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Understanding Dynamic Linkages and Technology Spillover from Korea's Masan Free Export Zone

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Abstract

Drawing upon the wealth of literature previously written about the Masan Free Export Zone (MAFEZ), this thesis will disentangle the conflicting information and hypotheses about the some of the zone's 'welfare benefits.' That is, the thesis will examine production linkages and technology spillover from the export processing zone (EPZ) itself to the greater economy. The vast literature already written on this subject is divergent, to say the least, and much of it is inconsistent with simple facts available in archival materials and exhaustively compiled statistical evidence. Therefore, this thesis will examine the extant literature on the zone and compare this with archival material gathered in South Korea to reinterpret the facts through a more holistic and inter-disciplinary lens. This thesis will demonstrate that the establishment of MAFEZ was successful in creating such welfare benefits to the domestic Korean economy outside of the zone, and that such success was mostly policy-induced. Chapter One will introduce some of the divergent ideas and academic controversies about EPZs in general and MAFEZ in particular. Chapter Two will give a brief history of Korea's export-oriented industrialization drive, and how Korean Industrial Estates (IEs) and EPZs figured in this drive. It will also delineate important political and economic differences between Korean IEs and EPZs. Chapter Three will examine in detail production linkages from MAFEZ. Chapter Four will study technology spillover from the zone and the impact of such spillover. This thesis will conclude with an overview of the argument and an explication of some of the problems that MAFEZ, as a development tool, faced during its evolution and expansion.

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Introduction

In South Korea, amongst other 'Asian Tiger' countries, Export Processing Zones[1] (EPZs) have played an important role in liberalizing markets, and in promoting modernization and socio-economic change. In the Republic of Korea (ROK), starting in the early 1970s, EPZs catalyzed the establishment of unions, capacity-building projects, technology transfer, development of essential workforce skills, and the opening of formerly protected domestic industry (Amsden, 1989 and 1990; Cumings, 2005; E.M. Kim, 1987; K.K. Cho, 1990;).

Much ink has been spilled concerning the effectiveness of EPZs in Korea and throughout the world in spearheading national export promotion policies (Amirhamadi and Wu, 1995; APHD, 1986; Basile and Germidis, 1984; Engman *et al.*, 2007; ESCAP/UNCTC, 1985; International Labour Office, 2003; ILO, 1988, 2008; Jayanthakumaran, 2003; Kreye *et al.*, 1987; Madani, 1998a, 1998b; Radelet *et al.*, 1997; Rhee *et al.*, 1990; UNIDO, 1976; UNIDO, 1980b; UNCTC/ILO, 1988; etc.), and, when successful, whether their success in this regard is due to policy measures or market pressures (Basile and Germidis, 1984; ESCAP, 2005; Keesing, 1990; McAleese and McDonald, 1978; UNCTC/ILO, 1988; UNIDO, 1993; etc.). On the subject of the Masan Free Export Zone (MAFEZ), the first Korean Export Processing Zone (EPZ), established in 1970, scholars most commonly debate the 'welfare effects' (see, e.g., Warr, 1989a,

[1] The term 'export processing zone' is often used as a blanket term meaning any industrial estate with special regulations governing the zone to encourage FDI and exports. There are other related terms such as 'free trade zone,' 'free export zone,' 'special economic zone,' 'free zone,' etc. The difference between them is mainly semantic. In this thesis 'export processing zone' will be used interchangeably with all of these. It is also important to note that since EPZs have such special regulations governing business interactions, which regular industrial estates do not, EPZs and industrial estates should be considered different entities and will be treated as such in this paper. The difference between EPZs and industrial estates in Korea will be clearly defined in Chapter Two.

1989b, 1990; Rondinelli, 1987; Basile and Germidis, 1984; Bartik, 1991; Ge, 1995; Miyagawa, 1986; Young and Miyagawa, 1987; UNCTC/ILO, 1988; Jayanthakumaran, 2003; Beladi and Marjit, 1992; Devereux and Chen, 1995; Hamada, 1974; Wong, 1986; Spinanger, 1984; Chen, 1993; etc.) of the establishment of the EPZ. That is, they question whether the zone has increased wealth in the region, especially through employment effects, the stimulation of raw materials' and other inputs' production, entrepreneurship in support industries, and technology transfer.

One way of measuring all of these welfare effects is by analyzing production linkage effects, and technology and knowledge spillover. Simply, such linkages refer to the extent to which zone manufacturers purchase raw materials or intermediate goods from local suppliers through subcontracting, supply procurement, or other forms of 'production sharing'[2]. Spillover refers to technology or knowledge transfers between EPZs and the greater economy through sharing of advanced production technology and knowledge about its production and use, and through formal and on-the-job vocational training. However, even the literature on production linkage effects and spillover from EPZs is contradictory – there seems to be no consensus on how such spillover and linkages help developing economies. This is certainly because, as Seyenne and Manyak (2004)[3], demonstrate, the degree to which technology is transferred and production spillover crystallizes differs significantly between nations. The diversity of EPZs

[2] 'Production sharing' was first coined by Peter Drucker in an article published in *the Wall Street Journal* in 1977. It specifically refers to the sharing of production processes between two or more countries. Since the establishment of EPZs involves the relocation of foreign firms to a manufacturing enclave in a (usually) developing nation, and since these firms employ local labour and inputs directly and indirectly through subcontracts, the production process is demonstrably shared between two countries. The term 'production sharing' will be used in this paper to refer to the division of production between EPZ firms and local, non-EPZ firms.

[3] These scholars studied EPZs in seventy-two countries and found that technology transfer, employment effects and production spillover vary significantly between nations.

throughout the world defies such a generalized approach, and such zones should be studied on a case by case basis. As such, lessons may be learned about the successes or failures of particular zones and distinctive lessons can be passed on to other nations experimenting with EPZs as development tools not as doctrine but as cautionary tales or success stories.

Even in the case of MAFEZ, academics seriously disagree on the manner in which such linkages may have benefited the Korean economy in its push from import substitution industrialization (ISI) to export-oriented industrialization (EOI). For example, some scholars feel that strong linkages were formed between Korean EPZs and the domestic economy (Sklair, 1985; Caves, 1996; Jenkins *et al.*, 1998; Lin, 1993); others feel that few, weak linkages were formed between the zones and the Korean economy suggesting that Korean EPZs remained industrial 'enclaves' or 'islands' (Kaplinsky, 1993; Madani, 1990; Rondinelli, 1987; Schrank, 2001; UNCTAD, 1984; Warr, 1989b, 1990). Similarly, academics have argued that there have been few, if any, technology and knowledge spillover from Korean EPZs to the domestic economy (Kaplinsky, 1993; Rondinelli, 1987; UNCTAD, 1993), while others argue that there has been much spillover (Basile and Germidis, 1985; Caves, 1996; Jenkins *et al.*, 1998; Lin, 1993).

A considerable array of data has been compiled about MAFEZ over the years. This data can be confusing in that the same information has been interpreted in diverse ways, using myriad scholarly approaches from nearly every discipline in the social sciences. A more holistic approach is needed.

