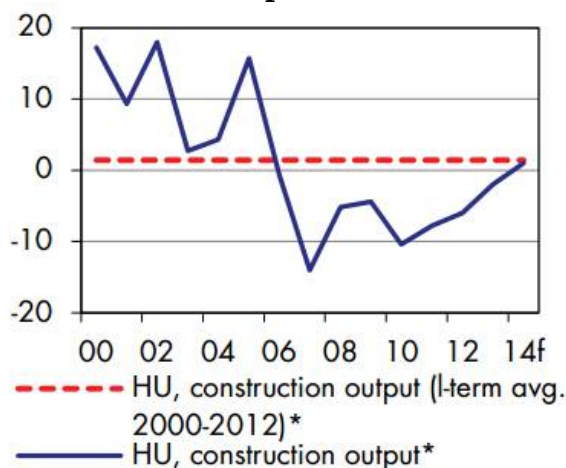
In 2012 Hungary experienced the seventh lean year. The economy was dragged down by the anemic domestic demand which was countered somewhat by net exports. There's expected the economy to show moderate signs of revival in the second half of 2013, but even then growth will remain weak as the domestic

purchasing power is dampened by heavy deleveraging, tight fiscal policy and high unemployment.

Construction in Hungary has been in deep recession for seven consecutive years. Indeed, its weight in the economy has declined by one third over the past decade as output has contracted by an average of 7% yoy since 2007. In 2012 it shrank by 6.0% yoy: while construction of buildings was down by 12.5%, civil engineering was down by “only” 1.2%. As there’s not seen economic growth in 2013, construction of buildings is not expected to reach the end of contraction. Even though civil engineering is expected to rebound due to the campaign season and upcoming elections, the weight of that is small, thus we project another 2% setback in the overall construction sector in 2013.

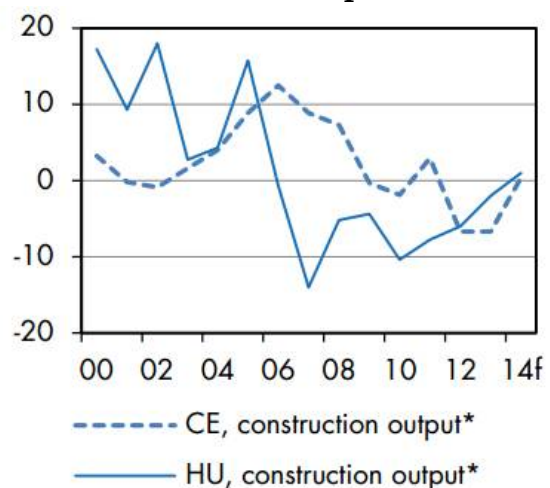
Residential housing dropped to a post-WWII low as the number of dwellings built was one quarter of 2007 volumes. The staggering drop in investment is due to pessimism towards the economic outlook: household purchasing power is far from recovering to pre-crisis levels; financing conditions are tight, while the predictability of economic policies is perceived to be worsening. The demand side is very weak: in the first three quarters of 2012 only 1,800 new homes were involved in transactions. Although last year the government launched a mortgage subsidy program, we have yet to see any stimulating effect. According to central bank data the mortgage outflow has not accelerated yet. There’s expected more weakness ahead in residential housing: we don’t expect material growth before 2015. In the office buildings market the drivers of occupier activity are renewals and renegotiations, not new rentals. The stock of vacant offices is very high, more than 25% in most regions. It is no surprise that the pipeline of new projects is virtually empty. Although some surveys indicate that market players think the bottom is near, yet the decisive majority doesn’t see any improvement.

**Construction output: HU**



\* % yoy

**Construction output: HU vs. CE**



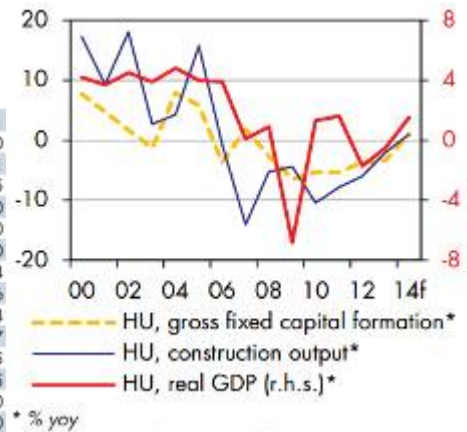
\* % yoy

Source: National sources, Raiffeisen RESEARCH

## Forecasts Hungary

	2010	2011	2012	2013 <sup>a</sup>	2014 <sup>f</sup>
Nominal GDP (EUR bn)	97.2	101.3	96.9	98.2	104.0
Nominal GDP per capita (EUR)	9,710.3	10,140.1	9,728.9	9,889.2	10,505.1
Real GDP [% yoy]	1.3	1.6	-1.7	-0.5	1.5
Gross fixed capital formation (real, % yoy)	-5.3	-5.3	-3.7	-3.3	1.0
Industrial output [% yoy]	10.6	5.4	-1.7	1.0	4.0
Construction output (real, % yoy)	-10.4	-7.8	-6.0	-2.0	1.0
Consumer prices (avg, % yoy)	4.9	3.9	5.7	2.8	3.4
Unemployment rate (avg, %)	11.1	11.0	10.9	11.0	10.6
General budget balance (% of GDP)	-4.2	4.3	-2.0	-3.0	-3.4
Public debt (% of GDP)	81.4	80.6	79.2	78.9	78.7
Current account balance (% of GDP)	1.0	0.8	1.6	1.8	1.5
Gross foreign debt (% of GDP)	142.2	132.5	126.9	123.2	112.5
EUR/LCY (avg)	275.5	279.3	289.2	297.5	290.0
USD/LCY (avg)	207.7	200.7	225.0	222.0	218.0

## HU: Construction investment, real



Source: National sources, Raiffeisen RESEARCH

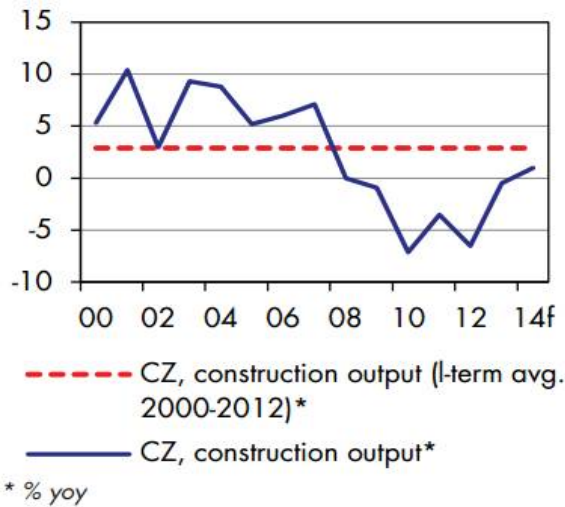
## CZECH REPUBLIC: BOTTOM SHOULD BE REACHED THIS YEAR

The Czech economy has been in a recession for one year. The fundamental cause of this recession is a decline of external demand in the Euro zone due to the debt crisis. However, this decline of external demand is amplified by pro-cyclical austerity measures of the Czech government that mainly reduce household consumption. We believe that the Czech economy should leave the recession in Q2 2013 partly due to cyclical reasons and partly because of expected recovery in the Euro zone.

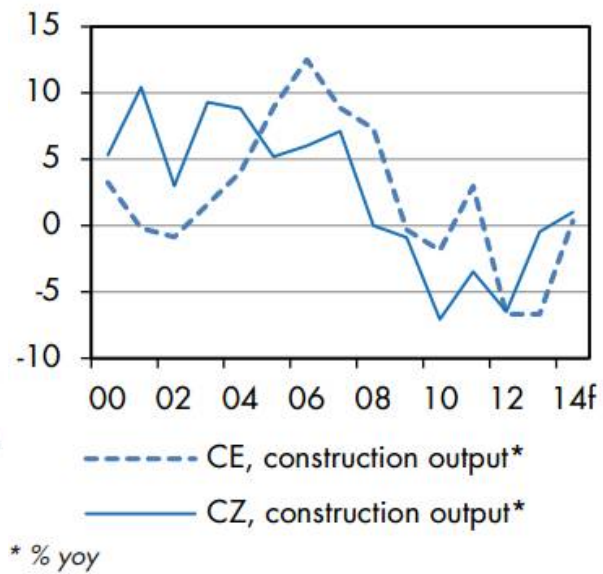
The share of construction in Czech gross value added is roughly 6% (source: Czech Statistical Office). The Czech construction sector is in a deep depression. The year 2012 was the fourth consecutive year of negative growth in construction. Construction output is now roughly 18% lower than in 2008. The downturn in the Czech construction sector is even deeper than in neighboring countries (except for Slovakia). This development is caused by cyclical reasons (construction has very long cycles) and by austerity measures of the Czech government that reduce infrastructure investment and the demand of households.

The decomposition of the construction output reveals that the fall of civil engineering continued in 2012. This sector recorded a decline of roughly 10% yoy in the last couple of years. A significant recovery of this sector can be expected when austerity measures are softened (it should be in 2014) and when problems with EU funds are resolved. The building sector recorded a drop by 6.5% in 2012, even deeper than in the year 2011. However, given the expected recovery of the Czech economy in the second half of 2013 as well as cyclical reasons (unprecedented long depression of the construction sector) we believe that construction output should reach its bottom in Q2 2013 and then gradually recover. The recovery should be supported by mildly expansive fiscal policy in 2014. Therefore, we forecast a decline of the construction sector by 0.5% in 2013, followed by an expansion of 1.0% in 2014.

### Construction output: CZ



### Construction output: CZ vs. CE

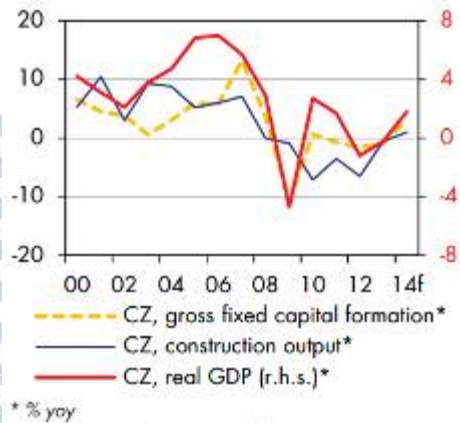


Source: National sources, Raiffeisen RESEARCH

### Forecasts Czech Republic real

	2010	2011	2012	2013e	2014f
Nominal GDP (EUR bn)	150.4	156.3	153.1	153.9	163.6
Nominal GDP per capita (EUR)	14,302.0	14,890.0	14,558.8	14,618.2	15,507.1
Real GDP (% yoy)	2.7	1.7	-1.2	-0.2	1.8
Gross fixed capital formation (real, % yoy)	0.6	-0.7	-1.6	-0.9	3.2
Industrial output (% yoy)	10.1	6.9	-1.2	-0.1	3.2
Construction output (real, % yoy)	-7.1	-3.5	-6.5	-0.5	1.0
Consumer prices (avg, % yoy)	1.5	1.9	3.3	1.9	2.0
Unemployment rate (avg, %)	7.0	6.7	6.8	7.4	7.5
General budget balance (% of GDP)	-4.8	-3.1	-4.9	-3.0	-2.6
Public debt (% of GDP)	37.8	40.8	45.8	47.9	48.9
Current account balance (% of GDP)	-3.9	-2.8	-2.4	-2.1	-2.0
Gross foreign debt (% of GDP)	47.5	48.8	49.6	50.2	49.9
EUR/LCY (avg)	25.3	24.6	25.1	25.3	24.5
USD/LCY (avg)	19.1	17.7	19.5	18.9	18.4

### CZ: Construction investment,



Source: National sources, Raiffeisen RESEARCH

### SLOVAKIA: CONSTRUCTION STILL LOOKING FOR THE BOTTOM

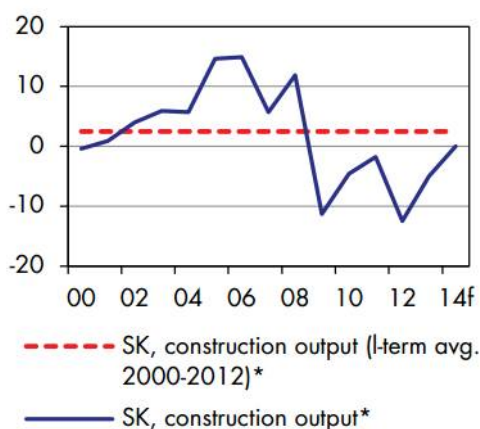
Solid growth over the last two years was generated mainly by the automotive industry.

The upcoming slowdown in the Slovak economy stems from still sluggish domestic demand (both household consumption and capital formation are in red territory) and decelerating foreign demand dampened by the debt crisis in the Eurozone. As Slovakia will no longer benefit from extraordinary automotive production increases, GDP headline figures will be more in-line with German GDP growth rates in the course of 2013. On average, we expect a slowdown of economic growth to +0.9% yoy. The residential housing market went through very rough times in the period 2009-2012. The number of finished flats dropped by 22 % and the number of started flats has decreased even more significantly. Accordingly, annual residential construction production fell down by 40 % from 2008 till 2012. However, we see better prospects stemming from underwent residential real estate market

consolidation and increased housing affordability recently. Hence, we expect production of this part of construction activity to be at least stable.

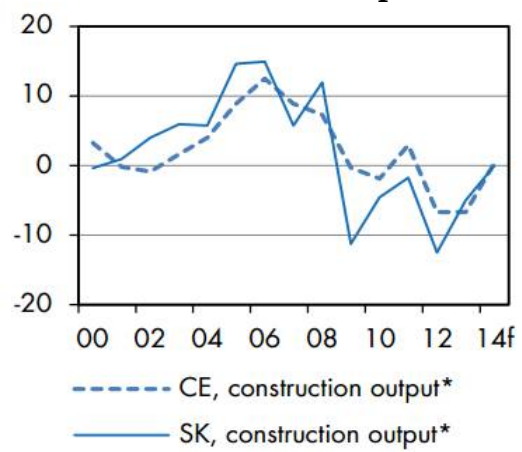
Non-residential construction creates roughly 50 % of whole construction output. After the first slump in 2009 this construction activity was quite stable. Nonresidential construction is very sensitive to economic growth which is not very favorable and will not support expansion in this part of the construction industry. Besides, funding of new possible projects will hardly find support in banking sector. Willingness to increase exposure to the construction sector is limited by already quite high portion built up in pre-crisis years. According to CBRE (one of the leading real estate companies in Slovakia), solid years will not continue as investors probably omit this part of the construction sector. Civil engineering was the steadiest part of the construction industry until 2012. However, due to unfinished project documentations and delayed construction of new highways civil engineering production decreased by 25 % in last year. There are eleven new projects in the pipeline, which should be launched in the course of this year, providing a glimmer of hope.

