Brainport: the creative mainport?
Is the creative industry-concept a logical step towards the development of the brainport-concept?

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Abstract

The central issue in this paper is the hypothesis that creative industries are an important means to realize the transformation from mainport to brainport, first by their forward linkages; the supply of output of creative industries located in the city of Rotterdam to the mainport businesses, and second by the effects on the attractiveness of the city of Rotterdam to act as a magnet on advanced logistics firms, active in supply chain management and other high-profile logistics activities. The Rotterdam-based creative industries might act as a source of innovation for the stagnating mainport-complex, and may provide the mainport of new growth directions. In the paper we start with a definition of the concepts of mainport, brainport and creative industries. Next, we describe the relation between the mainport and the port-city by making a comparison between mainport Schiphol, located near Amsterdam – a city with a large concentration of creative industries – and mainport Rotterdam. In addition we present the details of the creative industries both in the Rotterdam and Amsterdam region, and try to relate the forward linkages of the creative industries based in the Rotterdam region with the mainport-complex. We conclude that the Rotterdam based creative industries aren't very likely to give an impulse to the mainport, in which brainport functions will increase. This is because of the limited linkages between the port and the city, the limited impact of cultural industries in the city of Rotterdam and the attractiveness of Amsterdam with respect to both abundant creative industries and a mainport-environment. For mainport Rotterdam, creative industries are of no importance to act as a means of initiating a transformation from mainport to brainport. This transformation should be realized from within the brainport.

Keywords: mainport, brainport, creative industries, Rotterdam, Amsterdam

Introduction: Mainport Rotterdam under stress

Many seaports in Europe realized a spectacular development during the 1950-70s. Impressive 'Maritime Industrial Development Areas' were constructed and value added, employment and cargo throughput related to these seaports increased year by year. Seaports were considered regional-economic 'engines-of-growth'. Since the 1970s however, seaport development slowed down and traditional seaport cities like Le Havre, Marseilles or Rotterdam could not longer rely on their port-complex as the prime source of economic development for the port-city or region.

The city of Rotterdam is an excellent example of this trend. Rotterdam is dominated by its seaport. The port of Rotterdam was the largest port in the world during the period 1965-2003, as measured by tonnes of cargo transferred through the port. In 2004 the port of Shanghai became the global number one and replaced Rotterdam. In the past, during several years, ports like New York or London also were the largest in the world, but the economy of these cities wasn't dominated by their seaport. London and New York – and Shanghai at the moment – are global metropolises and the port is only one of the characteristics of these cities. In contrast, the Rotterdam port-complex is responsible for nearly twenty percent of the direct gross regional product in the port of Rotterdam region and is of considerable influence in the urban and regional economy.

Mainport Rotterdam is decreasing in importance in the Dutch economy

In the past two decades, the share of the port of Rotterdam-complex in Dutch gross national product declined from some 2,5 percent in the mid-1980s to 1,5 percent at the moment "(Port of Rotterdam 2005)." The economic performance of the Rotterdam port-complex – or 'Mainport Rotterdam' – resembles a 'snowman': the port-economy is slowly decreasing in the regional and national totals – despite the boom in container-handling. The dominant industries in the port – stevedoring, the production of commodity chemicals, oil refineries – face low growth during the last three decades and have invested very heavily in capital goods, resulting in an outflow of process operators and dockworkers. Direct port-related employment in Mainport Rotterdam declined from 73 thousand employees in 1988 to 58 thousand in 2004 "(Port of Rotterdam 2005)."

The Rotterdam-economy as a whole is also declining in importance, the share of the Rotterdam region in Dutch GNP declines from 9,5 percent to 8,8 percent in the period 1988-2000 "(OBR 2004)." This relates to the declining importance of the Mainport in the regional economy, but the Rotterdam economy also faces some structural problems: growth in employment is slow, the share of unemployed in the total Rotterdam working population, the number of poor residents, low educated residents and low paid jobs in the city all are very high. "Rotterdam is heading the wrong lists" became a well known slogan stressing the poor socio-economic performance of the city.

Also the environmental performance of Mainport Rotterdam is poor. Besides the emissions, noise and sound-levels characteristic for a very large industrial seaport, the Rotterdam region is confronted with negative externalities related to the growing use of trucks for the distribution of chemical and other products. Recently, the air pollution from sea ships is recognized as a major source of emissions. According to "EEB et al (2004)", by 2020 the emissions from international shipping around Europe will have surpassed the total from all land-based sources in the 25 EU member states combined.

New growth and dynamism: from mainport to brainport

During the past decades, several initiatives have been undertaken to reverse the trends described. One of the most ambitious efforts is related to the transformation of the 'mainport' into a 'brainport' – the transformation of the capital-intensive port-economy dominated by mass-production practices towards a knowledge intensive port-economy dominated by flexible and consumer oriented production practices and by the production of value-added services "(Kuipers 1999)."