A significant reason that scholars from different disciplines have come up with widely divergent results and opinions on the welfare benefits of Korean EPZs is that

scholars tend to apply rigid, single-disciplinary academic models to the unique case of these zones in an attempt to understand complex economic, political and social interactions. A multi-disciplinary approach involving economic, sociological, historical, geographical and political science methodologies is more suited to an understanding of how such zones have impacted the development of Korea's economy as it developed and opened up to global production. There are also simpler, more direct methods that can be used to unravel this confusion. For example, many newspaper articles (mainly Korean) have been compiled in the archives of the MAFEZ administration, which have not been referred to at all in any of the literature surveyed. These articles provide important information about the manner in which production sharing agreements evolved, and how technology and technical knowledge were transferred from the zone to greater domestic economy. Furthermore, the abundant statistics that have been compiled about the zone might simply be interpreted directly, rather than by immediately plugging such statistics into complex economic models.

It is hard to understand the complex, multifaceted regional impact of the implantation of an EPZ in Korea by creating a highly simplified economic model[4], which

[4] A multitude of economic models have been used to interpret the welfare benefits of EPZs, most commonly, various applications of the Heckscher-Ohlin approach, which expands upon David Ricardo's theory of comparative advantage to predict commerce and trade practices and advantages in a given trading region based upon the factor endowments of that region. Hamada (1974) used the Heckscher-Ohlin model to determine that factor intensities establish the welfare effects of an EPZ. According to Hamada, EPZs are welfare-reducing in that developing countries typically have a comparative advantage in labour-intensive industries. The introduction of FDI typically means that labour is withdrawn from the domestic economy to work in the zone where capital-intensive production is normally encouraged by the host government. This damages the country's comparative advantage. The gains in national income through the zone's implantation are also offset by tax concessions given to foreign firms and unfavourable foreign exchange earnings: "Outputs move according to the absolute and relative factor endowments left for the activities in the domestic zone and national income at international prices changes by exactly the same amount as the change in the tariff revenue from the trade of final and intermediate goods. Even in the absence of the subsidization effect of the tariff wall, the potential consumption possibility for the country does not necessarily improve due to the introduction of more investment in the duty-free zone" (Hamada, 1974 240). Hamada's work has been highly contested. For example, Hamilton and Svensson (1982) argue that

is the most common approach to studying such zones. Recently, regional science scholars and economic geographers have used schematic models and commodity chain analysis to understand the complexities of how raw materials become final commodities sitting on store shelves. Such models and analyses have been applied to the study of EPZs, as well. This is also a simplification of complex realities. While such models do help in comprehending the zones and how they function, and thus should be understood, they tend to oversimplify. This paper will therefore explore the extant theories to aid in a general understanding of the subject matter, but the data on MAFEZ itself will be assessed without plugging data into economic models or geographical theorems. This approach will clearly demonstrate that many of the negative assumptions about EPZs are demonstrably untrue in the case of MAFEZ, and that despite studies asserting the

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Hamada does not take into account the fact that most EPZs have different tax regimes and flows of capital into the zone and the host country. Kaplinsky (1993) also criticizes economists such as Hamada for grossly oversimplifying the complex realities of zones. Zones differ in terms of investment incentives, varying degrees of zone insularity (the 'enclave' concept), national export promotion policies, and the geographical and economic size of the host country.

Another strongly championed argument against EPZs is the cost-benefit analysis most commonly associated with Peter Warr (1984, 1989a, 1989b, 1990, 1991, 1993). Warr uses this analysis in specific countries such as South Korea to argue that the cost of establishing crucial zone infrastructure such as ports, electricity, telephony, airports, etc., far outweigh the financial gains of the EPZs. Warr is looking at net gains in terms of national income generated directly through zone manufacturing, but does not account for gains through production sharing arrangements beyond the perimeter of the zone, and clearly does not understand the vast, pervasive technology transfer stimulated by the zone's firms. Warr states that there has been little technology transfer in the case of MAFEZ because most of the zone's firms are involved in labour-intensive production and jealously guard their "unique technological advantages" (Warr, 1984 177). He furthermore posits that the only significant technology transfer has occurred in terms of training domestic managerial staff. This will be shown to be false in the fourth chapter of this thesis.

Devereux and Chen (1997) and Johansson and Nilsson (1997) are only a few of a host of economists that strongly disagree with scholars who criticize EPZs as a development tool through using Heckscher-Ohlin or cost-benefit analyses. For example, Devereux and Chen (1997) use the same Heckscher-Ohlin approach taken by Hamada, but they plug in important variables overlooked by Hamada, such as increasing volumes of trade. Through this method, they have deduced that most zones are probably welfare-improving to host countries. Warr himself criticizes Hamada's approach, calling it "irrelevant" because "it fails to capture the international mobility of *capital goods* – which is central to the functioning of EPZs" (1989 66). Madani (1999) also criticizes Hamada's method because "it is based on the assumption of full employment while most developing countries have to deal with sometimes severe unemployment and underemployment" (Madani, 1999 83).

contrary, a high degree of production linkages have formed from the zone to the wider economy, and the zone has spurred significant technology transfer.

Chapter One will explore the vast literature on EPZs and will group the ideas they propose into manageable, coherent arguments on the welfare benefits of these zones or the lack thereof. Chapter Two will define the differences between Korean industrial estates and Korean export processing zones and will provide a brief history of export-oriented industrialization in Korea. Chapter Three will demonstrate the clustering effects created by linkages from MAFEZ in terms of benefits to the entire region in which the zone is located. These benefits include subcontracting arrangements between zone and out-zone firms, the attendant employment effects and demands for domestic inputs. Chapter Four will examine regional benefits emanating from MAFEZ through technology and knowledge spillover. That is, the result of the import of advanced technology into MAFEZ (relative to what was then available in Korea) will be analyzed in terms of a 'diffusion' of technology and the accompanying knowledge of its use into Korea in general. The diffusion of knowledge through practical use of production machinery, development of new products and vocational and on-the-job training will also be examined here. The diffusion of such knowledge to regions outside of the zone is evident in the recruiting of skilled workers throughout the country and within the zone itself.

Research Design and Methodology

Research for this paper was originally designed and carried out in three distinct stages. The first stage involved a detailed survey of the vast academic and policy literature on EPZs. This involved familiarization with the central arguments surrounding EPZs and categorizing the arguments according to basic principles. This subject matter was categorized into three large subject areas: regional industry clustering, economic linkages through zone implantation, and technology spillover from EPZs.

It was decided that only MAFEZ would be studied in detail in this thesis, though Korea's second zone, the Iri Free Export Zone (IFEZ), which is much smaller than MAFEZ, was referred to in order to provide comparable information. In addition, MAFEZ was examined from the year of its establishment to the mid-1980s only, since by that time it had "gone through the infancy stage of [its] life cycle and reached a certain level of maturity" (UNIDO, 1988 2). The MAFEZ Administration Office (1987) likewise classifies the years 1970 to 1974 as the "formative period," 1975 to 1980 as the "take-off period," and 1981 to 1986 as the "maturity period" (MAFEZ Administration Office, 1987 413).[5] By this time, the zone had been restructured significantly, as will be detailed, and stability in terms of the makeup of investment in the zone and constant and loyal relationships with subcontractors had been established.

The following key questions were asked in the first stage: what are the linkages, if any, between MAFEZ enterprises and out-zone subcontractors and raw materials' suppliers? What affected such relationships? Was there significant technology transfer

[5] Following the chronological partitions as defined by the MAFEZ Administration Office, this essay will attempt to provide data from all three stages of growth in the zone. This will give an idea of how the zone matured and the degree to which spillover and linkages formed over time. For this reason, it will be necessary to make leaps in time in this paper.

that spilled over from the implantation of the zone to the domestic economy? How did the South Korean Government's policies shape such an association? What scholarly theories could be used to understand and illustrate such relationships and spillover, should they exist?