### Construction output: SK



CE \* % yoy

### Construction output: SK vs. CE



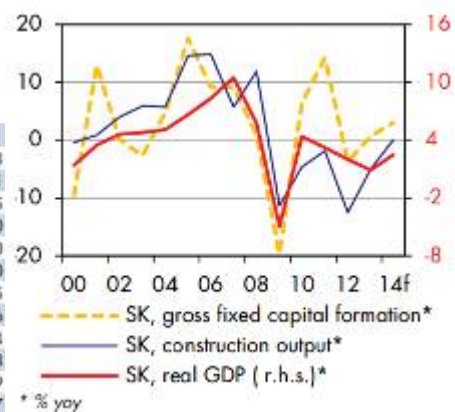
\* % yoy

Source: National sources, Raiffeisen RESEARCH

### Forecasts Slovakia

	2010	2011	2012	2013e	2014f
Nominal GDP (EUR bn)	65.9	69.1	71.5	73.2	76.3
Nominal GDP per capita (EUR)	12,151.4	12,721.0	13,131.4	13,423.3	13,978.1
Real GDP (% yoy)	4.4	3.2	2.0	0.9	2.5
Gross fixed capital formation (real, % yoy)	6.5	14.2	-3.7	0.7	3.0
Industrial output (% yoy)	18.9	7.3	8.1	1.4	3.0
Construction output (real, % yoy)	-4.6	-1.8	-12.5	-5.0	0.0
Consumer prices (avg, % yoy)	1.0	3.9	3.6	2.2	2.5
Unemployment rate (avg, %)	14.4	13.4	13.9	14.2	13.6
General budget balance (% of GDP)	-7.7	-4.9	-4.7	-2.9	-2.4
Public debt (% of GDP)	41.0	43.3	52.2	54.9	55.8
Current account balance (% of GDP)	-3.7	-2.0	2.2	2.9	2.9
Gross foreign debt (% of GDP)	74.5	76.3	71.2	69.9	74.7

### SK: Construction investment, real



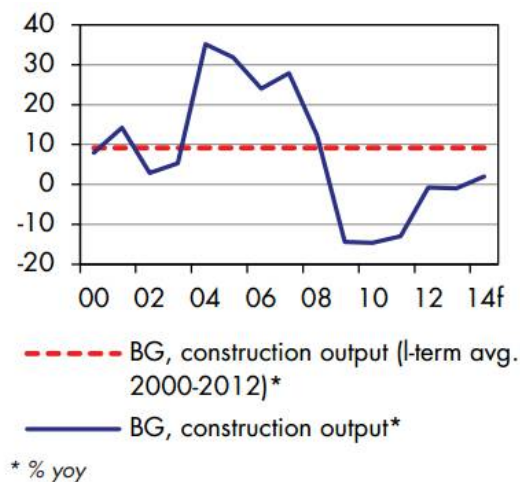
\* % yoy  
Source: National sources, Raiffeisen RESEARCH

### BULGARIA: REBOUND IS NOT YET ENVISAGED

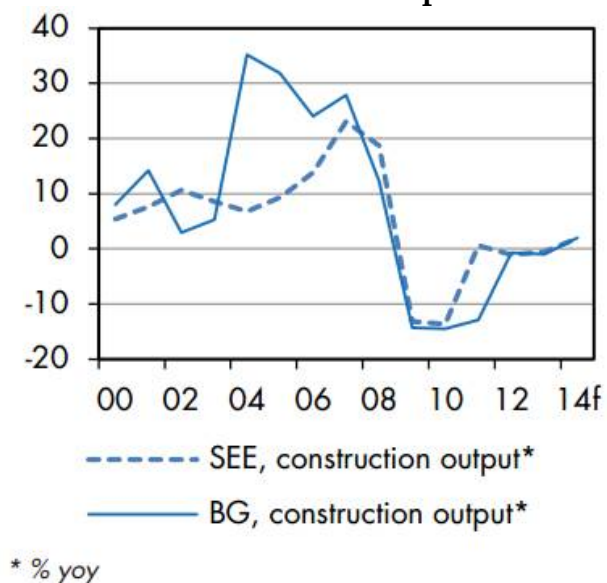
Since the start of the recession in Bulgaria in 2009 the construction sector has been declining. Being considered as one of the heavily overheating sectors in the pre-crisis booming period, construction underwent a significant correction in 2010 (around 20% decline in gross value added), followed by more moderate negative growth rates in 2011 and 2012. As overall economic growth in 2013 and 2014 is expected to remain modest, the sector is forecast to continue posting negative growth rates in 2013 followed by a modest increase in 2014. The decline in FDI (foreign direct investment) is one of the factors that drag down the construction sector on its path to recovery. In contrast to the peak of the booming period in 2007 when FDI in construction and real estate exceeded EUR 3.4 bn, in 2012 the inflow was ten times smaller at EUR 340 mn. In addition, while credit activity in the corporate sector was rebounding in 2012, reaching 5% yoy in Q4 2012, loans in the construction sector continued shrinking (6.8% yoy decline in Q4 2012). As a result, the output in building construction contracted by 5.6% in 2012, only slightly decelerating compared to the decline of 7% in 2011. In 2013, the negative trend in the building construction industry is expected to lose momentum, and to move into positive territory not earlier than 2014.

A positive contribution to the development of the construction sector in 2012 was made by the civil engineering sector. Its output augmented by almost 6%, mainly due to public infrastructure projects, financed by EU funds. This segment is envisaged to remain the key driving force of the recovery of the construction sector in the following years. However, due to the elections in 2013 and a certain deceleration in EU funds absorption can be envisaged, thus slowing down the growth rate in civil engineering output.

#### Construction output: BG



#### Construction output: BG vs. CE

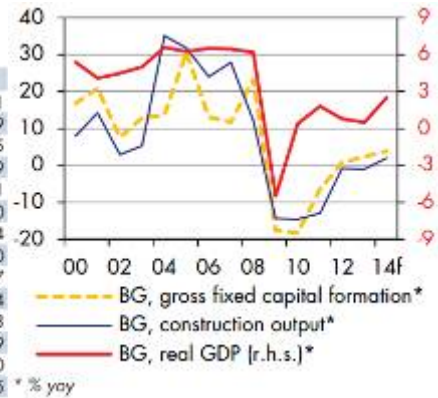


Source: National sources, Raiffeisen RESEARCH

## Forecasts Bulgaria

## BG: Construction investment, real

	2010	2011	2012	2013e	2014f
Nominal GDP (EUR bn)	36.1	38.5	39.7	40.9	43.1
Nominal GDP per capita (EUR)	4,803.8	5,264.3	5,453.3	5,662.7	6,000.9
Real GDP (% yoy)	0.4	1.8	0.8	0.5	2.5
Gross fixed capital formation (real, % yoy)	-18.3	-6.5	0.8	2.4	3.9
Industrial output (% yoy)	2.0	5.8	-0.4	0.5	2.1
Construction output (real, % yoy)	-14.5	-12.9	-0.8	-1.0	2.0
Consumer prices (avg, % yoy)	2.4	4.2	3.0	3.1	3.4
Unemployment rate (avg, %)	10.2	11.2	12.3	12.5	12.0
General budget balance (% of GDP)	-4.0	-2.1	-0.5	-2.1	-1.7
Public debt (% of GDP)	16.2	16.3	18.3	17.8	19.4
Current account balance (% of GDP)	-1.5	0.3	-0.7	-1.6	-2.3
Gross foreign debt (% of GDP)	102.7	93.1	96.4	93.3	92.9
EUR/LCY (avg)	2.0	2.0	2.0	2.0	2.0
USD/LCY (avg)	1.5	1.4	1.5	1.5	1.5



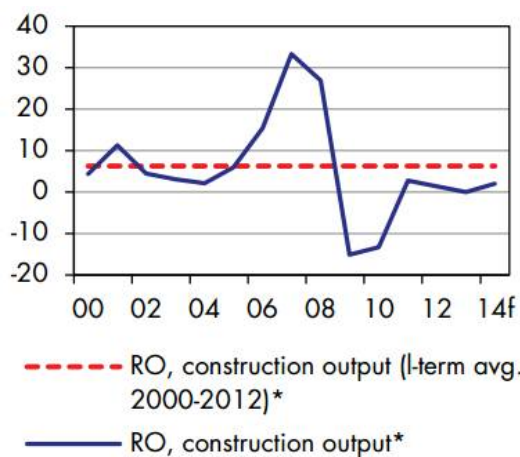
Source: National sources, Raiffeisen RESEARCH

### ROMANIA: CONSTRUCTION STILL WELL BELOW PRE-CRISIS LEVELS

The Romanian economy returned to growth in 2011 but the already sluggish recovery lost steam in 2012. We expect real activity to regain momentum in H2 2013, but at considerably slower growth rates than in the pre-crisis period. Gross value added (GVA) of the construction sector was flat in 2012, after dropping by roughly 7% on average in each of the previous three years. Construction's share in GDP decreased from 11% in 2008 towards 8.4% in the present. Construction works started to recover in 2011, on the back of engineering works and non-residential buildings. Engineering works increased their advance in 2012, as some infrastructure works have been delivered in H1 2012, but this tendency was reversed. Looking ahead, due to the commitment to continue with the fiscal consolidation process we don't see much room for the government to engage in large infrastructure projects. Progress in the absorption of EU funds for infrastructure works seems to be the only way to boost construction of this type of objects.

The residential sector and real estate market for newly built houses were severely hit by the sudden stop of foreign capital inflows, which induced a large decline in mortgage lending. All other indicators (output volume, building permits etc.) indicate that the residential sector is still on a downward trend. Supported by the First House program housing loans grew at above 10% in 2012, but this increase is also on a clearly diminishing trend. The future course of the economy and the real estate market as well as of non-performing loans (including the regulatory measures to reduce un-hedged exchange rate risks) is the most prominent factors effecting mortgage lending. We consider that housing loans will remain subdued in the short run, with both demand and supply depressed. Non-residential construction performed better than the residential segment, posting positive growth rates in the last two years and providing more encouraging signals. Overall, confidence in the construction sector is increasing, but remains considerably below the levels recorded before in the pre-crisis boom period. This suggests that although they are less pessimistic, agents in the construction sector don't see a rosy future ahead.

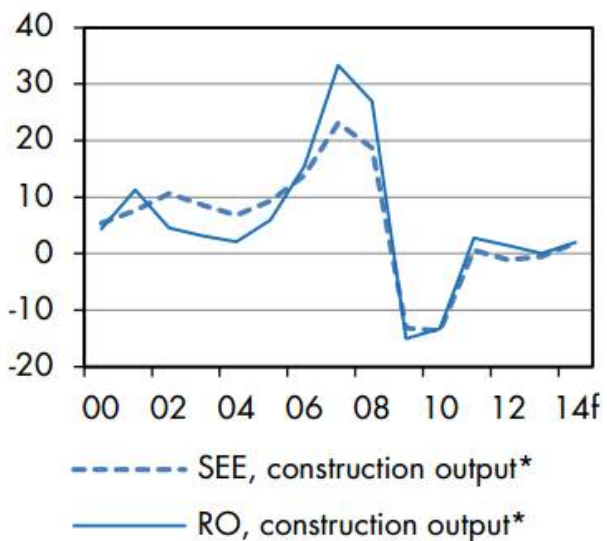
## Construction output: RO



\* % yoy

Source: National sources, Raiffeisen RESEARCH

## Construction output: RO vs. CE

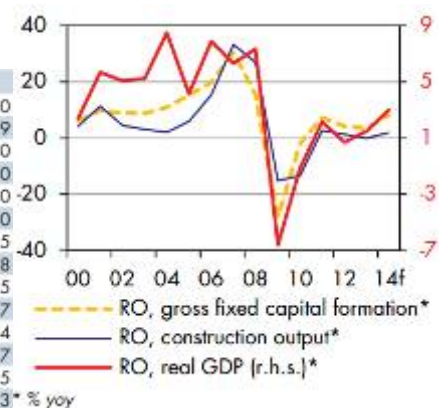


\* % yoy

## Forecasts Romania real

	2010	2011	2012	2013e	2014f
Nominal GDP (EUR bn)	124.4	131.4	131.8	140.3	150.0
Nominal GDP per capita (EUR)	5,804.5	6,138.5	6,923.9	7,386.7	7,894.9
Real GDP (% yoy)	-1.1	2.2	0.7	1.5	3.0
Gross fixed capital formation (real, % yoy)	-1.8	7.3	4.3	3.5	8.0
Industrial output (% yoy)	5.5	7.5	2.4	2.0	4.0
Construction output (real, % yoy)	-13.3	2.7	1.4	0.0	2.0
Consumer prices (avg, % yoy)	6.1	5.8	3.3	4.9	3.5
Unemployment rate (avg, %)	7.3	7.4	7.0	6.8	6.8
General budget balance (% of GDP)	-6.8	-5.7	-3.0	-2.8	-2.5
Public debt (% of GDP)	30.5	34.7	37.8	38.6	38.7
Current account balance (% of GDP)	-4.4	-4.5	-3.8	-3.4	-3.4
Gross foreign debt (% of GDP)	74.3	75.2	75.2	71.3	68.7
EUR/LCY (avg)	4.2	4.2	4.5	4.4	4.5
USD/LCY (avg)	3.2	3.0	3.5	3.3	3.3*

## RO: Construction investment,



Source: National sources, Raiffeisen RESEARCH

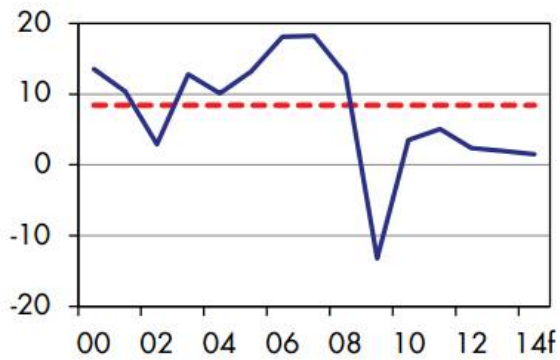
## RUSSIA: RESIDENTIAL CONSTRUCTION RECOVERS SLOWLY

After a good start into 2012 the Russian economy experienced a slowdown in the second half of the year. As a result the GDP growth rate dropped to 3.4% (vs. 4.3% in 2011). The situation in the construction sector deteriorated in the second half of 2012 with weak growth rates for this period (2.4% in 2012 vs. 5.1% in 2011). A strong deceleration was seen in non-residential construction as huge infrastructure projects (e.g. APEC summit in Vladivostok) were accomplished. The Russian residential housing market continues to recover but at a slower pace (+4.7% yoy in terms of volumes in 2012). New construction still remains below the pre-crisis peak level of 2007-2008, which drives prices to rise faster than CPI. The market demonstrates relatively low housing penetration. The demand increase looks promising in the mid-term thanks to (1) record-low unemployment rate, (2) growing consumer income (3) affordable mortgage loans and (4) a need to replace housing stock in poor condition (up to 40% of the total housing stock is > 40 years old) and unsafe housing

stock (ca. 3% of the housing stock). The situation in the commercial real estate market does not look so optimistic: the office space remains in oversupply though vacancy rates are gradually falling (to about 10-12% in Moscow), but are still above the pre-crisis level. At the same time rental rates remain stable yoy. Warehouse stock remains in high demand with vacancy rates at 2-3%. This is explained by the fast-growing retail and wholesale business, though the new construction is also expanding, keeping the rental rates relatively stable. Shopping centers also demonstrate stabilization of rental rates on the back of expanding supply.