As a policy concept, the brainport had a dominant position in a policy paper published in 1997 by the Dutch Ministry of Spatial Planning, called the 'Environment and Economics Policy Document' ('Nota

Milieu en Economie' "(Ministerie van VROM et al 1997)"). In this document the brainport-concept was seen as a means to realize a so called 'double objective' in seaport regions: more economic growth with less negative environmental impact. Knowledge-intensive seaport functions like chain-management, 3/4PL-services, forwarding, ship-brokering, marketing activities, research & consulting, ICT-related activities and head offices were seen as activities having the potential to realize this 'double objective'. In general, these knowledge-intensive activities in the logistics industry have a high growth rate, together with a relatively low environmental impact. They are therefore well suited to realize the double objective. In the brainport-vision, mainports should transform into brainports or, mainports and brainports should reinforce each other to realize this double objective.

The brainport-concept lost its potential for policymakers

Nearly ten years after de brainport-initiative, the 'double objective' is not realized. The environmental conditions didn't show a clear improvement "(ROM Rijnmond 2003)" and the economic performance of Mainport Rotterdam continued to be poor, as compared to other Dutch cities and regions "(OBR 2003)." The transformation from a mainport towards a brainport is a topic that lost its attraction to policy makers and is not used in recent policy documents in the Netherlands related to the future of the mainport ('Nota Ruimte' en 'Nota Mobiliteit') or in the new port strategy of the port of Rotterdam for 2020. In addition, the brainport-concept lost its focus with respect to seaport areas and nowadays is aimed at 'high-tech locations' like the city of Eindhoven, which adopted the brainport-concept to stress the importance of the R&D-campus of Philips Electronics and the Technical University of Eindhoven.

Next to this loss of the maritime brainport-concept, a new policy concept has entered the scene: the creative industry. 'Creative industries' showed high growth, in particular in the urban environment. Like the mainport, the creative industry-concept also became an important policy concept and is used by a number of important Dutch cities. An important background was the provocative book of "Richard Florida (2002)."

Creative industries as a means to realize the brainport-concept

In our contribution, we start from the hypothesis that the creative industry-concept has the potential to act as a logical step towards the development of the brainport-concept in large port-cities. The creative industry-concept might be used to start the transformation from the mainport towards the brainport (or the 'creative mainport'). These creative industries offer the mainport the much needed innovations, and creative solutions to be able to realize new growth directions.

Next, knowledge intensive logistical services related to the brainport function are to a certain degree related to 'creative business services' like advertising, design or architecture. In the logistics industry concepts like the 'supply chain director', 'logistics network manager' or the 'logistics orchestrator' "(Vermunt & Binnekade 2000)" are an illustration of the creative content of this top end of the industry. These 'supply chain designers' are developing supply chain solutions for large industrial firms or for logistics service providers and share to a certain degree the same characteristics with respect to the location of their offices as creative industries.

London is a prominent example of a brainport-cluster; a concentration of maritime publishers, advertising agencies, consultants, research institutions and other specialized professional services for the maritime industry. In London the transformation from a mainport towards a brainport has been realized.

We continue this article with a clear definition of the three concepts mainport, brainport and creative industry. Next, we will analyze the dynamics of the Rotterdam urban economy and the relations of the city-economy with the port-economy. In addition we will assess the functioning of the three concepts (mainport, brainport and creative industry) in policy making in Rotterdam. We will conclude with a clear view on the potential of the creative industry as a policy concept, to be used in the transformation of the mainport towards the brainport.

We think the lessons learned from the Rotterdam case might be of interest for other port-cities, struggling with the same need for a transformation towards new urban and port-functions.

Mainport, brainport and creative city

The mainport-concept: both a transport and regional economic concept

"A mainport is a central port in a continent to which the most important intercontinental transport flows are directed and from which additional inland distribution aimed at the particular continent is realised". The Dutch "Ministry of transport (1988)" used this definition in its Second Traffic and Transport Structure Plan. This definition stresses the function of the mainport as an intercontinental transport node. Next to being a very large transport node, the mainport is also considered as a location for port-related industrial and service activities, with related backward and forward linkages. This perspective originates from the 'classical' regional function of the seaport as a 'break-of-bulk location', 'growth pole' "(Dicken & Lloyd 1990)" or 'maritime industrial development area' (MIDA) "(Vigarié 1980)."