The second stage involved field research in Korea and further enhanced knowledge of EPZs, and specifically MAFEZ, beyond that acquired in the first stage of research. Archival research was carried out at the Korean Library of Congress, the Korean Central Library, the Korean National Archives, and the Seoul National University Library. In addition, informal interviews with Korean scholars who have studied the zone (e.g. from the perspective of labour relations) also added to a greater understanding of the central questions of this project. Finally, a visit to the MAFEZ Administration Office provided an opportunity to consult informally with zone administrators and to observe first-hand the layout of the zone and the surrounding city. The Administration Office kept scrapbooks of newspaper article clippings[6] for the years studied, and these were comprehensively consulted. These records, as well as other relevant documents, were digitally photographed with the consent of MAFEZ administrators.

Primary sources such as *the Korea Herald*, the five-year economic development plans and the Korean-language regional newspapers provided the researcher with a unique perspective on central issues, such as how linkages formed between domestic and foreign firms, within and outside of the EPZ, and how technology spillover aided the development of local industry. Since the author speaks and reads Korean, a great deal of

[6] While newspaper articles were carefully kept, and the newspaper titles and dates were given, the page numbers on which the articles are found was rarely provided. Therefore, page numbers of these articles are given in this paper only for the articles on which the page numbers were originally recorded in the MAFEZ archives.

archival material was accessible, which clearly has not been available to many other scholars who have studied Korean EPZs. Furthermore, consultation of Korea's five-year economic development plans and reports in Korean newspapers detail the outcomes of such economic planning and outline key differences between Korean EPZs and non-EPZ industrial estates. Such research has never been conducted, to the author's knowledge, and thus most scholars do not understand the close relationship between policy and outcome in Korean industrial history or the unique purpose of Korean EPZs in such policy-making.

These methods were used to find answers to the questions outlined above, as well as to three further questions: what prompted linkages and spillover from MAFEZ and what hindered them? As the zone's business expanded, what were some practical difficulties, and what eventualities aided in the diffusion of linkages and spillover? What were some results of linkages and spillover, or the lack thereof?

The third stage involved an analysis of all the data gathered in the first stage in light of the newer understanding and information garnered in the second. After consulting the archival material gathered from the MAFEZ Administration Office, it is obvious that much of the published and often-cited articles on MAFEZ are fundamentally incorrect. They fly in the face of facts which are easily obtainable in the Administration Office. Often, complex academic arguments and sophisticated economic models are made to make it seem that there were few welfare benefits that emanated from the EPZ, yet local newspapers dispassionately document the constant and far-reaching welfare benefits that originated with the zone's establishment, and this is well supported by

statistical evidence compiled by (mostly Korean) scholars. This paper was thus written based upon this realization.

Chapter 1

Conceptualizing the Regional Benefits of Export Processing Zone Implantation

Central Arguments Surrounding Export Processing Zones

The debate surrounding export processing zones (EPZs) has polarized in the past two decades. Scholars supporting the establishment of these zones have defined the positive social, economic and political influence that EPZs have had in countries with a high population base to support the zones, and strong and stable macroeconomic regimes.[7] Amirhamadi and Wu (1995), Madani (1998a, 1998b), Rhee *et al.* (1990), and Rhee and Belot (1990) have argued that EPZs have been catalysts for the establishment of export regimes, and have spurred gradual and manageable politico-economic changes for countries on the bottom rung of the export development ladder. Much of the negative literature about EPZs is devoted to the 'race to the bottom': zones which compete for foreign business by constantly increasing incentives for foreign direct investment (FDI), for which labourers themselves are the ones who are most often affected, in part by zone managers who keep labour costs low through tight wage caps (Arnold and Hartman, 2006; Romero, 1995; Schrank, 2001).

An export processing zone has been defined as "...a clearly delineated industrial estate which constitutes a free trade enclave in the customs and trade regime of a country, and where foreign manufacturing firms producing mainly for export benefit from a certain number of fiscal and financial incentives" (UNCTC and ILO, 1988 4).

[7] To specify, 'strong and stable macroeconomic regimes' refers to well-defined economic policy, amply supported with legislation, and which does not fluctuate greatly over time.

Policymakers have used EPZs as a tool to develop key areas of a country through encouragement of foreign investment and, by proxy, domestic entrepreneurship to support these foreign ventures. The stunning growth of EPZs as a development tool began in the 1970s. Since then, outcomes to international development from these zones have varied greatly. By 1975, some 79 EPZs had been founded in 25 countries (ILO, 2003 2), the vast majority of which were founded in the early 1970s, based upon the exemplars of Kaoshiung EPZ, Republic of China, and the Masan Free Export Zone (MAFEZ), Republic of Korea.

The spread of the EPZ model was driven in part by a desire from developing countries not to miss out on what was largely seen as a 'pie' of foreign investment; that is, foreign direct investment (FDI) was seen as finite, and developing countries, one and all, did not want to miss out on a slice of that pie. The result, according to a number of critics (see, e.g., Brown, 2001; ESCAP/UNCTC, 1985; Jauch, 2002; Johansson, 1994; Kusago and Tzannatos, 1998; Madani, 1990; Rondinelli, 1987; Warr, 1989) was a prisoner's dilemma: all countries needed to be at least as attractive as all the others in order to be competitive in selling their zones as investment locales. Thus, when one country increased incentives for foreign investment by lowering investor's costs, all countries felt pressured to follow suit, hence the 'race to the bottom.' Furthermore, critics argue that foreign investors in EPZs have proven to be footloose. When costs of operation associated with a given country's zones increase due to that country's economic development (often spurred by investment activity in EPZs), they are wont to relocate to a cheaper, less developed country. And why wouldn't they, given the more than 3,000 EPZs that are operating in at least 116 countries (ILO, 2003 2)?

There are, however, two major hidden assumptions in the 'race to the bottom' argument. The first assumption is that most foreign companies that invest in EPZs are quite footloose and tend to disinvest as soon as tax holidays and other concessions have lapsed and the cost of labour increases due to a host nation's economic development. This is certainly untrue in the case of Korea: there was a twenty percent Japanese disinvestment in the late-1970s and early-1980s when labour costs in the zone increased and manufacturing concerns were hard hit by the Energy Crisis of 1979. This disinvestment, however, was replaced in short order by Korean-Japanese joint ventures. There was little disinvestment from MAFEZ by companies of other nationalities. In fact, some seventy percent of foreign firms that established factories in the zone during the 'formative period' (1970 to 1975) were still doing business by the end of the 'maturity period' (1986) (see Annex Table 4).

The second hidden assumption is that EPZs are basically all identical or interchangeable enough to be direct competitors with all other EPZs. However, evidence gathered through literature review and field research demonstrates that this assumption is untrue, for two reasons. First, Chapter Four of this thesis will show that MAFEZ evolved over time toward more complex manufacturing capabilities, so that its competitive profile shifted over time. In its formative period, most MAFEZ electronics and electrical factories were involved in very simple, repetitive assembly manufacturing, but many were creating sophisticated patents and were developing the highest technology electronics equipment by the maturity period. The second reason why it is incorrect to assume that EPZs are interchangeable is because they often establish specialized niches that other EPZs cannot compete with. MAFEZ formed an electronics & electrical niche,

Mauritian zones formed textile niches, and Puerto Rican zones developed a niche in pharmaceuticals. Given that many EPZs evolve, mature, and form manufacturing niches throughout the world, it cannot be said that zones are interchangeable. Had MAFEZ not formed an electronics & electrical manufacturing niche, then perhaps there would have been more disinvestment as foreign firms sought cheaper labour and more favourable investment incentives in other developing countries. However, this did not happen in the case of MAFEZ – or, for that matter, in the case of Mauritian and Puerto Rican zones. This study does not deny the existence of footloose manufacturers in EPZs. It does, however, recognize that not all types of firms can be equally footloose, and that certain circumstances, policy measures, the emergence of production linkages with the domestic economy and the creation of indigenous technologies also help to deter the practice of footloose investment.