In 2012 active development of the infrastructure project Sochi Olympic Games 2014 continued with huge spending from federal budget and state companies. However, based on its schedule, in 2013 the construction output related to Sochi should decrease substantially. With no substitution for Sochi projects there is a risk of further deterioration in infrastructure construction.

### Construction output: RU

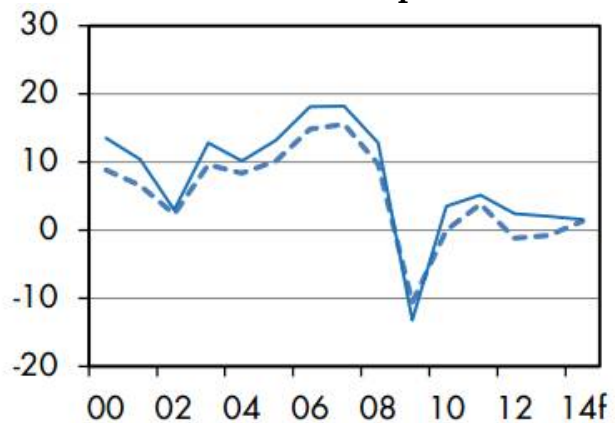


--- RU, construction output (l-term avg. 2000-2012)\*  
 — RU, construction output\*

\* % yoy

Source: National sources, Raiffeisen RESEARCH

### Construction output: RU vs. CE



--- CEE, construction output\*  
 — RU, construction output\*

\* % yoy

### Forecasts Russia real

	2010	2011	2012	2013e	2014f
Nominal GDP (EUR bn)	1,147.1	1,364.9	1,560.9	1,655.2	1,788.4
Nominal GDP per capita (EUR)	8,030.5	9,547.6	10,899.0	11,550.6	12,471.7
Real GDP (% yoy)	4.5	4.3	3.4	3.0	3.0
Gross fixed capital formation (real, % yoy)	6.0	8.3	6.7	6.0	5.7
Industrial output (% yoy)	8.2	4.7	2.6	2.0	1.8
Construction output (real, % yoy)	3.5	5.1	2.4	2.0	1.5
Consumer prices (avg, % yoy)	6.9	8.5	5.1	6.2	5.8
Unemployment rate (avg, %)	7.5	6.6	5.7	6.0	6.0
General budget balance (% of GDP)	-3.5	1.6	0.4	0.4	-1.0
Public debt (% of GDP)	9.3	9.8	10.5	11.0	11.5
Current account balance (% of GDP)	4.7	5.2	4.1	2.7	1.9
Gross foreign debt (% of GDP)	31.8	30.8	30.3	30.4	31.3
EUR/LCY (avg)	40.4	40.9	40.0	41.3	41.7
USD/LCY (avg)	30.4	29.4	30.8	30.8	31.3*

### RU: Construction investment,



--- RU, gross fixed capital formation\*  
 — RU, construction output\*  
 — RU, real GDP (r.h.s.)\*

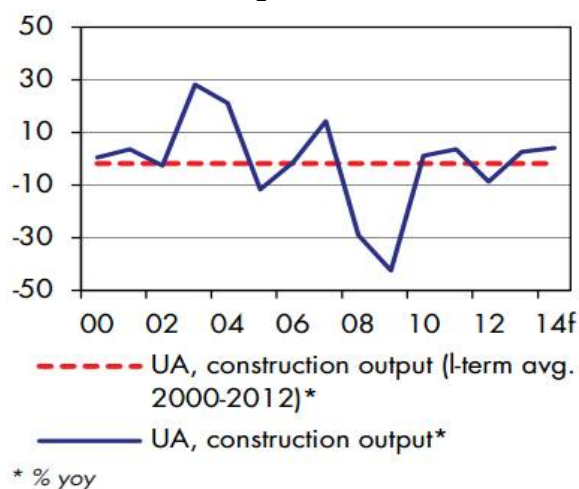
Source: National sources, Raiffeisen RESEARCH

## UKRAINE: THE LONG WAY TO RECOVERY

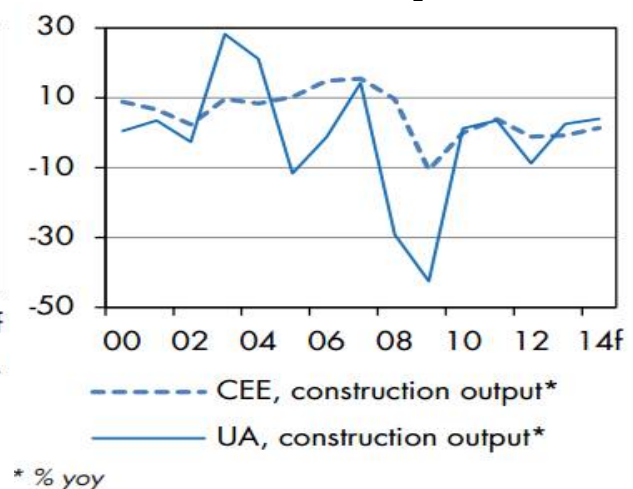
In 2012 Ukraine's open economy was hit hard by the deterioration in global economic conditions, which dampened the performance of export-oriented industries. On the domestic front, the economy was damaged by the extremely tight monetary stance, aimed at defending (for political reasons) the battered currency peg. Before the crisis construction was one of the fastest growing industries in the Ukrainian economy, with a sector growth rate reaching 14.2% in 2007, fuelled by increasing demand for residential and commercial property. The crisis changed the picture dramatically. In 2008 and 2009 GVA (gross value added) of the construction sector sank first by 29.1% and then by 42.5%. The industry's return to positive dynamics happened only in 2011 on the back of a gradual economic recovery and substantial government spending during the preparation to UEFA EURO 2012. This spending included investment in sports and general infrastructure (construction of stadiums, renovation of airports and railways, reconstruction of roads, energy systems, etc.) and construction of hotels and other accommodation facilities. However, 2012 dynamics deteriorated again (construction output went down by 9% yoy) due to much weaker public investment activity, attributed to the escalating fiscal problems.

Residential construction activity remains feeble in the post crisis years due to the frozen mortgage lending, as personal savings now emerged as the main source of housing demand. Mortgage lending has remained largely frozen since 2008 amidst the ban on FX lending to households, high interest rates in the local currency, unaffordable housing prices (compared to average income) and much tighter loan conditions. According to the data released by the Ukrainian National Mortgage Association, as of end-September 2012 the total volume of mortgage loans had decreased by 40% from the peak reached at end-2008. The latest developments in the sector of commercial property are associated with the completion of the projects announced before the crisis. The main constraints of further development lie in the lack of financing, high market saturation in big cities, low transparency of the market and high administrative barriers.

### Construction output: UA



### Construction output: UA vs. CE

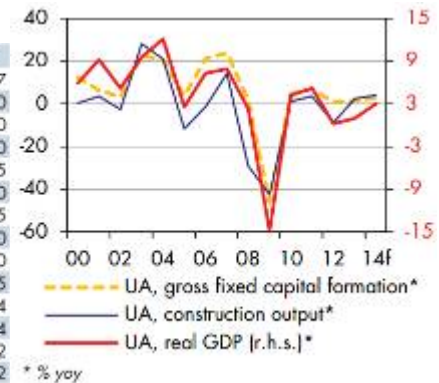


Source: National sources, Raiffeisen RESEARCH

## Forecasts Ukraine

	2010	2011	2012	2013e	2014f
Nominal GDP (EUR bn)	103.0	118.3	134.8	134.3	140.7
Nominal GDP per capita (EUR)	2,250.0	2,590.0	2,960.0	2,960.0	3,120.0
Real GDP (% yoy)	4.2	5.2	0.2	1.0	3.0
Gross fixed capital formation (real, % yoy)	4.7	7.1	0.9	1.3	3.0
Industrial output (% yoy)	11.2	7.6	-1.8	2.0	4.5
Construction output (real, % yoy)	1.2	3.5	-8.8	2.5	4.0
Consumer prices (avg, % yoy)	9.4	8.0	0.6	1.8	7.5
Unemployment rate (avg, %)	8.1	7.9	7.7	7.5	7.0
General budget balance (% of GDP)	-7.5	-4.3	-5.5	-4.0	-3.0
Public debt (% of GDP)	40.0	36.0	36.8	38.0	38.5
Current account balance (% of GDP)	-2.2	-6.2	-8.3	-6.8	-6.4
Gross foreign debt (% of GDP)	85.9	76.7	76.8	79.4	80.4
EUR/LCY (avg)	10.5	11.1	10.4	11.4	12.2
USD/LCY (avg)	7.9	8.0	8.1	8.5	9.2

## UA: Construction investment, real

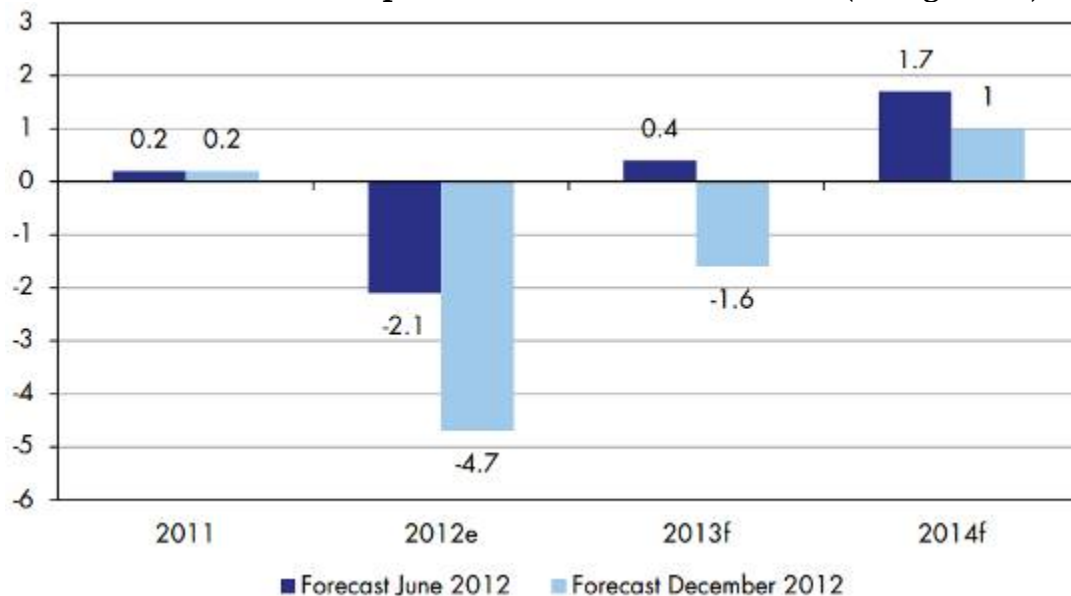


Source: National sources, Raiffeisen RESEARCH

## Construction markets in Europe and the US

The European research institute Euro-construct covering 19 member states published its latest bi-annual forecast in December 2012. After having downgraded their expectations already in June, further reduction of the estimates were published at the end of last year. Previously, a slow return to growth was expected for 2013. However, many construction markets will remain flat or decline further in the course of 2013. In addition, European construction output suffered heavily from difficult weather conditions in the first quarter of 2013. For 2014, the prospects are a bit more optimistic.

### Total construction output in Euro-construct countries (change in %)



Source: Euroconstruct, Raiffeisen RESEARCH

## FRANCE

In France economic activity has been stagnating since Spring 2011. Rising unemployment, tax increases as well as a decrease in disposable household income will lead to a very sluggish economic recovery. The French construction market saw an uptick of growth in 2011 before shrinking again in 2012. 2013 will mark another

year of recession. Accordingly, residential construction will face declining volumes in 2013. Building permits are expected to grow slowly again at the end of this year, leading to slightly increasing output volumes from 2014 onwards. In the short term, renovation may also suffer due to the decrease in household incomes.

The deterioration of business climate resulted in a subdued activity in non-residential construction. Building starts declined in 2012 and will lead to lower output volumes in 2013. The demand for industrial, storage and office buildings as well as commercial buildings significantly decreased. Nevertheless, the French municipal elections scheduled for mid-2014 will lead to higher pre-election spending in the areas of public infrastructure such as buildings for education, research and health, followed by a decline of investments in the second half of 2014. For 2015, a stagnating trend is expected.

In civil engineering, local authorities are expected to maintain an elevated level of investments in the course of 2013 due to the municipal elections that are set for next year. As for now, the collapse of Dexia did not have negative effects on the availability of credits. In 2014, a stagnating development of civil engineering expenditures is probable as authorities will seek to reduce their debt.

France				
	2011	2012e	2013f	2014f
residential	6.3%	-0.6%	-1.6%	2.5%
non-residential	3.0%	1.3%	-1.5%	-0.5%
infrastructure	1.9%	1.0%	1.3%	-0.2%
total construction	4.3%	0.3%	-0.9%	1.0%

Source: Euroconstruct, Raiffeisen RESEARCH

## ITALY

2012 the Italian construction sector was once again in recession, a development which started already in 2002. The prospects for 2013 are not positive either. As for now, the situation is not expected to improve until 2014. The Italian economy entered into recession again in the second half of 2011 and was hit by weak internal demand and underutilization of production capacities.

The residential construction market is expected to further shrink in 2013. Between 2002 and 2012 sales volumes dropped by 47%. The real estate prices reached very low levels. Nevertheless, large quantities of unsold stock, decreasing household incomes and a continuously tight credit market prevent any improvement in new residential construction. Renovation activities may improve in 2014, after stagnating in 2013. A strong driver behind refurbishment is the enhancement of quality and energy efficiency of buildings. Tax reliefs and subsidies for those projects are in place.

For the past years, the non-residential construction sector has shrunk as well. No improvement is expected for 2013 and 2014. Business confidence is at its lows and many industries are characterized by overcapacities. New projects are scarce. All market segments – office, production and commercial construction – are hit by a dramatic decline in demand. Debt crisis and austerity measures in the public sector are constraining civil engineering.

The decline in construction volumes is expected to continue in the years 2013 to 2015. Tight credit supply worsens the situation even more and is starting to negatively influence the PPP (public private partnership) market. Generally, PPPs are being considered as a practicable way to reduce the infrastructural gap while at the same time limiting the capital expenditure requirements for public bodies. The difficult budgetary situation of federal and local authorities and the heavy need for austerity measures further dampens the outlook for civil engineering construction in the next years.