The main policy indicators related to the mainport as a location for port-related and linked activities are employment and added value. Usually the added value and employment figures related to the port complex – including backward and forward linkages – are calculated as high as possible. The goal of these calculations is to convince policymakers of the economic impact of the mainport as compared to other infrastructure investment plans in the competition for government funding. The construction of a five billion Euro+ investment by the Dutch government in a dedicated rail track from Mainport Rotterdam to its German hinterland proves that this strategy has been quite successful. The maximum calculated economic impact related to the port of Rotterdam, including backward and forward linkages, is an astounding 760 thousand employees and 42 billion Euro "(NEI 1997)". The direct employment and added value is somewhat limited compared to this maximum: 58 thousand employees and 6.0 billion Euro (2004). As indicated before, employment figures are showing a downward trend, added value however is growing but reflects the sensitivity of port related activities to the business cycle and to oil prices.

The brainport-concept: towards advanced added value creation in logistics networks

The brainport-concept lacks a clear definition and is a rather fuzzy concept. "Pesquera & de la Hoz (1992)" were the first authors presenting a function for ports as the 'brains' of the total transportation network. In the view of Pesquera & de la Hoz, ports should transform from a gateway towards a logistics centre – a view similar to the mainport-brainport transformation. In this logistics centre, ports should provide flexible organisations, integrate complex chains and should develop ICT- and teleport services. By offering these brain-functions, the regional value added increases, as well as the attractiveness of the port-region as a place of doing business.

The brainport-concept used in the 'Environment and Economics Policy Document' "(Ministry of VROM et al 1997)" is related to Pesquera & the la Hoz. The brainport is seen as an addition to the mainport – "Next to Mainport-Holland also Brainport-Holland" – in a similar way compared to the transformation from gateway to logistics service centre, and should generate more added value because of the development of new advanced logistics value added services in the mainport. The brainport is aimed at increasing the knowledge-content in the mainport environment. Because of the increase in the number of knowledge intensive function, the amount of value added per unit pollution by the mainport-system rises.

In the Environment and Economics Policy Document, the transformation from mainport towards brainport should be realised by increasing attention paid to supply chain management practises, advanced logistics concepts like value added logistics and postponed manufacturing, by new ICT-tools increasing the efficiency of transport operations and by the foundation of a knowledge centre for the transport and logistics industry in the Netherlands. These new brainport-related functions should improve the regional attractiveness of mainport Rotterdam and should result in the location of offices in the region, filled with well-educated logistics professionals offering creative solutions for unstructured logistics problems.

A disadvantage of the brainport concept however, is the small amount of logistics orchestrators and other logistics high-end functions in the total employment of the logistics industry. "Deloitte & Touche Bakkenist (2001)" made a survey of the different business models in use by the logistics industry in the Netherlands.

Less that 0,01% was devoted to the advanced 4pl/supply chain director or logistics orchestrator business models and 99% of the logistics business – generating some 72% in turnover – relates to standard trucking services from A to B. This 0,01% of advanced logistics business models certainly will not generate a substantial amount of value added – we think this will not be more than 1-2% of the total value added in the logistics industry. This means 0.3-0.6 billion euros of a total of 31.4 billion euros (2001) "(Kuipers et al 2003)."

Creative industries: new growth potential for urban core regions

In the creative design of supply chains, together with the related ICT-architecture, the day-to-day activities of the perfect brainport employee resemble some of the professional activities characteristic for 'creative industries'. "Manshanden et al (2005)" define a creative industry "…as a specific type of economic activity producing goods and services resulting from individual or collective processes of both creative work and entrepreneurship. Content and symbolism are the most important characteristics of the goods and services produced. Creative goods and services are demanded by consumers and by the professional market because of the specific meaning and the related experience of the goods and services. This experience is related to the development of the lifestyles and cultural identities of a particular society".

Table 1: Creative industries: sectors and dominant sub-sectors

Creative industries	**Dominant sub-sectors**
The arts	Museums Art galleries The practise and production of arts for stage and theatre The practise of creative art Theatres and concert halls Services related to the practise of art
Media & entertainment	Publishers Press- and news-agencies, journalists Showing of movies Radio and television Production of movies Production of photographs Other entertainment
Creative professional services	Advertising, design and consultancy agencies Interior, fashion and other types of design firms Architectural firms and engineering offices Urban and landscape architectural design firms

Source: Manshanden et al (2005:11)

Starting from this definition, "Manshanden et al (2005)" distinguish three major creative industries: the arts, media and entertainment and creative professional services (table 1). "Manshanden et al (2005)" relate the regional-economic effects of creativity and creative industries to – also – three important effects:

1. *direct effects*: employment and value added for a city, region of country. Two main features deserve special attention with respect to creative industries: first, the large, above average growth in employment and second, the concentration of creative industries in the urban core of cities – usually low growth areas, possessing socio-economic problems.
2. *indirect effects*: creative industries act as 'pace-maker' for other industries in a city or region. This effect is related to backward and forward linkages of creative industries. Firms in creative industries use the outputs of other industries as a source for their production processes – for instance: painters need paint to be able to produce of painting (backward linkages). This painting may be sold to a port baron[1] (forward linkages).