The most common measures of EPZ success at the moment are linkages and spillover. EPZs have benefited countries of the Pacific Rim,[8] for example, by allowing experiments with market reforms within the zones' enclosed areas, and these reforms have encouraged gradual changes outside the zones through linkages to domestic industry and technological and knowledge spillover (see, e.g., Amirhamadi and Wu, 1995; Madani, 1998a, 1998b; Rhee *et al.*, 1990; Rhee and Belot, 1990; Romero, 1995; Schrank, 2001; Warr, 1989b).

These technological and economic benefits to regions surrounding EPZs are central to 'cluster' and 'agglomeration economics' theories. According to these scholarly approaches, the diffusion of technology and economic growth are stimulated by spatial

[8] Most notably, they have benefited the 'Asian Tigers' – South Korea, Taiwan, Hong Kong and Singapore. They have also been beneficial in many Southeast Asian countries, such as the Philippines, Thailand, Malaysia and Indonesia.

proximity to areas of heavy foreign and domestic investment (Glaeser *et al.*, 1992; Mills and McDonald, 1992; Moulaert and Djellal, 1995). Engman and associates argue, "An industry cluster may yield significant benefits in terms of information spillover, efficient division of labour among enterprises, the development of skilled labour markets and decrease in business transaction costs. However, . . . [d]epending on location, backward linkages may be limited and infrastructure costs high" (Engman *et al.*, 2007 25).

Engman and associates' argument encapsulates the central problem and dispute surrounding the welfare benefits of EPZs through technology spillover and economic linkages: although there may be great benefits to the country through implantation of an EPZ, certain externalities such as zone location, negative government policies, and operational issues may be harmful to the development of the zone and the region in which it is located (ESCAP, 2005 114; see also Yabuuchi, 2000).

The central problem that needs to be understood when it comes to assessing the large quantity of data on MAFEZ is first of all assessing whether it is, in fact, a success in terms of creating many linkages and pervasive spillover, and second whether this success or failure is policy- or market-induced.

An Introduction to the Concepts of Linkages and Spillover

Spillover and linkages are concepts that define the manner in which enterprises in an EPZ integrate with the host country's economy inside and outside of the zone. When there is beneficial integration between zone firms and the host economy, it is because spillover and linkages serve the common good of both the zone firms and the economy at large. It is helpful, therefore, to think of spillover and linkages not just as instruments

that facilitate *cooperation* between zone firms and host economies, but also as instruments that facilitate *integration* of zone firms with the host economies. Delineating the fact that zone firms merely cooperate with firms outside of the zone does not go far enough in demonstrating how zone firms rely on out-zone firms to produce to world standards, and how production work carried out in the zone is eventually replaced by work carried out beyond the perimeter of the zone. The term 'cooperation,' which is commonly used to describe the relationship between zone firms and out-zone subcontractors in creating finished products, is insufficient. It is insufficient because linkages and spillover help to integrate processes, and the subcontractor may assume the work of the zone contractor to such a degree that sometimes very little value is added within the zone itself. Thus, the zone firm would not exist but for the existence of the out-zone, and vice-versa; both are linked in a single, encompassing production process.

Countries with successful EPZs promulgate laws that not only allow spillover and linkages from zone firms and the domestic economy, but also encourage them. Domestic and foreign companies avail themselves of opportunities to integrate with foreign/domestic investment through production sharing agreements and subcontracting. Such production sharing and subcontracting enable firms within EPZs to keep pace with increasing demands for manufactured goods from abroad, to expand production quickly, and to survive economic downturns caused by variables such as energy crises and changes in consumer preferences by offloading some of the burden of these crises onto the subcontractors; firms outside of the zone profit from production demands that exceed the capacity of the foreign enterprises themselves and benefit from exposure to foreign manufacturing specifications and technology. As a result of such integration, the

implantation of EPZs may create socio-economic effects and relationships much different than those caused by the implantation of non-EPZ industrial estates.[9] A further explanation of the developmental benefits of linkages and spillover will demonstrate how implantation of EPZs benefit developing economies in a unique way.

Developmental Benefits of Spillover

Spillover refers to technology or knowledge transfers between the zone and the larger economy. Spillover most commonly occurs when there is a transfer of technical knowledge from a larger firm to a smaller, related one. The United Nations Centre on Transnational Corporations (UNCTC) has identified eight types of 'spillover,' that benefit both foreign zone firms[10] and domestic out-zone firms. They are: informational[11], technical[12], financial[13], procurement[14], locational[15], managerial[16], pricing[17] and others[18] (UNCTC, 1981 5-6). In terms of benefits that zone firms may bestow to out-zone firms and the domestic economy as a whole, technical and managerial spillover are the most important. They are important in that they benefit both the host firm and the domestic

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[9] The difference between EPZs and non-EPZ industrial estates will be clearly defined in Chapter Two.
[10] In this case, they are referring to foreign multinational firms, though the concepts are applicable to spillover from smaller foreign firms that invest in EPZs.
[11] 'Informational' spillover refers to "exchanges of information on demand, future investment, market conditions, etc." (UNCTC, 1981 5).
[12] 'Technical' spillover refers to "assistance given or received on innovation and product design, process know-how, production costs, quality control, training, testing, tooling etc." (UNCTC, 1981 5)
[13] 'Financial' spillover refers to "loans on concessional terms, grants, special prices or allowances" (UNCTC, 1981 6).
[14] 'Procurement' spillover refers to "help in the purchasing of materials" (UNCTC, 1981 6).
[15] 'Locational' spillover refers to "including a supplier to set up a plant in a given country or location" (UNCTC, 1981 6).
[16] 'Managerial' spillover refers to "advising on better financial, accounting, inventory and other control procedures" (UNCTC, 1981 6).
[17] 'Pricing' spillover refers to "contractual and bargaining procedures for deciding on prices" (UNCTC, 1981 6).
[18] 'Other' spillover include "arrangements regarding sales to other parties or on the open market, policies for diversification, assistance in exporting, etc." (UNCTC, 1981 6).

subcontracting enterprise equally and for protracted periods of time – usually for the entire length of the foreign firm's investment in the zone. They also spur the greatest integration between foreign and domestic firms operating in or near EPZs.

Spillover from EPZs to the surrounding economy occur on a large scale when domestic workers are employed by foreign businesses in the zone, learn technical skills and then start working for related indigenous enterprises outside of the zone. In Mauritius, one sees the finest example of the benefit of managerial spillover. R.V. Sannassee (2007) has demonstrated through extensive field research that foreign managers of EPZ firms in Mauritius dispensed a vast amount of knowledge through training, both technical and managerial but especially the latter, to native workers. As a result of the Mauritian workers' astuteness, foreign firms started to employ Mauritian workers at all levels from the shop floor to the board room and, for a variety of reasons, this worked best for the foreign firms. This also increased the amount of knowledge that was transferred to out-zone firms that worked in tandem with zone firms. The Mauritian example demonstrates the vast vocational knowledge that EPZs may impart to a local economy though managerial spillover. Unfortunately, Mauritian EPZs are still some way from being deemed a 'success' in that a clothing & textile monoculture[19] has largely taken over in the country, at least partly as a result of poor national policy-making and the demographic and physical size of the island.