Much more activity has been observed in the field of renewable energy. There, the construction of special plants entered a boom phase a couple of years ago, helped by favorable subsidy schemes. In 2012, growth slowed down substantially.

<b>Italy</b>				
	<b>2011</b>	<b>2012e</b>	<b>2013f</b>	<b>2014f</b>
residential	-1.6%	-6.3%	-2.0%	1.3%
non-residential	-3.6%	-6.6%	-1.2%	1.3%
infrastructure	-3.5%	-3.8%	-0.2%	-0.2%
total construction	-2.6%	-5.8%	-1.4%	1.0%

*Source: Euroconstruct, Raiffeisen RESEARCH*

## **SPAIN**

Spain faces severe economic challenges. After years of recession deficit has increased dramatically. Austerity measures that are in place need to be intensified and expanded furthermore. Rising unemployment leads to an erosion of disposable household incomes and increased emigration. The consequences are a shrinking private consumption as well as a lack of investments. Within the construction industry the turbulent economic climate caused weak public and private demand which has led to depressed levels of activity both in residential and non-residential. Continuously shrinking real estate prices, scarce (and expensive) credit facilities and declining household incomes have massively reduced the number of transactions and created a large over-supply in housing. Tax increases on housing purchases, starting with January 2013, pose another burden for residential real estate. In light of the heavy oversupply in residential housing the government aims no longer to promote new housing. Renovation activities are also in a state of decline due to the decrease of disposable household income. Therefore, the volume of activity in Spanish residential construction is expected to remain subdued for the next years.

The picture within non-residential construction is a very similar one. Massive oversupply on the one hand, a lack of demand in many markets (industrials, trade, offices, tourism) and scarce credit facilities on the other hand. There are no indications of a recovery in the next few years.

The impact of fiscal consolidation on civil engineering construction is probably most severe. Due to constrained public budgets the announcement of tenders has plummeted by two-thirds in the last two years. The decline continues even further. An increase in infrastructure investments will require the participation of the private sector (e.g. via PPPs). Currently, conditions for PPPs in place are not attractive enough.

<b>Spain</b>				
	<b>2011</b>	<b>2012e</b>	<b>2013f</b>	<b>2014f</b>
residential	-15.1%	-28.0%	-16.9%	0.9%
non-residential	-11.8%	-20.6%	-19.0%	-8.6%
infrastructure	-32.1%	-45.0%	-40.0%	-19.5%
total construction	-20.1%	-30.8%	-23.0%	-6.3%

*Source: Euroconstruct, Raiffeisen RESEARCH*

#### **UK**

2011 marked a recovery in the UK construction market, helped by the Olympic Games in 2012 and large-scale programs (e.g. BSF Building Schools for the Future). Meanwhile, those effects ran out and led to a shrinking UK construction market. Continued weakness in the macro economy constitutes another challenge for the industry.

The prospects for residential construction have worsened. On the one hand, private households are burdened by a squeeze of income. On the other hand, social housing is facing increased difficulties to get sufficient funding from sources other than the government as the latter is burdened by austerity measures.

Non-residential construction is constrained by the weak economic environment. New work activities are not expected to return to growth until 2015. Renovation should show a more stable development. It may benefit from retrofit works to improve the energy efficiency of buildings. This is to be classified more as long-term support than as short-term relief.

The activity level in civil engineering is expected to show slight growth in the subsequent periods until 2015. Investments in rail (e.g. the Crossrail project) and energy are holding up well. Nevertheless, expenditures in roads may fall in the short term after the completion of large projects (M25, A1). New projects will come on stream in the further course of the year (e.g. Forth Replacement Crossing).

## UK

	2011	2012e	2013f	2014f
residential	2.2%	-4.9%	0.1%	3.9%
non-residential	-0.5%	-6.6%	-5.3%	-1.4%
infrastructure	10.0%	-9.9%	1.0%	0.4%
total construction	2.3%	-6.6%	-2.1%	1.0%

*Source: Euroconstruct, Raiffeisen RESEARCH*

## US

The US construction industry has recently seen more green shoots, especially in residential housing which is considered as early-cycle and therefore serves as leading indicator for the whole construction industry. The improvement is driven by positive GDP growth and increasing new borrowing, creating a favorable credit impulse. Mortgage growth bottomed in 2010 and currently shows increasing momentum. Private residential construction spending keeps growing. The NAHB (National Association of Home Builders) homebuilder sentiment index depicts perceptions of current single-family home sales and sales expectations as well as builders' expectations for traffic of prospective buyers. The index keeps growing and recently reached a level of 47 (after having troughed below 8 in January 2009).

Non-residential construction should follow the trend described above. The Architecture

Billings Index (ABI), a leading indicator for non-residential construction activities, has been holding up well in recent months and stays above the important 50-level which indicates an increase in demand for design services. The ABI generally leads construction spending by nine to twelve months. Loan delinquency rates for commercial real estate loans continue to decline. Vacancy rates for office space and industrial properties keep trending down.

**NAHB Index**



*Source: Bloomberg, Raiffeisen RESEARCH*

## *Need of Construction Project's Organization and Management*

Regarding to the specific characteristics of the construction industry as: *the construction industry is the largest industry in the world; it is more of a service than a manufacturing industry; growth in this industry in fact is an indicator of the economic conditions of a country; the construction industry consumes a wide employment circle of labor; most construction projects exhibit cost overruns, time extensions, and conflicts among parties; the construction industry is more challenging than other industries due to its unique nature; every project is one-of a kind; many conflicting parties are involved; projects are constrained by time, money and quality; and high risk, is generated the need of the organization and management of the processes implemented throughout the lifecycle of the construction project by the arising of the investment idea to its completion.*

*Project management* is believed to be justified as a means of avoiding the ills inherent in the construction and production sectors of the economy and for which reasons most projects fail and or abandoned. The project management role arises from the need to take charge, control of events on the project implementation process, understand the intricacies of coordinating, controlling, organizing and directing the efforts and activities of the professional team and the physical problems of implementation process with the needs in the decision making process. The project is termed successful if it passes four success test criteria i.e. the time criterion – completed on time; the cost or money criterion – completed within budget; the effectiveness criterion – completed in accordance with the original set performance and quality standards; and client's satisfaction criterion – accepted by the intended users or clients whether the client is internal or from outside the organization. The success criteria call for successful project implementation by the utilization of proven management techniques of planning, organizing, directing and control. The issues on life cycle management, time management, conflict resolution and management, networking, contracts management, project choice and project quality are the key factors that contribute to project success. Effective project choice, which results in a good project selection, greatly improves the probability of project success especially when the project is executed in accordance with project management implementation guidelines.

## *The evolution of Project Management in Construction Projects*

Project management and projects are not new concepts. Throughout history, vast projects of different magnitudes have been successfully undertaken across generations. Project management first emerged in the early fifties on large defense projects. Gradually smaller organizations took to adapting the idea and currently the smallest construction firms are known to operate project management in some way. A great deal of project management involves avoiding problems, tackling new ground, managing a group of people and trying to achieve very clear objectives quickly and efficiently.

Project management is essentially about managing a project from its conception to its completion and needs to be discussed in terms of various stages of a project life cycle. A project could be viewed as a system, which is dynamic and ever changing from one stage to another in a life cycle, considering a generic project, its status changes from that of an idea or a concept through to feasibility studies, execution and finally completion. But projects are nowadays far more complicated than ever before. They involve larger capital investments, and embrace several disciplines, widely dispersed project participants, tighter schedules, stringent quality standards, etc. Coupled with high speed developments in ICT, these factors have influenced project management practices to take a new turn taking advantage of newly developed management tools and the latest technology.

Next, different definitions of Project Management and its functions and requirements from a life cycle point of view are stated. The challenges and problems facing current project management practices to fulfill these requirements are discussed. However, the stress is put in the communication and information management, which are Project Management functions that are having different treatment with the impact of the latest advances in technology and especially, with the emerging paradigm of performing project management over the web.

### *Definitions of Project Management*

After World War II, the complexities of projects and a shrinking wartime labor supply demanded new organizational structures. Program Evaluation and Review Technique (PERT) charts and Critical Path Method (CPM) were introduced giving managers greater control over massively engineered and extremely complex projects. These techniques spread to many industries as business leaders sought new management strategies and tools to handle their growth in a quickly changing and competitive world. This trend was enhanced by the availability and sophistication of advanced software packages, which are fully capable of addressing these techniques coupled with the ease to use interfaces. Thus, project management was taken up initially by large companies, later on by smaller firms, and now even the smallest ones are known to operate project management to a certain extent.

There are many definitions for project management. However irrespective of the nature of the project or the type of project in question, it is defined as the management of the project from its initial conception to its ultimate completion and its maintenance. Nevertheless, in construction the term is frequently used to refer to site or construction management rather than taking a holistic view of the project from the conceptual stage (preparation of the client brief) to its ultimate completion and maintenance (facilities management).

Walker (1984) provides a comprehensive definition for construction project management:

*“Construction Project Management is the planning, control and coordination of a project from conception to completion (including commissioning) on behalf of a client. It is concerned with the identification of the client’s objectives in terms of utility, function, quality, time and cost, and the establishment of relationships between resources. The integration, monitoring and control of the contributions to the project and their output, and the evaluation and selection of alternatives in pursuit of the client’s satisfaction with the project outcome are fundamental aspects of Project Management.”*

The Code of Practice for Project Management for Construction and Development (Chartered Institute of Building 2003) describes the Project Management as an emergent professional discipline which separates the management functions of a project from the design and execution functions and defines Project Management as:

*“the overall planning, coordination and control of a project from inception to completion n aimed at meeting a client’s requirements in order to produce a functionally and financially viable project that will be completed on time within authorized cost and to the required quality standards.”*

The Project Management Institute (PMI 2000) defines Project Management as:

*“the application of knowledge, skills, tools, and techniques to project activities to meet project requirements.”*

The PMI definition stresses the achievements of predetermined project objectives, which normally refer to scope, quality, time, cost and participant satisfaction, and directly links them to the project life cycle. A construction project goes through various stages along the path to completion. In a typical project, the status changes from that of an idea or concept, through to feasibility studies, execution and final completion.

According to the Royal Institute of British Architects (RIBA 2000), the project life cycle is divided into a number of stages each of which has assigned project management practices and project managers with defined responsibilities. In general, the following stages are defined: *Inception, Feasibility studies, Schematic design, Detail Design, Production Information, Bills of Quantities, Tendering, Project Planning, Construction and Project Completion.*

RIBA (2000) has well defined the roles of the different participants such as architects, engineers, surveyors, planners, project managers, contractors and sub contractors in each of the aforementioned stages. These roles are focused on managing and coordinating the project information and the flow among the various participants with the aim of satisfying the objectives of each stage.

*“The overall role of project management, in this scenario, is to harmonize the functions of planning, communicating, monitoring and control in order to meet the project’s overall objectives as defined by the scope, time, cost, and quality and client satisfaction.”*

Project management has three essential requirements: thinking ahead, communicating and evaluation.

According to Peters (1981) half the value of project planning is to provide the opportunity and motivation, simply to get people to think ahead about the project that they are undertaking. This process tends to reveal problems, which helps to find solutions at early stages of a project.

*Communication*, on the other hand, deals with producing, issuing and transmitting reports/documents, and with holding occasional meetings among the project participants so that the proposed timing, method and strategy are made available and understood. In essence, the collaboration of the various participants in a project is measured by how effectively the communication channels were managed.

*Evaluation* of the outcomes is a critical to improve current practices. Communicating and feeding back information and messages to the project team is also essential to the achievement of the project goals by all the participants. Thus, the effectiveness of the project manager to communicate with, evaluate, and feedback to the rest of the project team during each stage of the life cycle determines how efficiently the project's goals will be achieved.

Traditional project management practices have evolved over time as the requirements for managing and controlling construction projects unfolded. Nonetheless, with the advances of management techniques and information and communication technology, traditional practices have proven to be insufficient in meeting the new project requirements.

Construction Projects are being designed by diverse number of designers (which may well be placed at different geographical locations), procured and managed by new partnering strategies, materials are purchased and delivered through strategic alliance with suppliers, etc.

The common point of all the Project Management definitions is to consider PM as:

*“planning, coordination and control of a project along the whole life cycle of the project to meet the client's requirements.”*

In general terms, the responsibilities of the Project Management are to plan, coordinate and control the overall project. Such duties can be performed through a good communication and information management, and must be studied in depth.

## THE CONSTRUCTION PROJECT

The construction project is defined as all other projects by the following characteristics:

- Defined goal or objective;
- Specific tasks to be performed;
- Defined beginning and end;
- Resources being consumed.

The goal of construction project is to build something. The difference of the construction industry's projects from other industries' projects is that its projects are large, built on-site, and generally unique. Time, money, labor, equipment, and, materials are all examples of the kinds of resources that are consumed by the construction project. Projects begin with a stated goal established by the owner/investor and accomplished by the project team. As the team begins to design, estimate, and plan out the project, the members learn more about the project than was known when the goal was first established. This often leads to a redefinition of the stated project goals.



*Mega construction site Marina South, Singapore*

## **THE PROJECT GOALS AND SCOPE**

The construction industry is unique in several aspects. The major reasons for this uniqueness are the following:

- The diversity in the types, forms, and shapes of construction projects;
- Projects' production cycle and lifetime;
- Low research and development expenditures;

- Geographical dispersion;
- The labor force; and
- The contractual relationships.

Because of these major differences of the construction industry, the implementation of goal setting techniques is different.



*The Jabal Omar development in Makkah is one of the largest construction projects in the country*

### **Project Goal**

Conceptually, a *goal* is defined as what an individual consciously tries to attain; that is, the aim or end of an action. Other similar concepts include performance standard (a measuring rod for evaluating performance), quota (an assigned goal, a minimum amount of work or production), work norm (a standard of acceptable behavior defined by a work group), task (a piece of work to be accomplished), objective (the ultimate aim of an action or series of actions), deadline (a time limit for completing a task), budget (a spending goal or limit), intention (a psychological state), and purpose (a consciously held goal or a motive underlying a goal).

The two major attributes of goals are content and intensity. The content of a goal is the object or result being sought, and the main dimensions of goal content are specificity or clarity (the degree of quantitative precision with which the aim is specified) and difficulty (a certain level of task proficiency measured against the standard or level of performance sought). The intensity of a goal pertains to the process of setting the goal or determining how to reach it, the degree of goal

commitment, and the importance of the goal for the individual; intensity may be measured by such factors as the scope of the cognitive process, the degree of effort required, the importance of the goal, and the context in which it is set.

The implementation of goal setting in the construction industry is characterized by the difficulties in agreeing on: attainable goals with regard to many existing variable elements on typical construction sites; and methods for productivity measurement and performance evaluation.