[1] Port barons played an important function in the forward linkages from creative industries in Rotterdam. The museum Boymans-Van Beuningen is a result of this. At the moment mr. Van Caldenborgh, owner of the port-based petrochemical company Caldic is one of the top collectors of contemporary art in the Netherlands.

3. *effects on the attractiveness of cities*: creative industries act as a magnet for other creative and knowledge intensive activities. The presence of creative industries in a city is an important characteristic of the image of the city as a place of doing business. Cities investing heavily in cultural facilities, and in which creative industries are playing an important economic function, show as a result a more innovative economy – compared to other cities, not giving creative industries such an important function with respect to urban policymaking.

Creative industries: source of innovation for the stagnating mainport-complex

The hypothesis of our contribution is that creative industries are an important means to realise the transformation from mainport to brainport, first by their forward linkages; the supply of output of creative industries located in the city of Rotterdam to the mainport economy, and second by the effects on the attractiveness of the city of Rotterdam to act as a magnet on advanced logistics firms, active in supply chain management and other high-profile logistics activities. Creative industries might act as a source of innovation for the stagnating mainport-complex, and may provide the mainport of new growth directions.

To be able to assess the function of creative industries in the transformation from the mainport towards the brainport, we present an overview of the Rotterdam port-economy and the relation between the port and the port-city. We describe the structural characteristics of the city of Rotterdam together with data on the city of Amsterdam: both cities posses a mainport, but Amsterdam shows, compared to Rotterdam, a much more dominant complex of creative industries and a much better regional-economic performance.

The relation of mainport and port city: evidence from a comparison of Mainport Rotterdam and mainport Schiphol/Amsterdam Airport

The mainports in the regional economy of Rotterdam and Amsterdam

For quite a long time, the regional economy of Rotterdam has been regarded as being heavily dependent on the (main)port. Like stated before, the presence of the largest port in the world, generating large flows of goods, resulted in a regional economic port-complex. Since the 1980s, regional economic and sector policies in the Netherlands have promoted the further development of the port, thereby using the concept of the mainport as a regional economic growth-engine, presented above.

Table 2: Regional economic structure of region “Groot Rijnmond” (Mainport Rotterdam) and region “Groot Amsterdam” (Mainport Schiphol/Amsterdam Airport), 1997, gross regional production and specialization index (100 = proportional to average Dutch ratio)

	Gross Regional Product (bln Euro)			**Specialization**	
	Groot Rijnmond	Groot Amsterdam	The Netherlands	Groot Rijnmond	Groot Amsterdam
Agriculture	1.0	0.7	20.5	47	27
Manufacturing	20.3	15.4	188.4	110	61
Construction	4.2	4.5	47.2	90	71
Public utilities	1.6	1.9	16.6	97	87
Consumer services	4.5	9.2	61.1	75	113
Trade and transport	11.1	18.3	80.3	141	170
Professional+financial services	8.3	18.2	86.1	98	158
Exploitation real estate	2.8	3.9	32.1	89	91
Non profit	6.9	10.7	86.7	82	93
Total	60.5	82.9	619.1		

Source: “Manshanden et al (2002)”

The Netherlands has two mainports: the port of Rotterdam and Schiphol/Amsterdam Airport. Both mainports have a strong international position, resulting from the comparative advantage of the

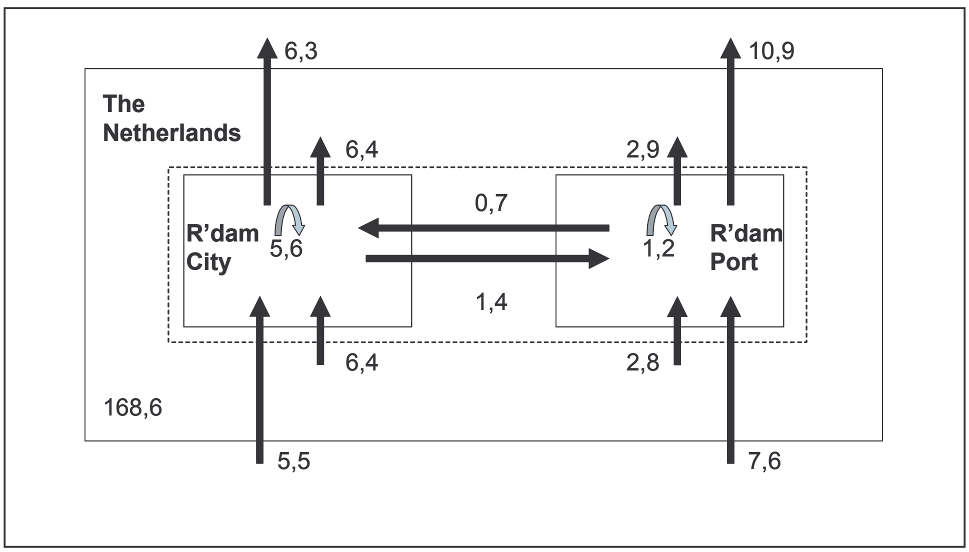
Netherlands: centrally located in Europe and a specialization in trade, transport, wholesale and financial activities.