[19] A clothing monoculture often creates little technological spillover, as will be demonstrated in greater detail in Chapter Four.

The UNCTC explores the kind of technical spillover[20] that occurs between transnational corporations and subcontractors in developing nations that produce automotive parts for export. This technical spillover, however, is the same as that between EPZ firms and out-zone subcontractors throughout the world, and thus their illustration is germane to this study. The UNCTC divides technical spillover into three levels of intensity:

> minimal, intermediate and high. ***Minimal technical [spillover]*** mainly take[s] the form of quality control, though communication of specifications of the component required can also be included among these linkages. Such specification forms a necessary element of every subcontracting relationship, though the extent to which this is true and the extent of technical interchange required will vary according to technological relatedness, the frequency of model change and the nature of the component.... ***Intermediate technical [spillover]*** may be defined as [that] where product design is developed jointly, and not simply communicated by the ... firm to the supplier, and where quality control assistance is supplemented by assistance in production methods.... ***High technical [spillover]*** may occur when the lead enterprise does more than help the supplier to design a new component or solve technical and production problems, by actually undertaking in-house design and development work to modify the [product] to suit the capabilities of the supplier. (UNCTC, 1981 42-44; emphasis mine.)

To paraphrase the meaning of this passage from the UNCTC, the intensity of technical spillover depends upon how *integrated* production processes are between sub-contractors and transnational corporations. The greater the technical spillover is, the higher the level of integration.

These kinds of integrated production processes occur to the greatest extent in production sharing arrangements that involve high-tech manufacturing and impart the greatest technology and knowledge spillover. Thus, EPZ directors and national policymakers often give special concessions to high-tech firms operating in these zones.

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[20] The UNCTC in fact refers to 'technical linkages.' However, the same phenomenon is referred to as 'technical spillover' in this thesis. To avoid confusion, the term 'spillover' will be used to replace the word 'linkage' as the UNCTC has employed the word.

Firms that employ technologically complex production methods typically forge more linkages with the domestic economy from EPZs than firms that mainly rely on labour-intensive assembly operations. The desired outcome of zone planners and policymakers is the establishment of as many technologically self-sufficient out-zone manufacturers as possible. While this may seem straightforward enough to achieve, it is not so easy an accomplishment given the different political and economic climates and policies of various nations.

Academics have exhaustively explored the similarities and differences between South Korean, Taiwanese and Chinese EPZs and significant economic changes that occurred in those countries from the 1960s to the 1990s due to the influence of those zones. They have established that EPZs have created less regulated and healthier economies (Madani, 1998a; Radelet *et al.*, 1997; Rhee and Belot, 1990; Schrank, 2001; Wall, 1993; Yuan and Eden, 1992). Perhaps David Wall best sums up the changes in once-closed economies that occurred because of EPZs: "[t]hose early experiments with market forces succeeded beyond their supporters' wildest dreams and the zones became greenhouses for capitalism rather than its prisons" (1991 244). Wall specifically writes about the economic shift toward capitalism that occurred in China, but he does not go into detail about the political ramifications of such. One scholar who has written about EPZs in developing countries as well as in industrialized regions has commented, "the many varieties of free trade zone in use around the world are strikingly similar in terms of the goods produced, the investment incentives, the labor conditions and the expectations which national governments have of their contribution to national economic growth" (Emadi-Coffin, 2002 81). While the zones may seem similar on the surface, however, it

is important to gauge the effects that they have outside of the EPZ, effects which are often strikingly dissimilar between countries. In addition, some countries have been reluctant to permit a high degree of production sharing with firms outside of EPZs out of fear that such practices might diffuse business practices or counter-revolutionary ideals beyond the perimeter of the zone.[21]

The amount of production sharing that is permitted in a given country is one way to differentiate the development policies of different countries that employ EPZs as development tools. In Korea, out-zone firms are permitted to produce up to forty percent of the value of final manufactures exported from EPZs. Thus they are often relied upon as contingent manufacturers when there are more orders than zone firms can fill, as well as regular manufacturers of components for the EPZ companies. Needless to say, the amount of production sharing that is permitted directly affects the number and intensity of linkages and spillover between zone and out-zone firms. Hrastelj found a great deal of openness to production sharing in his native Yugoslavia and identified four sequential stages in the intensification of production sharing arrangements from EPZs in his country. He identified the stages as: (1) Haphazard[22], (2) Interdependent[23], (3) Integrative[24], and (4) Advanced[25] (Hrastelj, 1992 18). He defines the difference in stages based upon 'know-how transfer' and the degree of integration between zone contractors

[21] Basil and Germidis (1984) and David Wall (1995) use the example of China, here, in the early 1980s, though China has engaged in production sharing extensively since then. Such a liberalizing of production sharing policies was a mainstay of Deng Xiaoping's 'Open-Door Policy.'

[22] Defined by Hrastelj as a stage involving "long production runs and low costs" and "little if any" know-how transfer (Hrastelj, 1992 18).

[23] Defined by Hrastelj as a stage involving production sharing of "standard items" and "yearly contracts," while know-how transfer is "conventional" but includes "training" (Hrastelj, 1992 18).

[24] Defined by Hrastelj as a stage involving "subcontracts [that are] integrated in conventional business system, coproduction" (Hrastelj, 1992 18). Know-how transfer involves "intensive, also reversible, extension of cooperation" (Hrastelj, 1992 18).

[25] Defined by Hrastelj as a stage involving "two-way investments, sale of conventional products under brand name domestically" (Hrastelj, 1992 18). Know-how transfer in this stage deepens and subcontractors become partners "in multinational marketing" (Hrastelj, 1992 18).

and out-zone subcontractors. To compare the Yugoslav model with the Korean, the literature surveyed does not reveal any out-zone firms that have attained the advanced stage in Korea. However, the integrative stage has been achieved in Korean EPZs, especially the oldest ones, the Masan Free Export Zone (MAFEZ) and the Iri Free Export Zone (IFEZ). Such integration is demonstrated by product input-output statistics and production sharing values as will be explored in Chapter Three. The advanced stage of production sharing from EPZs that Hrastelj identifies, which includes sales of contracted products sold domestically, and subcontracting firms involved in multinational marketing, exceeds the mandate for EPZs in any country[26]. To reach the advanced stage of production sharing is to succeed beyond the mandate of any EPZ – to surpass the purpose and thus the very definition of an export processing zone. In fact, when subcontracting companies succeed to the stage when they are importing international, brand-name products to the domestic market, they are no long involved in export processing, but import processing. Thus, it is helpful to end the analysis at the integrative stage of production sharing, and to consider EPZs as 'instruments of integration' between domestic and foreign business. It is also worth exploring how EPZs as instruments of integration benefit developing countries more than EPZs that do not encourage such integration and remain production enclaves.

[26] In the case of MAFEZ, sales on the domestic market of all zone-manufactured products peaked at a negligible 0.6 % of all MAFEZ outputs in 1985 (UNIDO, 1988 39) even though, according to the Law of the Free Export Zone, zone firms were permitted to sell up to 40% of their total output on the Korean market.