Because the precise degree of association between goals and performance, is an empirical question, results about the characteristics of goals and the process used in other industries can be helpful in designing a successful goal setting program for the construction industry, even though there are major differences between the construction industry and other industries.

For construction project's goal settings could be made following advanced conclusions:

- For a goal setting program to be successful, it should have strong organizational support. Both management and employees should participate in the setting of goals, and both should understand and be prepared to undertake the work plan required to accomplish these goals. Having a workshop to discuss the program, the methodology for setting goals, and the criteria for evaluating performance helps to reduce friction and avoid misunderstandings.;
- It is probably not possible to include a large number of tasks in the program at the initial stage, and only a limited number of tasks should be selected. This allows more effort and attention to be concentrated on a few tasks and limits the disruption or damage that might occur if a difficulty should arise during implementations;
- Specify clearly at the outset the criteria for performance measurement. Without a clear knowledge of how performance would be measured, setting goals and its comparison with performance is meaningless;
- State unambiguously the goal or goals to be reached. These goals should be challenging, but they should be realistic and consistent with previous performance. In the construction industry, the cost per unit of work is the easiest criterion to specify for both management and field personnel, provided there is sufficient documentation of progress and cost. With the involvement of unionized labor, the proposed program should be discussed with union officials, and they should be assured that no jobs will be cut and no individual will be punished or rewarded based on his/her performance;
- Pay special attention to documentation and data gathering because these will be the basis for productivity comparisons and future goal-setting attempts.

## *The Goal statement*

After getting the more specifics about the project's goal, have to put goal in writing in a goal statement. A goal statement outlines why is doing this project and what hope to accomplish at the end, what is the desired result. The project goal statement considers for a moment what such a project might involve. Writing a goal statement helps you focus on such a project from the outset.

## *The Project scope*

When is understood the goal, can begin to define the specific parameters of the project. This is often referred to as a project's scope. It is necessary to know that a scope is not a goal. The project scope is the work performed to deliver a product, service, or result with the specified features and functions. In the project context, the term scope can refer to:

- Product scope. The features and functions that characterize a product, service, or result; *and/or*
- Project scope. The work performed to deliver a product, service, or result with the specified features and functions. The term project scope is sometimes viewed as including product scope.

The project scope management includes the processes required to ensure that the project includes all the work required, and only the work required, to complete the project successfully. The project scope management is processes, which include the following:

- Plan Scope Management—the process of creating a scope management plan that documents how the project scope will be defined, validated, and controlled;
- Collect Requirements—the process of determining, documenting, and managing stakeholder needs and requirements to meet project objectives;
- Define Scope—the process of developing a detailed description of the project and product;
- Create WBS—the process of subdividing project deliverables and project work into smaller, more manageable components;
- Validate Scope—the process of formalizing acceptance of the completed project deliverables;
- Control Scope—the process of monitoring the status of the project and product scope and managing changes to the scope baseline.

Completion of the project scope is measured against the project management plan. Completion of the product scope is measured against the product requirements. The project scope management processes need to be well integrated, so that the work of the project will result in delivery of the specified product scope.

## *The scope statement*

The project scope statement is description of the project scope, major deliverables, assumptions, and constraints. Scope statements define both what a project will involve and what it will not involve. They typically have to get into specifics about the project budget, timeframe, and deliverables in a scope statement. There's not include every single detail, but should have enough information that a project team can understand the most important parameters of the project. Together, a goal statement and a scope statement are two valuable tools for focusing the project team and keeping it on project proceeding track. If take the next logical step in pinning down the project at the outset, this will be created a project charter. The project charter would include specifying a project name, getting authorization in writing to begin the project as of a certain date and to draw on a specified budget, creating a list of responsibilities, and having those with an interest in the project (called stakeholders) sign off giving authority to run the project. The goal and scope statements can be used to obtain the various pieces of the project charter.

## *Breaking Your Project into Phases*

Knowing the goal and scope of the project, it's helps to identify the steps that should be performing to accomplish them. Before creating the first task, should probably begin to think beyond the scope of the project to more detailed project parameters. These parameters help to determine what tasks to include in the project.

For example, can be considered:

- *Deliverables*: These are tangible products, services, or results that will produce during the project. Somewhere in the project should be tasks that reflect the delivery of each deliverable;
- *Key Dates*: In addition to the project end date, do you have to meet other key dates along the way?
- *Completion Criteria*: Knowing the completion criteria gives to the team something specific to aim for and helps you create the last phase of your project;
- *Expectations*: Knowing what expect from the project team and project management can help to identify some tasks. If expect something from the project team and project management have to include such a task in the project;
- *Potential Risks*: Identifying potential problem areas can help to built in some checks and balances to help avoid or minimize them. For example, can be created tasks that contain terms such as Q&A, Testing, Review, Debrief, and Revise to monitor or fix problems along the way.

## **THE PROJECT LIFE-CYCLE**

The Project Management Institute (PMI 2000) defines the Project Life cycle (PLC) as:

*“the steady progression of a project from its beginning to its completion”.*

The Life cycle of a project is divided into phases and then into stages. However, some phases of most projects involve iterations to a greater or lesser degree depending on the type of project.

At its most basic, it is generally accepted that a typical PLC consists of two broad periods each of two major phases (i.e. four in all). The first period involves conceptualizing and validating with a business case. Then planning and developing a project brief or charter. The second period involves implementation, i.e. detailed design and construction of the product followed by product transfer to the intended customer.

Many Project Management researches give different definitions to Project Life cycle and describe different phases of the PLC. These phases are known by different names in different project environments but from the traditional view these phases are divided into:

*Phase 1: Conception of an idea.* The sense of vision, big picture.

*Phase 2: Development of the idea into a practical plan.* The listening, analysis, alignment, planning, commitment.

*Phase 3: Plan execution.* Production work, coordination, cooperation, testing.

*Phase 4: Project completion.* Transfer of product and information, review, closure.

In general, the activities within each phase tend to be quite distinct, requiring different levels of management attention and different skill sets.

Depending on the size, complexity, risk, sensitivity and so on, these typical phases may be broken down into sub-phases, and a variety of different stages or iterations depending on the project and its type. These will be specific to the project, and will depend on the overall accomplishment strategy.

If is focused on the construction, projects are intricate, time-consuming undertakings. The total development of a project normally consists of several phases requiring a diverse range of specialized services. In progressing from initial planning to project completion, the typical job passes through successive and distinct stages that demand input from such disparate areas as financial organizations, governmental agencies, engineers, architects, lawyers, insurance and surety companies, contractors, independent consultant, material manufacturers and suppliers, builders, etc. During the construction process itself, even a modest structure involves many skills, materials, and literally hundreds of different operations. The assembly process must follow a natural order of events that constitutes a complicated pattern of individual time requirements and restrictive sequential relationships among the structure's many segments.

Essentially, a project is conceived to meet market demands or needs in a timely fashion. As a general idea, typical Project Management researches give the following description of a construction project. When starting a project, various possibilities may be considered in the conceptual planning stage, and the technological and economic feasibility of each alternative is assessed and compared in order to select the best possible project. The financing schemes for the proposed alternatives must also be examined, and the project is programmed with respect to the timing for its completion and for available cash flows. Once the scope of the project is clearly defined, detailed engineering design provides the blueprint for construction, and the definitive cost estimate serves as the baseline for cost control. In the procurement and construction stage, the delivery of materials and the erection of the project on site must be carefully planned and controlled. After the construction is completed, there usually is a brief period of start-up or shake-down of the constructed facility when it is first occupied. Finally, the management of the facility is turned over to the owner for full occupancy until the facility lives out its useful life and is designated for demolition or conversion.

On this ground, the main stages for construction project management are:

- *Market Demands or Perceived Needs.* The aim of this stage is to define project objectives and scope. Once an owner has identified the need for a new facility, the owner must define the requirements and delineate the budgetary constraints. It involves establishing broad project characteristics such as location, performance criteria, size, configuration, layout, equipment, services and other owner requirements needed to establish the general aspects of the project.
- *Conceptual Planning and Feasibility Study.* Conceptual planning stops short of the detailed design, although a considerable amount of preliminary architectural or engineering work may be required. The definition of the work is basically the responsibility of the owner, although a design professional may be called in to provide technical assistance and advice.
- *Design and Engineering.* The objectives of this stage are Construction Plans and Specifications. This phase involves the architectural and engineering design of the entire project. It culminates in the preparation of final working drawings and specifications for the total construction program. In practice, design, procurement, and construction often overlap procurement and construction beginning on certain segments as soon as the design is completed and drawings and specifications become available.
- *Procurement and Construction.* Procurement refers to the ordering, expediting and delivering of key project equipment and materials, especially those that may involve long delivery periods. This function may or may not be handled separately from the construction process itself. Construction is, of course, the process of physically erecting the project and putting the materials and equipment into place and this involves providing the manpower, construction equipment, materials, supplies, supervision, and management which are necessary to accomplish the work.

- *Start-up of occupancy.* After the construction is completed, there usually is a brief period of start-up or shake-down of the constructed facility when it is first occupied. When the occupancy permit is issued and the facilities are accepted, then the occupancy is allowed.
- *Operation and maintenance.* Finally, the management of the facility is turned over to the owner for full occupancy. This stage is focused on the use of facilities and the maintenance of the whole building. In this stage the possible renovations of the building are also included.
- *Disposal of facility.* When the facility lives out its useful life and is designated for demolition or conversion. This stage refers to the demolition and possible recycling of the facilities and parts of the building.

The acquisition of a constructed facility usually represents a major capital investment, whether its owner happens to be an individual, a private corporation or a public agency. Since the commitment of resources for such an investment is motivated by market demands or perceived needs, the facility is expected to satisfy certain objectives within the constraints specified by the owner and relevant regulations. From the perspective of an owner, the project life cycle for a constructed facility can be illustrated schematically in Figure 1.1.

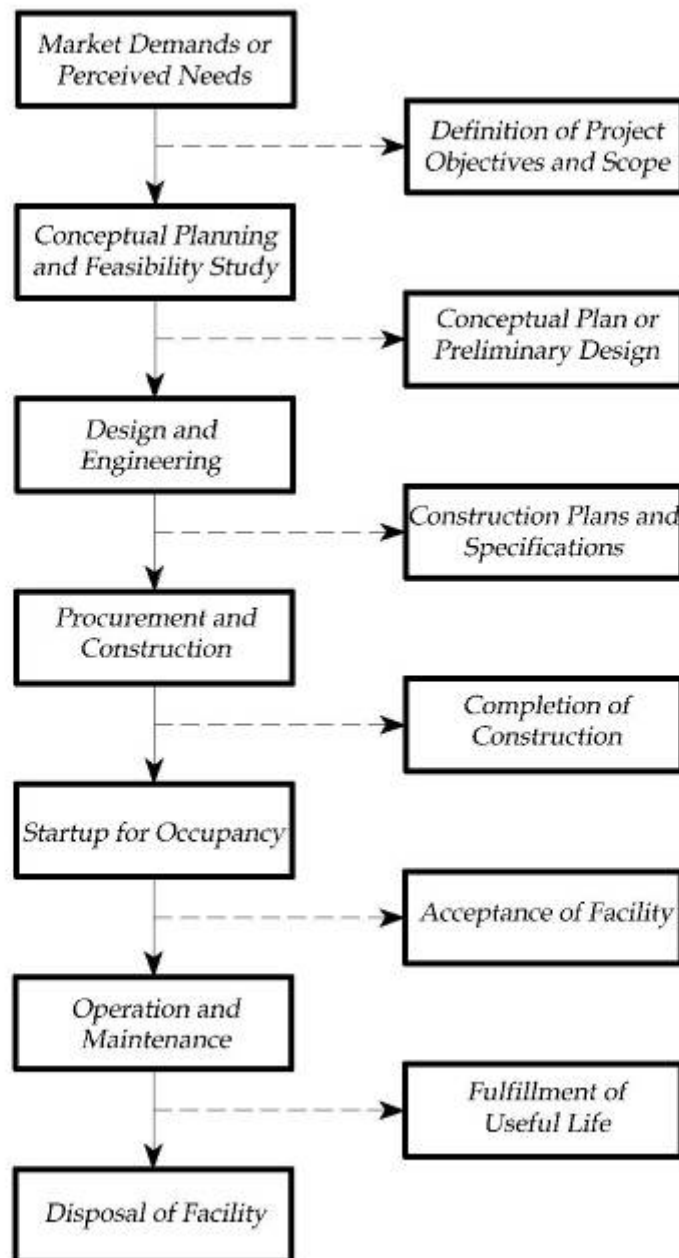
A project is expected to meet market demands or needs in a timely fashion. Various possibilities may be considered in the conceptual planning stage, and the technological and economic feasibility of each alternative will be assessed and compared in order to select the best possible project. The financing schemes for the proposed alternatives must also be examined, and the project will be programmed with respect to the timing for its completion and for available cash flows. After the scope of the project is clearly defined, detailed engineering design will provide the blueprint for construction, and the definitive cost estimate will serve as the baseline for cost control. In the procurement and construction stage, the delivery of materials and the erection of the project on site must be carefully planned and controlled. After the construction is completed, there is usually a brief period of start-up of the constructed facility when it is first occupied. Finally, the management of the facility is turned over to the owner for full occupancy until the facility lives out its useful life and is designated for demolition or conversion.

Of course, the stages of development in Figure 1.1 may not be strictly sequential. Some of the stages require iteration, and others may be carried out in parallel or with overlapping time frames, depending on the nature, size and urgency of the project.

Furthermore, an owner may have in-house capacities to handle the work in every stage of the entire process. By examining the project life cycle from an owner's

perspective we can focus on the proper roles of various activities and participants in all stages regardless of the contractual arrangements for different types of work.