Before we go to the issue of the functioning of creative industries to be able to make the transformation from mainport to brainport, the issue of economic benefits from the mainport is the focus. From a research project on the comparison between the regional economies of Rotterdam and Amsterdam by analyzing bi-regional input-output tables, we derived some important conclusions on the economic functioning of the Rotterdam economic region "(Manshanden et al 2002)."

The Rotterdam-economy has a more dominant international orientation compared to Amsterdam

The region of Rotterdam has far stronger economic relations with the rest of the world, based on import and export flows (figure 1), compared to Amsterdam. Because of the presence of international tourism and international head-offices, the Amsterdam region possesses a strong metropolitan urban atmosphere. The expenditures by tourism and head-offices however have a strong *local* impact on all kinds of nearby services. The port of Rotterdam, in contrast, has big flows of transactions with the world and with the rest of the Dutch economy – and not so much with the local economy of the city of Rotterdam (figure 1). This is caused because the large flows of goods handled by, and processed in the port do not necessarily result in expenditures in the city of Rotterdam. Intermediate deliveries from the port to the city are very small compared to the total of intermediate linkages: only 0.7 billion euro. The deliveries from the city to the port are twice as much: 1.4 billion euro – but stay small compared to the total (figure 1).

Figure 1: Intermediate linkages port of Rotterdam, city of Rotterdam, remaining Dutch economy, import and export flows, bln Euro (1997).



Source: "Manshanden et al (2002)"

When going into detail, professional & financial services are the most important sectors located in the city of Rotterdam and supplying the mainport, manufacturing comes next and public utilities and consumer services also are important (table 3). Within the mainport, two – obvious – sectors in the mainport are most important as a source of the deliveries from the city: manufacturing and trade & transport.

The deliveries from the mainport to the city are small (table 4). Only manufacturing and public utilities are significant, and only the manufacturing sector located within the city receives a significant amount of supply originating from the mainport.

Table 3: Deliveries from the city of Rotterdam to mainport Rotterdam by sector, 1997, billion euros

To the mainport / **From the city**	Agriculture	Manufacturing	Construction	Public Utilities	Consumer services	Trade+ transport	Prof.+finan. services	Exploitat. real estate	Non profit	Total
Agriculture	0	0	0	0	0	0	0	0	0	0
Manufacturing	0	0.3	0	0	0	0	0	0	0	0.3
Construction	0	0	0	0	0	0	0	0	0	0.1
Public utilities	0	0.1	0	0.1	0	0	0	0	0	0.2
Consumer services	0	0	0	0	0	0.1	0	0	0	0.2
Trade and transport	0	0	0	0	0	0.1	0	0	0	0.1
Professional+financialservices	0	0.2	0	0	0	0.2	0	0	0	0.4
Exploitation real estate	0	0	0	0	0	0.1	0	0	0	0.1
Non profit	0	0	0	0	0	0	0	0	0.1	0.1
Total	0	0.6	0	0.1	0	0.6	0	0	0.1	1.4

Source: “Manshanden et al (2002)”
Note: figures are round up, so cells summed up may differ from totals

Table 4: Deliveries from mainport Rotterdam to the city of Rotterdam by sector, 1997, billion euros

To the city / **From the mainport**	Agriculture	Manufacturing	Construction	Public Utilities	Consumer services	Trade + transport	Prof.+finan. Services	Exploitat. real estate	Non profit	Total
Agriculture	0	0	0	0	0	0	0	0	0	0
Manufacturing	0	0.1	0	0	0	0	0	0	0	0.2
Construction	0	0	0	0	0	0	0	0	0	0
Public utilities	0	0	0	0.1	0	0	0	0	0	0.2
Consumer services	0	0	0	0	0	0	0	0	0	0
Trade and transport	0	0	0	0	0	0.1	0	0	0	0.1
Professional+financialservices	0	0	0	0	0	0	0	0	0	0.1
Exploitation real estate	0	0	0	0	0	0	0	0	0	0
Non profit	0	0	0	0	0	0	0	0	0.1	0.1
Total	0	0.2	0	0.1	0.1	0.1	0	0	0.1	0.7

Source: “Manshanden et al (2002)”
Note: figures are round up, so cells summed up may differ from totals

The manufacturing industries, relatively strong in the Greater Rotterdam Area, have an international character due to the fact that they produce tradable and transportable goods. Production and consumption take place at different times in different places. Because a large share of the Rotterdam regional economy consists of those manufacturing industries with direct import and export flows, local economic transactions are relatively small compared to the size of regional economy.