Developmental Benefits of Linkages

Linkages occur when zone manufacturers purchase raw materials or intermediate goods from local suppliers through subcontracting, production sharing or otherwise. As a result, there is a measured increase in the number of ancillary industries and firms that support the activities and production of the zone firms.[27] As such, planned linkages from the creation of such ancillary industries are often key strategies in national development. Economists such as Madani (1998a, 1998b), Din (1994), Ge (1993) and Warr (1989) have emphasized that governments and policymakers should provide legal incentives to entrepreneurs and corporations when establishing EPZs in parts of a country targeted for development. These scholars argue that such incentives will maximize production linkages. Such linkages would most easily be formed in close proximity to large population bases, extant industry, mineral resources and physical infrastructure such as airports, highways, canals and seaports. To reiterate a central point, policymakers often consider EPZs to be enablers of a pre-existent potential for development in given parts of the country.

Linkages benefit both zone enterprises and out-zone subcontractors. Since the focus of this thesis is the benefit to domestic industry outside of the zones, linkages will

[27] A second order of linkages should be noted, as well. That is, the creation of a service industry to support firms and jobs directly or indirectly related to production. To use the Korean example, K.S. Lee *et al* note increased service sector jobs in Masan City after the founding of MAFEZ. In particular, they investigated the increase in food & catering, transportation and "general services" (1987 130) and received employment figures directly from the newly-established service industry firms. However, the data is far from exhaustive and there are no other data supporting their findings which gives a fuller picture of linkage effects to the service industry. For this reason, a further investigation of service industry firms that were created to support MAFEZ industries will not be attempted in this paper. Suffice to say that Lee and associates felt that such service jobs were "imperative" (K.S. Lee *et al.*, 1987 130) to Masan's burgeoning economy up to 1985.

be explored from the point of view of those that benefit local, non-EPZ firms and those that integrate foreign EPZ firms with domestic out-zone firms.[28]

Understanding Backward and Forward Linkages

Backward and forward production linkages are as old as industry itself. However, it was not until the 1960s that the terms were conceptualized and were broadly applied to management and industrial studies. Albert O. Hirschman, the author of these concepts,[29] describes them as follows:

> 1. The input-provision, derived demand, or *backward linkage effects*, i.e., every nonprimary economic activity, will induce attempts to supply through domestic production the inputs needed in that activity.
> 2. The output-utilization or *forward linkage effects*, i.e., every activity that does not by its nature cater exclusively to final demands, will induce attempts to utilize its outputs as inputs in some new activities (Hirschman, 1966 100).

He thus sees and describes all economic activity involved in the industrialization process and in industrial planning as chains of input and output, wherein all factor production at various stages is related. Hirchman's arguments are particularly germane to the study of EPZs and the creation of external input firms, as he stresses the importance of the connection between satellite and master industries.

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[28] It is important to note that in some countries, domestic investment is not permitted in EPZs. In the case of Korea, wholly-owned Korean firms were not permitted in the zones until 1980. Before that time, all Korean investment in EPZs were joint-ventures with foreign enterprises, and such arrangements were in the minority. The majority of investing firms were wholly-owned Japanese firms.

[29] Although Hirschman authored these specific concepts, his ideas clearly drew upon the pioneering work of the Russian-born economist, Wassily Leontieff. Leontieff measured production linkages through input-output analyses, before Hirschman had coined the terms 'backward and forward linkages' and Leontieff was awarded the Nobel Prize for this work. His approach drew, in turn, upon earlier ideas developed by the eighteenth century French economist François Quesnay.

In terms of EPZs, it is best to think of master industries as those within the zone and satellite industries as those without that produce intermediates. Hirschman describes a satellite industry as one with the following characteristics:[30]

a. it enjoys a strong locational advantage from proximity to the master industry;
b. it uses as principal input an output or by-product of the master industry without subjecting it to elaborate transformation, or its principal output is a – usually minor – input of the master industry; and
c. its minimum economic size is smaller than that of the master industry. (Hirschman, 1966 102)

In the case of input firms, they often use the raw materials of other industries within the host nation at the behest of EPZ firms in order to manufacture the needed intermediate components of zone enterprises. However, all production of intermediates, regardless of their lack of refinement, are related to the master industry in that there would be no reason to produce or create the inputs without the demand created by the master industries.

For the sake of creating this kind of final demand, underdeveloped countries often establish 'last' industries first. That is, an establishment that requires final demands is first created, and this generates a backward demand for inputs along the chain of production to the initial harvesting of raw materials (Hirschman, 1966 111-12). This is directly related to the study of EPZs in that Hirschman emphasizes the importance of location in the establishment of last industries to facilitate the movements of factor inputs from their place of harvest to their places of refinement or intermediate production to

[30] It is understood that "a strong locational advantage from proximity to the master industry" is no longer necessarily the case in consideration of today's globalized production, and that proximity to a master industry is no longer so important even for manufacturers in EPZs. However, Korean satellite industries certainly seemed to benefit by such propinquity in the 1970s and 1980s, as will be demonstrated in Chapter Three. One should keep in mind the historical context of the subject being studied here. Also, satellite industries do not necessarily use an output or by-product of a master industry in the cases studied in the preparation of this thesis.

their places of final demand. EPZs as a development tool, then, should be established in a location that will maximize the dynamic of backward demand and minimize inconvenience. Thus the description by Peter Warr (1989), amongst others, of EPZs as manufacturing 'enclaves,' has a distinct connection to Hirschman. The latter describes the importance of proper location for the establishment of industries designed to initiate backward linkages:

> The enclave nature of these industries is sometimes emphasized by location of the plant at a point as close as possible to the most convenient port of arrival of the imported materials, and again this type of venture has proven particularly attractive to foreign capital – many of the branch plants owned by foreign corporations specialize in this kind of operation. (Hirschman, 1966 112)

When such a 'last' industry is first established in a given location, it often usually requires most of the inputs for processing from abroad, because inputs and raw materials available locally are not of an international standard. Over time, the country is able to produce these inputs to global standards, and thus such products are 'imported,' or, more accurately, are *introduced* from the general domestic economy to the enclave of international manufacturing. The introduction of a 'last industry first' thus spurs a backward demand, internationally, for imported inputs, and a desire for local manufacturers to start producing similar inputs to an international standard and thus start selling these parts to the last industry. The establishment of a 'last industry first' is often followed closely by a national industrialization push from ISI to EOI.

In the initial stages of ISI, when there are few foreign companies investing in a given developing country, not to mention EPZs, it may be best for these companies to use imported inputs rather than wait for the country in which they are investing to found input industries capable of harvesting raw materials and producing intermediates of

suitable quality and specification. As the host country pushes from the ISI stage of Development to the EOI stage, there is an increase in suitable domestic inputs that foreign enterprises within the country may draw upon, and this, in turn, attracts more foreign investment into the country.

In well-managed countries and development regimes, however, such as was seen in South Korea from the 1960s to the 1980s, backward linkages formed through this push toward EOI. Hirschman argues that all underdeveloped countries endeavour to bite off "*as large piece of value added at a time* as the underdeveloped country can possibly digest" (1966 119; emphasis Hirschman's) in this push from ISI to EOI.

Development scholars have gauged the importance of backward and forward linkages in Korean EPZs through measuring the cumulative effect of such linkages, usually measured in input and output tables provided by EPZ administrators and various economic think tanks and institutions (see, e.g., ILO, 2003; UNIDO, 1988; Healey, 1991; K.S. Lee *et al.*, 1987; K.S. Lee, 1991; Lee and Wu, 1993; J.D. Park, 1997; K.K. Cho, 1990; Tsui, 1987). While this kind of empirical analysis is undoubtedly important, it does not explore the bigger picture of how commodity chains are formed, how such chains are managed, and how they have affected Korea's overall development. Such theoretical ruminations are essential to gain a better understanding of dynamic relations between factors of production initiated by final demand in EPZs.