**Figure 1.1 The Project Life Cycle**



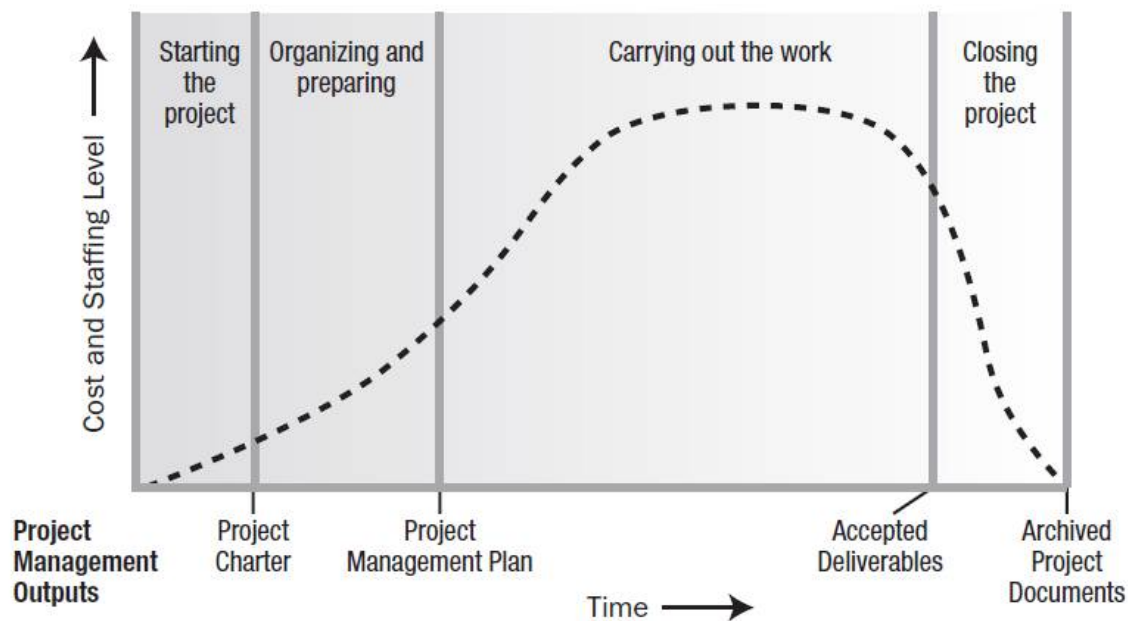
The project life cycle may be viewed as a process through which a project is implemented from beginning to end. This process is often very complex; however, it can be decomposed into several stages as indicated by the general outline in Figure 1.1. The solutions at various stages are then integrated to obtain the final outcome. Although each stage requires different expertise, it usually includes both technical and managerial activities in the knowledge domain of the specialist. The owner may choose to decompose the entire process into more or less stages based on the size

and nature of the project. Very often, the owner retains direct control of work in the planning stages, but increasingly outside planners and financial experts are used as consultants because of the complexities of projects. Since operation and maintenance of a facility will go on long after the completion and acceptance of a project, it is usually treated as a separate problem except in the consideration of the life cycle cost of a facility. All stages from conceptual planning and feasibility studies to the acceptance of a facility for occupancy may be broadly lumped together and referred to as the Design/Construct process, while the procurement and construction alone are traditionally regarded as the province of the construction industry.

Regarding to that the projects vary in size and complexity, all projects can be mapped to the following generic life cycle structure (see Figure 1.2):

- Starting the project;
- Organizing and preparing;
- Carrying out the project work, and
- Closing the project.

**Figure 1.2 The Generic Project Life Cycle Structure**

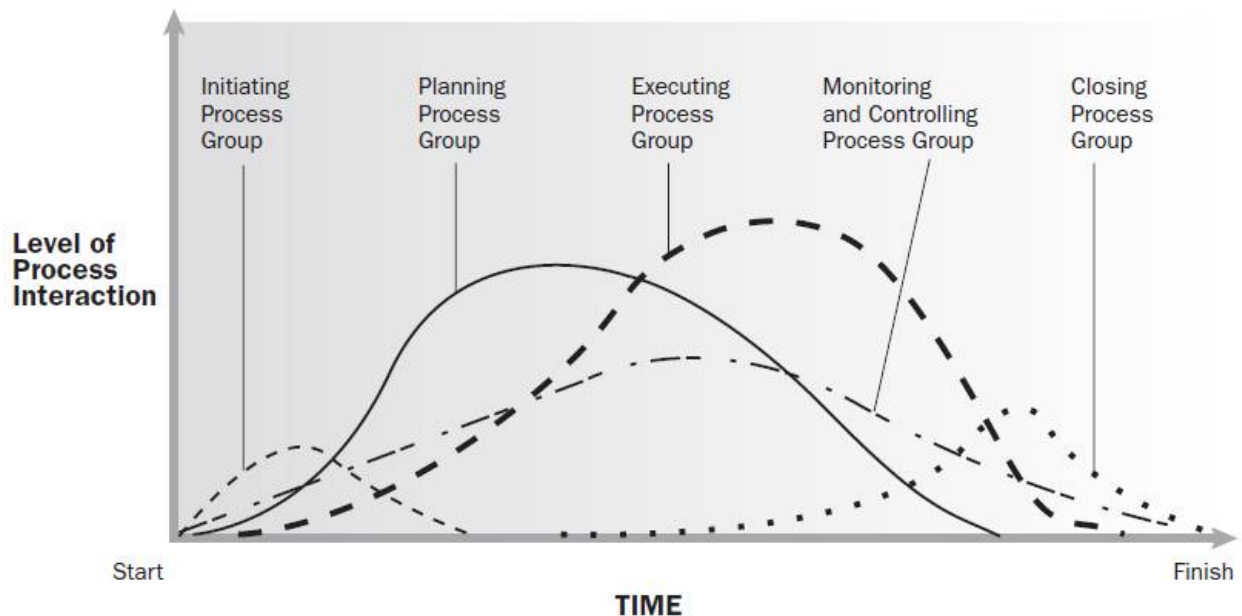


*Source: PMBOK® Guide Fifth Edition*

This generic life cycle structure is often referred to when communicating with upper management or other entities less familiar with the details of the project. It should not be confused with the Project Management Process Groups (Initiating Process Group, Planning Process Group, Executing Process Group, Monitoring and Controlling Process Group, Closing Process Group) (Figure 1.3, Figure 1.3 a, Figure 1.3 b), because the processes in a Process Group consist of activities that may be performed and recur within each phase of a project as well as for the project as a whole. The project life cycle is independent from the life cycle of the product

produced by or modified by the project. However, the project should take the current life-cycle phase of the product into consideration. This high-level view can provide a common frame of reference for comparing projects—even if they are dissimilar in nature.

**Figure 1.3 The Project Management Process Groups interacted in a Phase or Project**



Source: PMBOK®

The generic life cycle structure generally displays the following characteristics:

- Cost and staffing levels are low at the start, peak as the work is carried out, and drop rapidly as the project draws to a close. Figure 1.2 illustrates this typical pattern.
- The typical cost and staffing curve above may not apply to all projects. A project may require significant expenditures to secure needed resources early in its life cycle, for instance, or be fully staffed from a point very early in its life cycle.
- Risk and uncertainty (Figure 1.4) are greatest at the start of the project. These factors decrease over the life of the project as decisions are reached and as deliverables are accepted.
- The ability to influence the final characteristics of the project's product, without significantly impacting cost, is highest at the start of the project and decreases as the project progresses towards completion. Figure 1.3 illustrates the idea that the cost of making changes and correcting errors typically increases substantially as the project approaches completion.

While these characteristics remain present to some extent in almost all project life cycles, they are not always present to the same degree. Adaptive life cycles, in

particular, are developed with the intent of keeping stakeholder influences higher and the costs of changes lower throughout the life cycle than in predictive life cycles.

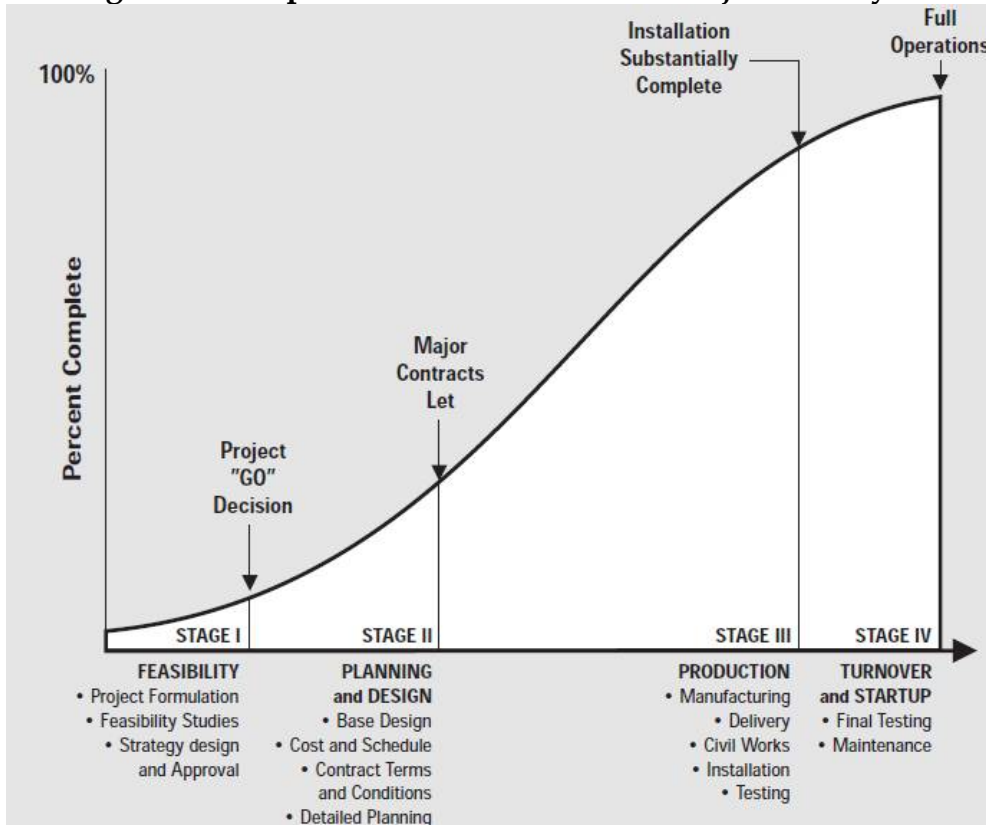
**Figure 1.3a Mapping of Project Management Process and Construction Management Process to the Process Group and Knowledge Area**

<b>Process Groups</b>	<b>Initiating</b>	<b>Planning</b>	<b>Executing</b>	<b>Controlling</b>	<b>Closing</b>
<b>4. Project Integration Management</b>		4.1 Project Plan Development	4.2 Project Plan Execution	4.3 Integrated Change Control	
<b>5. Project Scope Management</b>	5.1 Initiation	5.2 Scope Planning 5.3 Scope Definition		5.4 Scope Verification 5.5 Scope Change Control	
<b>6. Project Time Management</b>		6.1 Activity Definition 6.2 Activity Sequencing 6.3 Activity Duration Estimating 6.4 Schedule Development	6.6 Activity Weights Definition	6.5 Schedule Control 6.7 Progress Curves Development 6.8 Progress Monitoring	
<b>7. Project Cost Management</b>		7.1 Resource Planning 7.2 Cost Estimating 7.3 Cost Budgeting		7.4 Cost Control	
<b>8. Project Quality Management</b>		8.1 Quality Planning	8.2 Quality Assurance	8.3 Quality Control	
<b>9. Project Human Resource Management</b>		9.1 Organizational Planning 9.2 Staff Acquisition	9.3 Team Development		9.3 Project Completion
<b>10. Project Communications Management</b>		10.1 Communications Planning	10.2 Information Distribution	10.3 Performance Reporting	10.4 Administrative Closure
<b>11. Project Risk Management</b>		11.1 Risk Management Planning 11.2 Risk Identification 11.3 Qualitative Risk Analysis 11.4 Quantitative Risk Analysis 11.5 Risk Response Planning		11.6 Risk Monitoring and Control	
<b>12. Project Procurement Management</b>		12.1 Procurement Planning 12.2 Solicitation	12.3 Solicitation 12.4 Source Selection 12.5 Contract Administration		12.6 Contract Closeout
<b>13. Project Safety Management</b>		13.1 Safety Planning	13.2 Safety Plan Execution		13.3 Administration & Reporting
<b>14. Project Environmental Management</b>		14.1 Environmental Planning	14.2 Environmental Assurance	14.3 Environmental Control	
<b>15. Project Financial Management</b>		15.1 Financial Planning		15.2 Financial Control	15.3 Administration & Records
<b>16. Project Claim Management</b>		16.1 Claim Identification 16.2 Claim Quantification		16.3 Claim Prevention	16.3 Claim Resolution

**Figure 3–1. Mapping of Project Management Processes and Construction Management Processes to the**

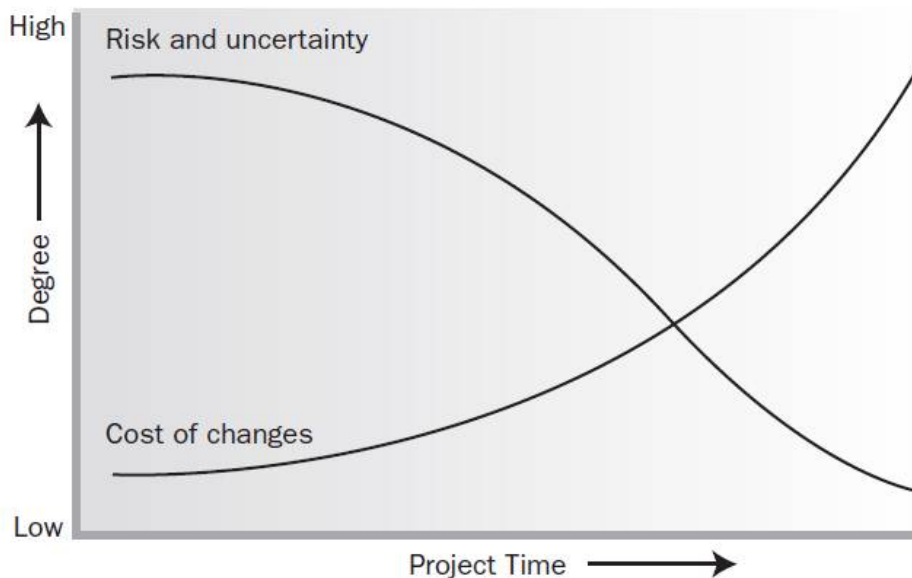
*Source: PMBOK® Construction Extension*

**Figure 1.3b Representative Construction Project Life Cycle**



Source: PMBOK®

**Figure 1.4 Impact of variable based on Project Time**



Source: PMBOK®

There is no single best approach in organizing project management throughout a project's life cycle. All organizational approaches have advantages and disadvantages, depending on the knowledge of the owner in construction

management as well as the type, size and location of the project. It is important for the owner to be aware of the approach which is most appropriate and beneficial for a particular project. In making choices, owners should be concerned with the life cycle costs of constructed facilities rather than simply the initial construction costs. Saving small amounts of money during construction may not be worthwhile if the result is much larger operating costs or not meeting the functional requirements for the new facility satisfactorily. Thus, owners must be very concerned with the quality of the finished product as well as the cost of construction itself. Since facility operation and maintenance is a part of the project life cycle, the owners' expectation to satisfy investment objectives during the project life cycle will require consideration of the cost of operation and maintenance. Therefore, the facility's operating management should also be considered as early as possible, just as the construction process should be kept in mind at the early stages of planning and programming.