Local expenditures of the manufacturing industries in the Amsterdam area, being smaller in size compared to the Rotterdam manufacturing industries (table 2), are in absolute terms just as big as those of the industries in Rotterdam. This difference is merely due to the composition of the manufacturing industries; in Rotterdam it is large scale, capital intensive chemical and oil refinery industry. In Amsterdam it is publishing, pharmaceutical and agrobusiness (wheat and corn mills) and steel mills. Industrial composition in Amsterdam is more diversified than in Rotterdam. This also helps to understand why manufacturing industries in Rotterdam have less ties with the regional economy and have more relations with the rest of the Netherlands and the rest of the world. By the same token, the rate of spending of the Rotterdam manufacturing industries to the local service industries is smaller compared to Amsterdam.

In sum, the linkage between the manufacturing industries and the service industries in Rotterdam economy is weak. The same applies for the relations with the consumer services; the expenditures from the producer services to consumer services in Rotterdam are absolutely and relatively smaller.

Local linkages between sectors in the Rotterdam-economy are small

The service industries complex in Rotterdam is small compared to Amsterdam (table 2), and has relatively the same rate of expenditure in the local area, but the absolute amount of money that professional services are spending in the local Rotterdam economy is much smaller. To remind: in absolute terms, both regional economies do have a comparable magnitude (table 2). At the other hand, the number of transactions between manufacturing industries in Rotterdam is large. It mainly concerns the deliveries between the oil refinery and chemical industries. But these deliveries to a large degree are in-company transactions (for instance the Shell and Exxon complexes in the Rotterdam region).

It is concluded that the local linkages between sectors in Rotterdam are smaller than in Amsterdam. This is caused by the sectoral composition of the regional economy. Accordingly, it is probable that there is a agglomeration effect: if local expenditures are large, supply of services is larger and more diversified. This results in cumulative causation: the larger the supply of services, the more firms will be inclined to subcontract.

The growth difference between Rotterdam and Amsterdam is not only to be explained by the growth difference between the two urban areas. The growth difference, caused by the sector composition, is enhanced by the larger local backward linkages of sectors in Amsterdam. This mainly favors labor-intensive industries in Amsterdam. In Rotterdam this local backward linkage is weaker. The large sectors in Rotterdam do not growth fast, and by the same token have a local multiplier. So, the local effect of any impulse in Rotterdam is dampened, whereas in Amsterdam it is stronger. Weak impulses do have strong effects there, whereas in Rotterdam strong impulses have weak effects. In reality, the impulse is weak in Rotterdam and strong in Amsterdam.

The port and city of Rotterdam are functioning quite apart from each other

In terms of gross production – that is, intermediate deliveries are included – the urban economy of Rotterdam and surroundings is twice as large compared to the mainport Rotterdam – 41.5 and 19.0 billion euro respectively. However, it is mainport Rotterdam that has the strong linkages with the rest of the world. The port related sectors account for 31% of regional production, but for 63% of exports produced by the regional economy.

In perspective, the most striking key characteristic is that port and city of Rotterdam do function quite apart from each other, they have weak ties and a different spatial scope. The city of Rotterdam is characterized by a local economy with intertwined sectors. The port is characterized by national and – especially – international linkages.

With these two subsystems in mind, the potential for creative industries, located in the city of Rotterdam, to give an impulse to the mainport is rather limited because of the small amount of linkages and because of the relative separately operating port and city economic systems. The financial services sector and business sector in the city deliver each other for 0.9 billion euros, but deliver only 0.4 billion euros to the port (0.4 billion of the total of 1.4 billion – table 3). Internal deliveries in the port-complex are 1.2 billion euros: five times smaller than the total of internal deliveries in the city – 5.6 billion euros (figure 1).

The urban economy of Rotterdam has a far more complex economic structure than the port. If we focus on internal urban deliveries, the financial sector, together with business services, are the backbone of Rotterdam's urban economy. In contract, the port has a far more simple economic structure, with large (in-company) deliveries between manufacturing industries (oil refinery and chemical) and transport/wholesale services. From the internal deliveries between port and city, only 10-15% is between port and city (and vise versa), the other 85-90% goes to the rest of the Netherlands and abroad, or to the own region (city to city or port to port).