Understanding Commodity Chains

Hopkins and Wallerstein define a 'commodity chain' as "a network of labor and production processes whose end result is a finished commodity" (1986 159). In later work, they contend that

> [a]ll firms or other units of production receive inputs and send outputs. Their transformation of the inputs that results in outputs locates them within a commodity chain (or quite often within multiple commodity chains). In terms of the structure of the capitalist world-economy, commodity chains may be thought of as the warp and woof of its system of social production. (Hopkins and Wallerstein, 1994 17)

The commodity chain model demonstrates all integrated processes involved in creating commodities, including the harvesting of raw materials, the sequential transformation into inputs, the manufacture and the delivery of final goods. At every link or 'node' along the commodity chain, value is added. Continued and loyal inter-firm transactions and sourcing along this chain create functional integration between firms.

Hopkins and Wallerstein refer to separable processes along the commodity chain as 'boxes:'

> A box is thus a particular, quite specific production process. The first thing to note about a box is that its boundaries are socially defined, and thus may be redefined. Boxes may be consolidated (where there were two, there comes to be one) or subdivided (where there was one, there come to be two). These redefinitions are effected through technological changes and/or social organizational changes. (Hopkins and Wallerstein, 1994 18)

In reference to EPZs, such boxes can be redefined when there is a transfer of technological knowledge from zone enterprises to input firms. Such a technological transfer, and by proxy, a subdivision of boxes, occurs when local firms learn how to produce an input in a manner acceptable or adequate to the needs of the zone enterprise. Through learning trade practices or secrets in a zone enterprise, a technician is able to

reproduce such practices outside of the zone, thus creating a new box along the commodity chain. This simplifies the process of production for the enterprise that manufactures a final demand, and creates new business opportunities for local entrepreneurs. Here, Hopkins and Wallerstein are demonstrating one manner in which a spillover may occur.

It is important to further explore the meaning of linkages along the commodity chain. Rather than forward and backward linkages, Hopkins and Wallerstein deem horizontal and vertical linkages more suitable to describe connections between boxes. Horizontal linkages refer to the hirschmanian concept. Vertical linkages refer to "two or more boxes [which] are part of the same firm" (Hopkins and Wallerstein, 1994 19). Thus, when a given firm can carry out more than one production process along the commodity chain, we have a concentration of processes. It is also important to note the interrelatedness of linkages and spillover in these scholars' concept of 'boxes' in that it is the transfer of technological knowledge that facilitates the creation of more than one linkage from a given subsidiary firm to the core enterprise.

Wei Ge also talks of vertical and horizontal linkages between input firms and EPZ enterprises in his work. He emphasized the importance of "tight linkages" between EPZs and "development zones" (Ge, 1993 53-54). 'Tight linkages' refers to continued and loyal sourcing of intermediates from input firms, and 'development zones' refers to areas contiguous to EPZs that are targeted for development through the processes of integration and linkage described by Hirschman, Hopkins and Wallerstein. To developmentalists, city planners and economic policymakers, it is crucial to understand the manner in which such connections form and the way in which industrial districts, especially EPZs, can be

catalysts in the creation of such linkages. The next chapter will demonstrate how certain policy measures in Korea were intended to create such linkages, and how Korean EPZs are distinctive from regular industrial estates in that country.

Chapter 2

The Results of Korean Economic Planning with Respect to Korean Industrial Estates and EPZs

South Korea did not achieve rapid industrialization and development through market forces alone. Indeed, market forces played a small role in the creation of the 'Korean miracle.' The implementation of policy measures and the constant inducement of foreign direct investment provided the greatest impetus to national development, and this chapter will demonstrate that Korean Industrial Estates (IEs) and EPZs were significant results of this kind of economic planning. The chapter will thus give a brief history of Korea's export-oriented industrialization drive, and how Korean IEs and EPZs figured in this drive. It will also delineate important political and economic differences between Korean IEs and EPZs.

A Brief History of Korean Export-Oriented Industrialization

South Korea achieved impressive economic development during its export-oriented industrialization (EOI) drive. Anne Krueger (1979) has correctly identified the beginning of this drive as between the years 1961 and 1965 (Krueger, 1979 92) though Korea had been providing export incentives to foreign and domestic exporters operating domestically since 1950. Krueger (1979) documents twenty-four export incentives that were established between 1950 and 1975, demonstrating that national development strategies had shifted to export-orientation a lot earlier than many scholars have argued. Such measures include: tariff exemptions on imports of raw materials (from 1959 to

1975)[31], tariff and tax exemptions for domestic suppliers of exporting firms (from 1965 to 1975), domestic indirect and direct tax exemptions (from 1961 to 1972), accelerated currency depreciation (from 1966 to 1975) and wastage allowance subsidies (from 1965 to 1975). Credit subsidies during this same time period included: export credits (from 1950 to 1975), production loans for exporters (from 1959 to 1975) and import credits for exports (from 1964 to 1975) (Krueger, 1979 93; for a full list of these export incentives and credit subsidies, see Annex Table 1).

The years 1961 to 1965 correspond to important changes in Korean economic and political history, including the beginning of the Park Chung-Hee Administration (1961), the initiating of the First Five-Year Economic Development Plan (1962) and the promulgation of the new Korean Constitution, called 'Yushin' (1963). From the beginning of this export drive, South Korea realized astonishing growth, fuelled largely by exports. Between 1963 and 1987, real per capita GDP growth hit just under seven percent per year, the greatest sustained increase of any country with such a large population in history (Mahler, 1990 41). The *Korea Herald* reported that rates of growth hit 10 percent annually between the years 1961 and 1974, with the greatest increase, 16.5%, occurring in 1973 (*Korea Herald*, 28 December, 1975 II). This is impressive for a number of reasons: first, most Korean industry, which had been established during the Japanese occupation (1910-1945) was completely destroyed during the Korean War (1950-1953) except that which was located in North Korea; second, most raw mineral

[31] Krueger explains further that, "Some of the incentives, of course, served merely as an offset to the disincentive for export that the trade regime would otherwise have provided. Tariff exemptions on imports of raw materials, for example, would not by themselves constitute an 'export incentive' but would merely serve to enable Korean producers to compete in international markets without negative effective protection" (Krueger, 1979 92). She further explicates, in an endnote, "However, the fact is that even in this case the tariff exemption covered more than the intermediate goods necessary for production of exportables. The exporters were therefore able to profit by this means when they sold on the domestic market" (Krueger, 1979 237).

resources and mines were located in North Korea as well; third, economic growth averaged only 4.1 percent per year between 1953 and 1961 (Das, 1992 1) despite the fact that South Korea was virtually starting from nothing after the war; fourth, arable land constituted only 21.6 percent of total land area in South Korea and two-thirds of the population worked in the agricultural sector by the beginning of the 1960s (Müller, 1997 185); fifth, in 1960, total South Korean exports amounted to only USD$33 million and the trade deficit was USD$310 (Song, 1990 60). It cannot be claimed that Korea's growth in the decades after the war resulted from market forces; the country was (and remains) resource-poor and had virtually no industry. But for strong economic planning and foreign aid, the country would have been virtually insolvent soon after the end of the war.