### *Project Phases*

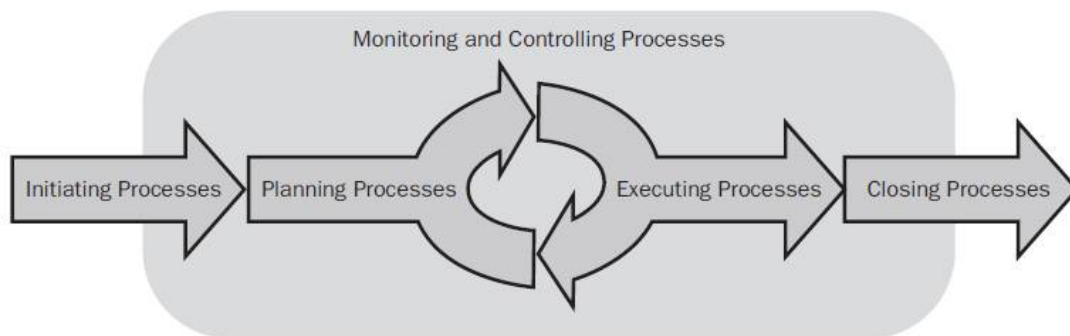
A project may be divided into any number of phases. A project phase is a collection of logically related project activities that culminates in the completion of one or more deliverables. Project phases are used when the nature of the work to be performed is unique to a portion of the project, and are typically linked to the development of a specific major deliverable. A phase may emphasize processes from a particular Project Management Process Group, but it is likely that most or all processes will be executed in some form in each phase. Project phases typically are completed sequentially, but can overlap in some project situations. Different phases typically have a different duration or effort. The high-level nature of project phases makes them an element of the project life cycle.

The phase structure allows the project to be segmented into logical subsets for ease of management, planning, and control. The number of phases, the need for phases, and the degree of control applied depend on the size, complexity, and potential impact of the project. Regardless of the number of phases comprising a project, all phases have similar characteristics:

- The work has a distinct focus that differs from any other phase. This often involves different organizations, locations, and skill sets.
- Achieving the primary deliverable or objective of the phase requires controls or processes unique to the phase or its activities. The repetition of processes across all five Process Groups provides an additional degree of control and defines the boundaries of the phase.
- The closure of a phase ends with some form of transfer or hand-off of the work product produced as the phase deliverable. This phase end represents a natural point to reassess the activities underway and to change or terminate the project if necessary. This point may be referred to as a stage gate, milestone, phase review, phase gate or kill point. In many cases, the closure of a phase is required to be approved in some form before it can be considered closed.

There is no single ideal structure that will apply to all projects. Although industry common practices will often lead to the use of a preferred structure, projects in the same industry – or even in the same organization – may have significant variation. Some will have only one phase, as shown in Figure 1.5. Other projects may have two or more phases.

**Figure 1.5 Example of a Single - Phase Project**



Source: PMBOK® Guide Fifth Edition

Some organizations have established policies that standardize all projects, while others allow the project team to choose and tailor the most appropriate approach for their individual project. For instance, one organization may treat a feasibility study as routine pre-project work, another may treat it as the first phase of a project, and a third may treat the feasibility study as a separate, stand-alone project. Likewise, one project team may divide a project into two phases whereas another project team may choose to manage all the work as a single phase. Much depends on the nature of the specific project and the style of the project team or organization.

### *Phase - to - Phase Relationships*

When projects have more than one phase, the phases are part of a generally sequential process designed to ensure proper control of the project and attain the desired product, service, or result. However, there are situations when a project might benefit from overlapping or concurrent phases.

There are basic types of phase-to-phase relationships:

- *Sequential relationship:* In a sequential relationship, a phase starts only when the previous phase is complete. Figure 1.6 shows an example of a project with three entirely sequential phases. The step-by-step nature of this approach reduces uncertainty, but may eliminate options for reducing the overall schedule.

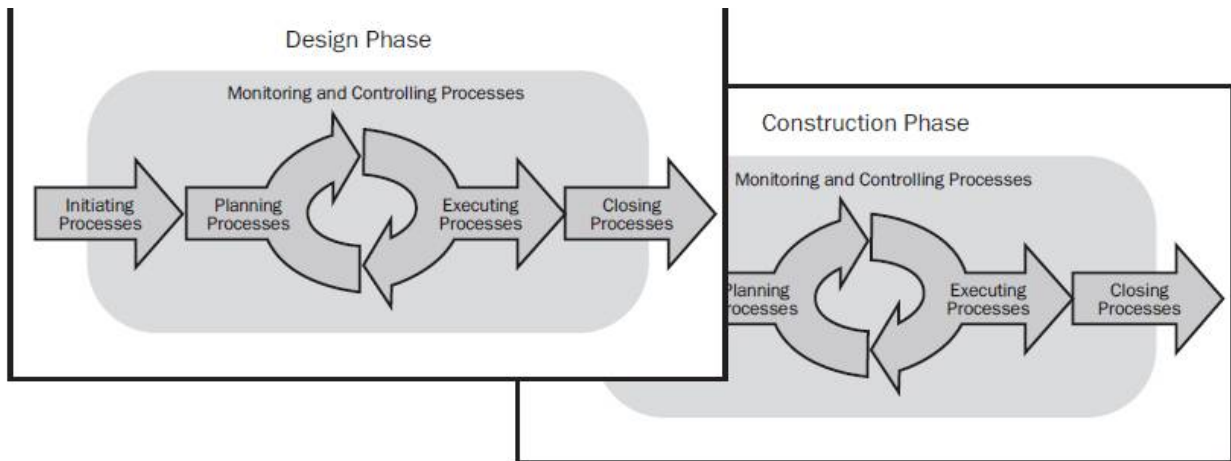
**Figure 1.6 Example of a Single - Phase Project**



Source: PMBOK® Guide Fifth Edition

- *Overlapping relationship:* In an overlapping relationship, a phase starts prior to completion of the previous one (Figure 1.7). This can sometimes be applied as an example of the schedule compression technique called fast tracking. Overlapping phases may require additional resources to allow work to be done in parallel, may increase risk, and can result in rework if a subsequent phase progresses before accurate information is available from the previous phase.

**Figure 1.7 Example of a Single - Phase Project**



Source: PMBOK® Guide Fifth Edition

For projects with more than one phase, there may be different relationships (overlapping, sequential, parallel) between individual phases. Considerations such as level of control required, effectiveness, and degree of uncertainty determine the relationship to be applied between phases. Based on those considerations, both relationships could occur between different phases of a single project.

In summary the *Construction Project Phases* can be summarized as follows:

### *Preconstruction phase*

The *preconstruction phase* of a project can be broken into conceptual planning, schematic design, design development, and contract documents.

#### *Conceptual design:*

- Very important for the owner;
- During this stage the owner hires key consultants including the designer and project manager, selects the project site, make geological and hydrological investigations, investigate the infrastructural and engineering communication of the construction site, and establish a conceptual estimate, schedule, and program;
- The owner must gather as much information as possible about the project;
- The most important decision is to proceed with the project or not.

#### *Schematic design:*

- During this phase, the project team investigates alternate design solutions, materials and systems;
- Completion of this stage represents about 30% of the design completion for the project.

#### *Design development:*

- Designing the main systems and components of the project;
- Good communication between owner, designer, and construction manager is critical during this stage because selections during this design stage affect project appearance, construction and cost;
- This stage takes the project from 30% design to 60% design.

#### *Contract documents:*

- Final preparation of the documents necessary for the bid package such as the drawings, specifications, general conditions, and bill of quantities;
- All documents need to be closely reviewed by the construction manager and appropriate owner personnel to decrease conflicts, and changes;
- With the contract documents are almost complete; a detailed and complete cost estimate for the project can be done.

### **Procurement phase (Bidding and award phase)**

The *Procurement phase* of a project can be broken into:

- The project formally transits from design into construction;
- This stage begins with a public advertisement for all interested bidders or an invitation for specific bidders;
- In fast-track projects, this phase overlaps with the design phase;
- If the project is phased, each work package will be advertised and bid out individually;
- It is very important stage to select highly qualified contractors. It is not wise to select the under-bid contractors.

### **Construction Phase**

The *Construction phase* of a project can consists:

- The actual physical construction of the project stage;

- This stage takes the project from procurement through the final completion;
- It is the time where the bulk of the owner's funds will be spent;
- It is the outcome of all previous stages (i.e., good preparation means smooth construction);
- The consultant will be deployed for contract administration and construction supervision;
- Changes during construction may hinder the progress of the project.

### *Closeout Phase*

The *Closeout phase* of a project can consists:

- Transition from design and construction to the actual use of the constructed facility;
- In this stage, the management team must provide documentation, shop drawings, as-built drawings, and operation manuals to the owner organization;
- The as-built drawings are the original contract drawings adjusted to reflect all the changes that occurred;
- Assessment of the project team's performance is crucial in this stage for avoiding mistakes in the future;
- Actual activity costs and durations should be recorded and compared with that was planned. This updated costs and durations will serve as the basis for the estimating and scheduling of future projects. Figure 1.8 shows the increasing cumulative cost as the projects progresses while the influence in the project cost and scope decreases.

## **MAJOR TYPES OF CONSTRUCTION PROJECTS**

The constructed facilities may be classified into four major categories, each with its own characteristics:

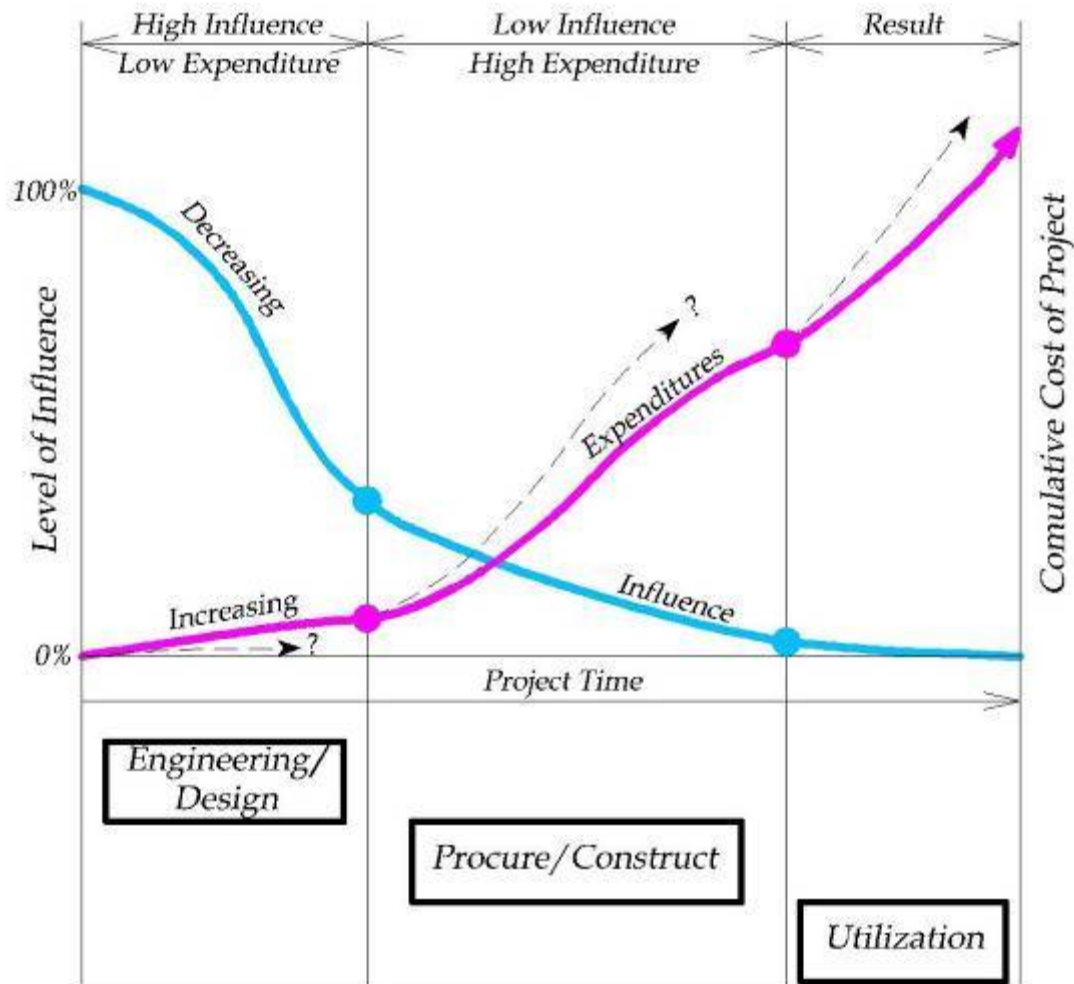
### *Residential Housing Construction*

Residential housing construction includes houses and high-rise apartments. During the development and construction of such projects, the developers usually serve as surrogate owners and take charge, making necessary contractual agreements for design and construction, and arranging the financing and sale of the completed structures.

The residential housing market is heavily affected by general economic conditions. Often, a slight increase in total demand will cause a substantial investment in construction, since many housing projects can be started at different locations by different individuals and developers at the same time. Because of the relative ease of entry, many new builders are attracted to the residential housing construction.

Hence, this market is highly competitive, with potentially high risks as well as high rewards.

**Figure 1.8 Level of influence vs. project duration**



Source: E. Elbeltagi (2009)

### **Institutional and Commercial Building Construction**

Institutional and commercial building encompasses a great variety of project types and sizes, such as schools and universities, medical centers and hospitals, sports facilities, shopping centers, warehouses and light manufacturing plants, and skyscrapers for offices and hotels. The owners of such buildings may or may not be familiar with construction industry practices, but they usually are able to select competent professional consultants and arrange the financing of the constructed facilities themselves.

Because of the higher costs and greater sophistication of institutional and commercial buildings in comparison with residential housing, this market segment

is shared by fewer competitors. Since the construction of some of these buildings is a long process which once started will take some time to proceed until completion, the demand is less sensitive to general economic conditions than that for housing construction.

### *Specialized Industrial Construction*

Specialized industrial construction usually involves very large scale projects with a high degree of technological complexity, such as oil refineries, steel mills, chemical processing plants and coal-fired or nuclear power plants. The owners usually are deeply involved in the development of a project, and prefer to work with designers-builders such that the total time for the completion of the project can be shortened.

The initiation of such projects is also affected by the state of the economy, long range demand forecasting is the most important factor since such projects is capital intensive and require considerable amount of planning and construction time. Governmental regulation such as environmental protection can also influence decisions on these projects.

### *Infrastructure and Heavy Construction*

Infrastructure and heavy construction includes projects such as highways, tunnels, bridges, pipelines, drainage systems and sewage treatment plants. Most of these projects are publicly owned and therefore financed either through bonds or taxes. This category of construction is characterized by a high degree of mechanization, which has gradually replaced some labor intensive operations. The demands for different segments of infrastructure and heavy construction may shift with saturation in some segments.