In the linkages between port and city we see again the difference between the Amsterdam economy and Rotterdam. The important oil refinery, chemical industries and transport services together are dominating the port-economy. The characteristics of the linkages of those industries explain the relation city-port. Except for the linkage between industries and transport services, is the supply of urban financial and business services to industries and transport in the port the most important linkage between the urban and port economy. Compared to the Amsterdam economy, Rotterdam lacks a large service complex, demanding lots of other services – for example head-offices that demands advertising.

Based on the dynamics of the Rotterdam port and city, the potential for creative industries to be able to influence the mainport economy and to become a source of innovation, creativity and advanced value added is rather limited. The transformation from mainport to brainport by means of indirect economic relations of creative industries will be difficult. Amsterdam has much better perspectives for a transformation of the Schiphol-mainport to a brainport because of the larger importance of linkages and the more diversified economy. In the next paragraph we present the characteristics of the creative industries in the Rotterdam and Amsterdam economy, based on recent research projects aimed at creative industries in both cities (Manshanden et al 2005; Rutten et al 2004).

Creative industries in the Rotterdam and Amsterdam regions

The economic impact of creative industries in the Rotterdam-region is relatively limited, both in absolute employment and value added figures, as compared to Amsterdam and the Dutch economy as a whole (table 5). In terms of employment and value added, Amsterdam is nearly three times as big as Rotterdam. Bearing in mind the tendency of creative industries to be located in the large urban environments, the performance of Rotterdam is poor – just above the share of creative industries in the total Dutch economy.

Table 5: The economic impact of creative industries in Rotterdam, Amsterdam and the Netherlands, full-time jobs and value added, 2003

Creative industries	**Employment**			**Value added**		
	x thousand			*x billion euro*		
	Rotter-dam	Amster-dam	The Nether-lands	Rotter-dam	Amster-dam[a]	The Nether-lands[a]
The arts	2.0	7.7	31.0	0,1	0.3	1.2
Media & entertainment	3.4	11.7	65.5	0,1	0.5	2.6
Creative professional services	5.0	9.9	94.0	0.2	0.4	4.0
Totals creative industry	10.3	29.3	190.5	0.4	1.1	7.9
Totals regional economy	316.3	418.2	6544.5	19.1	24.7	409.8
Share creative industries (%)	3.3	7.0	2.9	2.2	4.4	1.9

Source: (Manshanden et al 2005; Rutten et al 2004)
[a] 2002.

When looking at the growth-rate of creative industries in Rotterdam, Amsterdam and the Dutch economy as a whole, Rotterdam is catching up (table 6). Especially in the media and entertainment sector, growth in Rotterdam is impressive, in particular compared to the growth in media and entertainment in Amsterdam and the Netherlands as a whole.

Table 6: Average yearly job creation in creative industries in Rotterdam, Amsterdam and the Netherlands, 1996-2003.

Creative industries	**Rotterdam**	**Amsterdam**	**The Netherlands**
	%		
The Arts	8.5	10.1	7.2
Media & entertainment	13.3	1.1	3.3
Creative professional services	5.2	7.4	4.1
Totals creative industries	**8.0**	**5.1**	**4.3**
Total regional job creation	2.7	3.5	2.3

Source: "Manshanden et al (2005)"

In Rotterdam, the creative professional services show the largest share of the total (table 7), with nearly half the employment – 48 percent, meaning 5.0 thousand employees. Within the creative profession services, architectural firms and engineering offices are dominant with an employment of 2.7 thousand employees. This relates to Rotterdam as the location of offices of the most well-known architects in the Netherlands (OMA, MVRDV) as well as engineering services for the petrochemical complex.

When relating the forward linkages of the creative industries to the important other industries in the Rotterdam regional-economy, a more detailed picture emerges of the intermediate linkages of the creative industries based in the Rotterdam-city towards the dominant port-industries manufacturing and trade & transport (table 3).

There is a strong demand for the output of the creative industries in the Rotterdam region itself: 32% of the output of creative professional services, and 27% of both media & entertainment and the arts is demanded in the Rotterdam region. For the creative industries as a total this percentage is 28% – in general the output of products and services produced as well as consumed in the Rotterdam region is only 15%. "Manshanden et al (2005)" therefore conclude that the creative industries in the Rotterdam region have a strong regional orientation, compared to other industries.

Table 7: Employment in subsectors in the total creative industries in Rotterdam, Amsterdam and the Netherlands, 2003.

Creative industries	**Rotterdam**	**Amsterdam**	**The Netherlands**
	%		
The Arts	19.1	26.5	16.3
Media & entertainment	32.9	39.9	34.4
Creative professional services	48.0	33.7	49.3
Totals creative industries	**100,0**	**100,0**	**100,0**

Source: "Manshanden et al (2005)"

The major consumers of the services and the products of the creative industries *within* the Rotterdam region are the manufacturing, trade and distribution and professional services (table 8). Manufacturing and trade and distribution, however, are important mainport-related industries. Especially, demand for creative professional services by these sectors is relatively high.

In perspective, with a total value added of 0.4 billion euros (table 5), the economic impact of creative industries in the Rotterdam region is not very impressive yet – despite its fast growth rate. Nearly a third of the output of the Rotterdam based creative industries is consumed within the region. We estimate that also nearly a third of this regional consumed 'creative output' is consumed by mainport related firms, in the manufacturing, trade and distribution sectors. This relates to a maximum turnover of something like 0.1 billion euros – too small to be of decisive importance in the mainport economy, realizing inputs totaling some 11.8 billion euros (figure 1), and a value added of 6.0 billion euros.

Table 8: Regional markets in the Rotterdam-region ("Groot-Rijnmond") for the creative industries (1996)

Economic sectors	**The arts**	**Media & entertain ment**	**Creative profession al services**	**Totals creative industry**
	%			
Creative industries	21	13	3	10
Agriculture	0	0	1	0
Manufacturing	9	21	28	22
Trade and distribution	10	15	22	17
Financial services	2	7	8	6
Professional services	20	23	21	21
Consumer services	4	7	8	7
Non-profit+other services	35	14	10	16
Total	**100**	**100**	**100**	**100**

Source: "Manshanden et al (2005)"

In addition, this small amount of 'creative turnover' produced by the creative industries located in the city of Rotterdam and used by the mainport-complex will be dominated by engineering and architecture firms. Those engineering projects for sure will not – or to a very limited amount – contain the content and symbolic characteristics that were defined as being most important for the output of creative industries – these outputs certainly have very little resemblance with the lifestyle and cultural identities of a particular society.

The Rotterdam-based creative industries are growing very fast, but the share of the creative industries in the total Rotterdam-economy is not significantly higher than the share of creative industries in the national total. We think that the effect of the Rotterdam creative industries to act as a magnet on advanced logistics firms, active in supply chain management and other high-profile logistics activities will not be very powerful.Top-end, creative logistics service providers, searching for a creative environment combined with a mainport-complex, certainly will favor Amsterdam with respect to their location.

Conclusion and discussion

The hypothesis we used in this paper is that creative industries are an important means to realize the transformation from mainport to brainport, first by their forward linkages; the supply of output of creative industries located in the city of Rotterdam to the mainport businesses, and second by the effects on the attractiveness of the city of Rotterdam to act as a magnet on advanced logistics firms, active in supply chain management and other high-profile logistics activities. Creative industries might act as a source of innovation for the stagnating mainport-complex, and may provide the mainport of new growth directions.

By analysing the intermediate linkages between the port of Rotterdam and the city of Rotterdam we concluded that these linkages were small, compared to the Amsterdam region, but also compared to the linkages between the port and the city to the rest of the Netherlands and to sources of demand and supply abroad. We observed as a striking characteristic that port and city of Rotterdam are functioning quite apart from each other – they have weak ties and a different spatial scope. The city of Rotterdam is characterized by a local economy with intertwined sectors. The port is characterized by national and – especially – international linkages.

With these two relatively divided subsystems in mind, the potential for creative industries, located in the city of Rotterdam, to give an impulse to the mainport-complex is rather limited because of the small amount of linkages and because of the relative separately operating port and city economic systems.

Next, with a total value added of 0.4 billion euros, the economic impact of creative industries in the Rotterdam region is not very impressive yet – despite its fast growth rate. Nearly a third of the output of the Rotterdam based creative industries is consumed within the region. We estimated that also nearly a third of this regional consumed ‘creative output’ is consumed by mainport related firms, in the manufacturing, trade and distribution sectors. This relates to a maximum turnover of something like 0.1 billion euros – too small to be of decisive importance in the mainport economy, realizing inputs totaling some 11.8 billion euros and a value added of 6.0 billion euros.

In addition, we think that the effect of the Rotterdam creative industries to act as a magnet on advanced logistics firms, active in supply chain management and other high-profile logistics activities will not be very powerful.Top-end, creative logistics service providers, searching for a creative environment combined with a mainport-complex, certainly will favor Amsterdam with respect to their location.

Creative industries therefore are of no importance to act as a means of initiating a transformation from mainport to brainport. This transformation should be realized from within the mainport or from transfers from abroad or the rest of the Netherlands. The creative impulse occurring at the moment within the city of Rotterdam – not only noticeable in the growth figures of these services in the city of Rotterdam, but also in certain parts of the city (Witte de With area, Zeehavenkwartier, Lloydkwartier, Delfgaauwstraat) – is of very little importance to the much needed transformation of the mainport-complex.

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