## **CONSTRUCTION PROJECTS PARTICIPANTS**

Basically, Project Management theories define many different participants/roles in a construction project. The persons recognized by the law as participants in the construction process with their specific obligations are: Building Owner/Investor, Design and Technology manager, Designers, Planning manager, Technical assistant/controller, Contractor, Project manager, Supply manager, Supplier of Plant and Equipment, Site manager, Other services subcontractor, Mechanical services subcontractor, Fire services subcontractor, Transportation subcontractor, Electrical services subcontractor, etc. All these participants/roles can be joined into only three categories of actors: owner, architect-engineer (design professional) and general contractor. Then each actor can develop as many roles as necessary:

### *The Owner/Investor (The Client)*

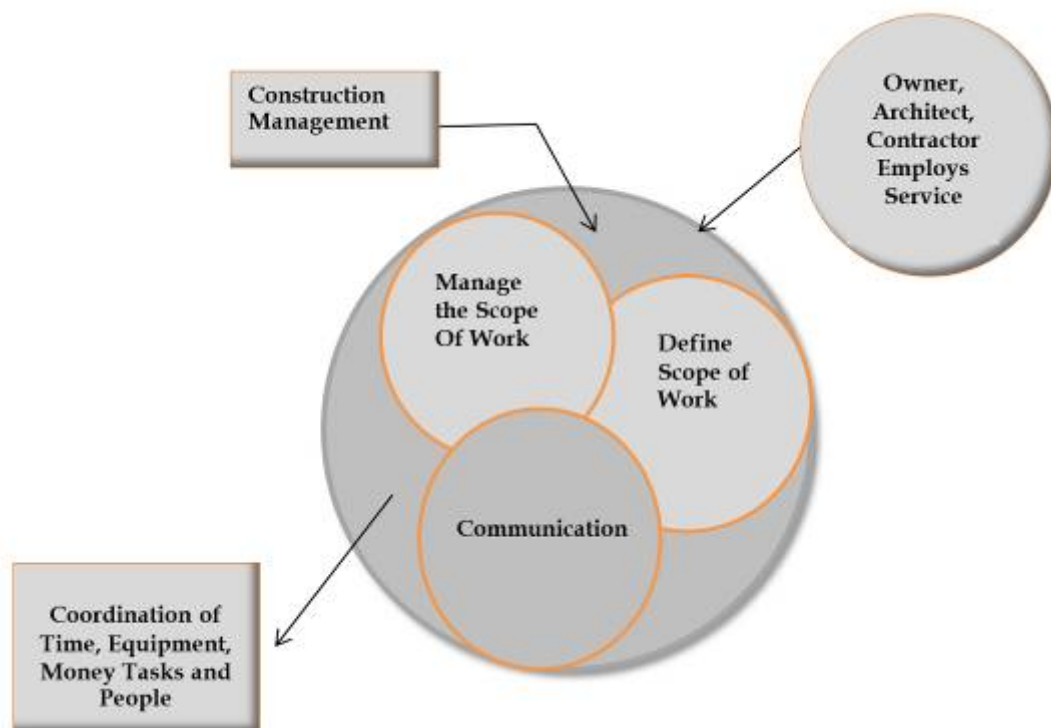
The owner is the individual or organization for whom a project is to be built under a contract. The owner/investor, whether public or private, is the instigating party that

gets the project financed, designed, and built. They need to select qualified designers, consultants, and contractors. In order to achieve success on a project, owners/investors need to define accurately the projects objectives. They need to establish a reasonable and balanced scope, budget, and schedule. Depending on the owners'/investors' capabilities, they may handle all or portions of planning, project management, design, engineering, procurement, and construction. The owner/investor engages architects, engineering firms, and contractors as necessary to accomplish the desired work.

Public owners/investors are public bodies of some kind ranging from agencies from the country level to the municipal level. Public owners/investors must proceed in accordance with applicable statutes and administrative directives pertaining to advertising for bids, bidding procedure, contracts and other matters relating to the design and construction process.

Private owners/investors may be individuals, partnerships, corporations. Most private owners/investors have facilities or projects built for their own use or to be sold, operated, leased, or rented to others. Some private owners do not intend to be the end users of the constructed facility; rather, they plan to sell, lease or rent the completed structure to others.

**Figure 1.9 Construction Management Process and Relationships with Project's Participants**



Source:  
PMBOK®

### *The Design Professionals*

The design professionals are architects, engineers, and design consultants. The major role of the design professional is to interpret or assist the owner/investor in developing the project's scope, budget, and schedule and to prepare construction documents. Depending on the size and sophistication of the owner/investor, the design professional can be part of the owner's/investor's group or an independent, hired for the project. In some cases design professional and construction contractor together form a design-build company. Since such design is architectural or engineering in nature, or often a combination of both, the term 'architect-engineer' is used to refer to the design professional, regardless of the applicable specialty or the relationship between the architect-engineer and the owner.

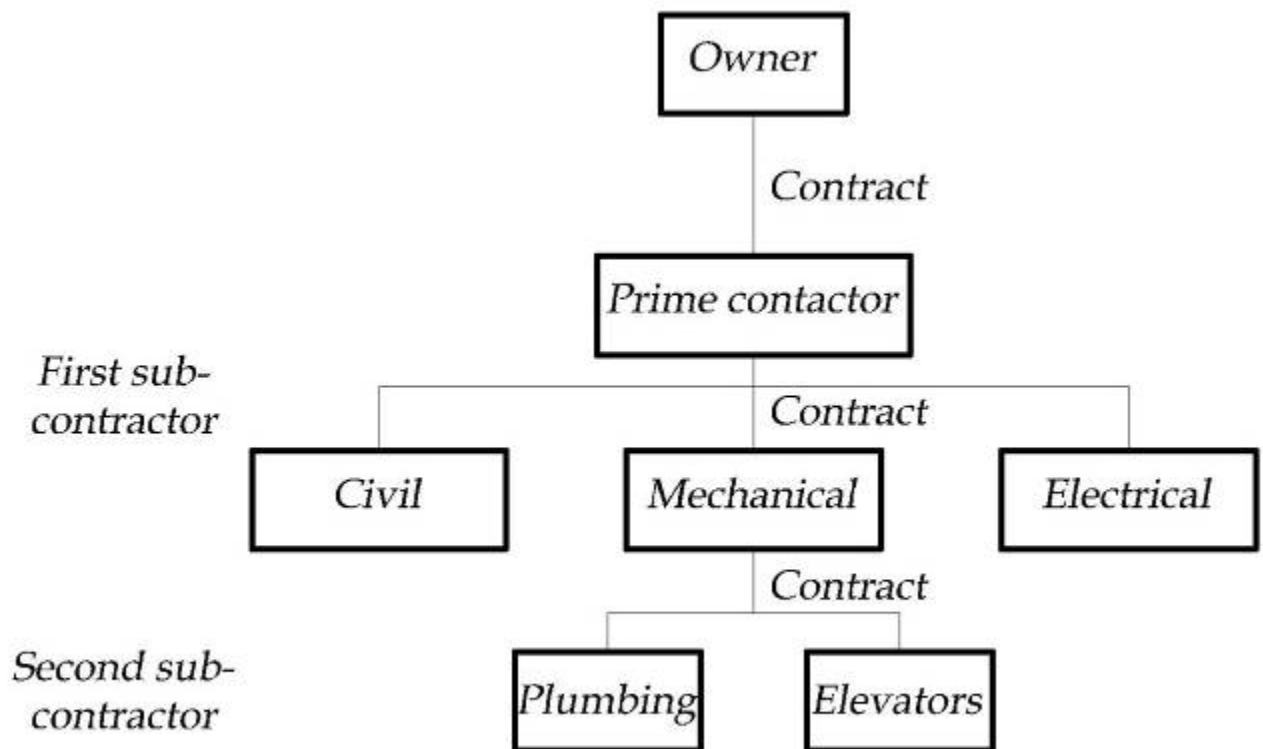
Regarding to the Bulgarian regulation, the designer of the construction works can be an individual who has a degree in his area of specialization, as well as designer capacity, or an entity employing such individuals. Designers are responsible for the preparation of the project design and, if explicitly assigned by the investor, for carrying out preliminary research and investigation. They also exercise author's supervision for compliance of the construction works with the design, and are authorized to issue instructions in that respect, which are mandatory for other participants in the process. In all categories (from I to V) of projects except VI, the author's supervision is mandatory for the structural part of the works.

According to the Chambers of Architects and Engineers in Project Development Design Act, foreigners and nationals of EU Member States, the other states of the European Economic Area and Switzerland, whose professional qualification has been recognized according to the Recognition of Professional Qualifications Act, have the right to practice as architects, landscape architects, urban planners or engineers in the field of urban planning and development design in the Republic of Bulgaria.

### *The Construction Professionals*

The constructions Professional are the parties that responsible for constructing the project. In traditional management where the owner/investor, design professional, and contractors are separate companies, the contractor would be termed a prime contractor. The prime contractor is responsible for delivering a complete project in accordance with the contract documents. In most cases, the prime contractor divides the work among many specialty contractors called subcontractors as shown in Figure 1.10.

Figure 1.10 Contractor hierarchy



The General Contractor is the firm that is in prime contract with the owner/investor for the construction of a project, either in its entirety or for some designated portion thereof. Under the single-contract system, the owner/investor awards construction of the entire project to one prime contractor. In this situation, the contractor brings together all the elements and inputs of the construction process into a single, coordinated effort, and assumes full, centralized responsibility for the delivery of the finished job, constructed in accordance with the contract documents. The prime contractor is fully responsible to the owner/investor for the performance of the subcontractors and that of other third parties to the construction contract. When separate contracts are used several independent contractors work on the project simultaneously, and each of them is responsible for a designated portion of the work. Each contractor is in contact with the owner/investor and operates independently of the others. Hence, each of these contractors is a prime contractor. Responsibility for coordination of these contractors may be undertaken by the owner, the architect-engineer, a construction manager, or one of the prime contractors who is paid extra to perform certain overall job management duties.

The contractor is a registered trader. Regarding the Bulgarian law the contractor can be local trader registered under the Bulgarian Commercial Act or a foreign trader registered under its national legislation. A precondition for execution of construction works by the contractors is the registration at the Central Constructors Register, administrated by the Chamber of Constructors. The body competent to

register contractors at the Constructors Register is the Commission with the Constructors Chamber.

As per amendments to the Constructors Chamber Act, effective from 23 February 2010, the registration of a contractor in a relevant register in a Member State or in a State part of the European Economic Area, shall be treated as a registration in the Bulgarian Central Professional Constructors Register.

Based on the above amendments, on 9 February 2012 the Commission with the Constructors Chamber adopted a resolution for applying of a simplified procedure for registration with the Constructors Register of European constructors that execute one-off specific construction project in Bulgaria.

Exempted from registration are the contractors executing villas, residential and commercial-residential buildings with 10 meter height, executing VI category construction projects, and performing repair or reconstruction of V category construction projects.

The contractor is responsible for execution of the works in compliance with the approved design and permits, and the legal requirements concerning construction works, methods, materials and products, as well as for preparing the “as-built” documentation for the works, if this role is explicitly assigned to him under the construction contract.

### *The Project Manager*

The project manager is the individual charged with the overall coordination of the entire construction program for the owner/investor. These include planning, design, procurement, and construction. Among his/her duties:

- Clear definitions of the goals of the project;
- Investigate alternative solutions for the occurred problems;
- Develop a detailed plan to make the selected program reality;
- Implement the plan and control the project.

### *The Construction Manager*

The construction manager is a specialized firm or organization which administrates the on-site erection activities and the consulting services required by the owner/investor from planning through design and construction to commissioning. The construction manager is responsible for design coordination, proper selection of materials and methods of construction, contracts preparation for award, cost and scheduling information and control.

More often the Project manager and the Construction manager are the same person or company that performs initiatives and obligations of both.

## *Consultant*

The consultant is a trader that has been licensed by the Minister of Regional Development and Public Works for carrying out compliance evaluations of project designs and for exercising independent supervision over construction works.

According to amendments of the Territorial Development Act (TDA), effective from 23 February 2010, a license issued by the Minister of Regional Development and Public Works is not required for persons that have submitted a copy of document, issued by respective competent authority in a Member State or in a State part of the European Economic Area, certifying the right to render consultant's activity.

On 27 December 2011 were promulgated amendments of the Ordinance for the conditions and the procedure for issuance of licenses to consultants for carrying out compliance evaluations of project designs and for exercising independent supervision over construction works. By the amendments specific rules and procedure were adopted with regard to recognition of the right of the EU consultant to render consultant's activity. Apart from the above two activities requiring licensing, a consultant may be appointed by the investor also to carry out preliminary research and investigation, procurement of the design process and/or management of the construction process until the completed works are put into operation.

TDA mandates that a consultant be appointed by the investor for supervising the construction projects categories I to IV. The supervision of category V projects can be exercised by the technical controller. Category VI construction projects are not subject to supervision. The supervisor (consultant or technical controller):

- Is responsible for the lawful commencement and execution of the construction works, the completeness and correctness of all acts and protocols executed during the construction, the fitness of the completed works for putting into operation, the assessment of their energy efficiency and their accessibility to disabled persons;
- Is obliged to inform the regional branch of National Construction Supervision Directorate (NCSD) of any breach of the technical norms and regulations it has identified in the course of the construction works;
- Is authorized by law to certify the order book for the construction works and to issue mandatory instructions and orders to the contractor, that can be appealed within 3 days before NCSD;
- Must sign almost all of the acts and protocols executed in the course of the construction works and issue a final report to the investor upon their completion;
- Is jointly liable with the contractor for any damage resulting from breach of the technical norms and regulations, or deviation from the approved designs.

When appointing a consultant, investors should bear in mind that a consultant cannot act as a supervisor or carry out the compliance evaluation of designs for projects in which it or its employees or related parties are involved as designers, contractors or suppliers.

### *Structural engineer*

The structural engineer is an individual possessing the special capacity for exercising technical control over the structural part of detailed project designs (technical and execution designs). He must also countersign the “as-built” documentation. The structural engineer should be included in a promulgated in the State Gazette list, prepared and updated annually by the Chamber of Development Design Engineers. According to amendments of the TDA, effective from 23 February 2010, the activities of the structural engineer can be performed by individuals entered in a relevant list or register kept by respective competent authority in a Member State or in a State part of the European Economic Area.

### *Technical controller*

The technical controller is an individual with technical education managing the execution of the construction works on behalf of the contractor. If the works are executed by the investor himself, he is obliged to appoint a technical controller. Technical controllers are also responsible for the supervision of projects in category V, where no consultant has been appointed by the investor.

### *Insurance*

Designers, consultants, contractors, structural engineers and supervisors are obliged to insure for professional liability for damage caused as a result of unlawful acts or omissions in the course of the fulfillment of their obligations. A special Ordinance determines the minimum liability limits under the insurance policies for different participants in the construction process and for different categories of construction projects.

As the mandatory insurance covers the minimum liability of the insured under any project in which it participates during its term of validity, the investor may, in its contracts with the respective project participants, require that they undertake additional insurance especially for their own project. Extended insurance coverage (e.g. contractor’s-all-risks,), if required by the investor, has to be agreed contractually, as it is not mandatory under the law.

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