It is not possible to go into all of the strategies and economic planning that led to the Korean 'miracle.' This chapter will, however, document how industrial estate (IE)[32] and export processing zone (EPZ) development occupied a vanguard role in the Park Administration's national development and economic decentralization strategy, as Kim and Gallant (1996) suggest.

The Role of Korean Industrial Estates in Korea's Economic Development Plans

In *the First Five-Year Economic Development Plan* (1962-1966), the emphasis was decidedly placed on the construction of infrastructure and the primacy of the emergent export-based economy. Little was said of IEs or the economic reasoning

[32] An 'Industrial Estate' is a tract of land divided from residential areas and reserved for industrial production purposes by a multitude of firms that share common physical and administrative infrastructures. They differ from export processing zones, because they do not cater to foreign manufacturing firms producing mainly for export by offering legal and financial incentives to attract their investment.

prompting their construction, yet in the first year of the plan, the first large-scale IE was established in Ulsan[33], thus signaling an end to the *ad hoc* establishment of factories throughout the country that predominated in the 1950s.[34] In 1965, the Export Industrial Estate Promotion Act was passed, paving the way for the establishment of the Guro IE in the suburbs of Seoul in the same year. This and other designated Export IEs[35] were obliged to sell at least 70 percent of their products abroad and were permitted to sell a maximum of 30 percent domestically (*Korea Herald*, 16 February, 1974 6). This also marked the first time that foreign direct investment was permitted in a planned IE. In short order, five Export IEs were established in the Seoul/Incheon region, and some 300 plants located in these zones by the end of the decade (*Korea Herald*, 16 February, 1974 6).

The Second Five-Year Economic Development Plan (1967-1971) accelerated the transition from an agricultural-based to a manufacturing-based economy. Thus, the

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[33] In 1972, the Ulsan IE was designated as a petrochemical IE, thus spurring the investment of more than twenty petrochemical companies. In the 1960s, it was given no industry-specific designation, thus initial investment came from companies involved in various kinds of manufacturing and industrial processing.

[34] For a description of this lack of industrial planning in the 1950s, see Jin and Park, 1991.

[35] Export IEs were established "with a view to improving export industrial structure and technology for a balanced development of the national economy (*sic*).... Koreans residing abroad are allowed to bring in materials and money for their plants in these zones.... Various advantages are accorded to foreigners, such as reduction in tax and administrative conveniences" (*Korea Herald*, 16 February, 1974 6). Such IEs are different than Korean EPZs in that foreign investment is strongly encouraged through joint-ventures with Korean interests only, and fully foreign-owned investment is tolerated only for a maximum of five years in the case of enterprises which "contribute substantially to the infusion of technology into other lines of business," promote "domestic technical know-how," or are "instrumental in diversifying the country's sources of foreign capital inflow" (*Korea Herald*, 14 May, 1975 III). During the period of *the Third Five-Year Economic Development Plan*, the Foreign Capital Inducement Law was revised to specify foreign investors privileges and obligations when investing in non-EPZ IEs throughout Korea, such as these Export IEs: "Some foreign ventures which are desirable for the domestic industry, but prospective Korean counterparts are difficult to be found, will be permitted on the condition that their capital share should be turned over to 50 per cent to the Korean side in five years, [Economic Planning Minister Tae Won-son] said. Such investments will be required to turn over up to 30 per cent in three years after the business authorization (*sic*), and to 50 per cent in the subsequent two years, spreading the total over five years. Excluding the above instances, the 50-50 capital sharing should be applied to the foreign ventures which are labor intensive, simple bonded processing and using domestically manufactured raw materials, the minister said" (*Korea Herald*, 3 March, 1973 4). Minister Tae furthermore stated that in 1973, for the first time, "the Law on the Masan Free Export Zone will be revised so as to remove the limitation on the capital share of the Korean partners with foreign investors in the area" (*Korea Herald*, 3 March, 1973 4).

government strategically located industry-specific Civilian IEs[36] throughout the country. Salient examples include the first foundry of the Pohang Iron and Steel Company (POSCO) in Pohang in 1968, and initial phases of what would become a shipbuilding IE in Koje and a petrochemical IE in Ulsan. Such industrial projects in provincial locations were intended to balance the living standards of citizens throughout the country. The establishment of MAFEZ was decreed, but the only reasons given were to increase exports and to mobilize Korea's significant human resources.

It was not until *the Third Five-Year Economic Development Plan* (1972-1976) that the Government of Korea laid bare its reasons for industrial location. For example, industrial location would be selected "on the basis of economic factors, thereby increasing industrial competition power (*sic*)" (GROK, 1971 117). Furthermore, as

> a means of strengthening the competitiveness of industry, factory location will be chosen on an economic basis. In determining factory location therefore, comprehensive studies will be made of all factors related to the supply of raw materials, distance to retail markets, employment of necessary labor force, and supporting facilities, including transportation, electric power, industrial water, and harbor facilities. Relations with related industries will also be taken into consideration. In the case of export industries, factory location will be established in coastal industrial estates because of convenience in shipping. In the case of regional or specialized industries, businesses best suited for respective areas should be chosen with regard to raw materials, labor requirements and technical matters. (GROK, 1971 117-18)

This is the first mention export industries being located in coastal areas due to convenience in shipping. This plan coincides with *the First National Physical Plan* (1972-1981) which emphasized the coordination of Korea's natural advantages, such as

[36] "These are the industrial estates operated by civilian organizations" (*Korea Herald*, 16 February, 1974 6) as opposed to those run by the government, the military, etc. Unlike Provincial IEs, which have been controlled directly by the Ministry of Commerce and Industry since 1973 (*Korea Herald*, 9 May, 1973 8) and Free Export Zones, whose administrations work under the auspices of the Korean government, Civilian IEs' administrations are independent of federal, provincial or municipal government.

ease in shipping and location of natural resources, with industrial location. During this development period, MAFEZ's construction was finished and achieved full occupancy, the Iri Free Export Zone (IFEZ) was established, and the Gumi Electronics Industrial Complex[37] was founded near the city of Daegu.

The Fourth Five-Year Economic Development Plan (1977-1981) was the most explicit in terms of a strategy for the location of industry. For example, the plan states that "collective estates for each industry will be developed [and] common service and testing facilities to enhance standardized production, quality improvement, and product specialization will be established in industrial estates" (GROK, 1976 47). This is the first mention in any of the development plans of initiatives to enhance product specialization, standardization and quality. The plan also underscores the constantly increasing industrial pollution in urban areas and the constantly decreasing land available in South Korea for factories. Thus, polluting "industries currently located in large cities are to be gradually relocated.... In choosing the location for new industrial estates special consideration will be given to the efficient utilization of limited land resources and to the regional dispersion of industries" (GROK, 1976 61). In this plan, it is also stated that 9.6 square kilometres would be reserved for the construction of Provincial IEs[38] and 16.1 square kilometres for Civilian IEs involved in the making of heavy and chemical

[37] This complex, located near the coastal city of Daegu, is the only example of an IE in Korea reserved solely for the production of electronics parts and products. Foreign investors in this complex are afforded most of the same privileges as investors in Korean EPZs. However, "Foreign investors will be granted tax privileges for the portion of their foreign investment while domestic enterprise will benefit from the tax privileges as stipulated in the Local Industry Development Law" (*Korea Herald*, 16 February, 1974 6).

[38] Provincial IEs "were established in order to ensure a balanced development of the country and to give equal job opportunities to all provinces" (*Korea Herald*, 16 February, 1974 6). Despite the name, control of these IEs was not given to provincial authorities. In 1973, Provincial IEs were "put under the control of the Office of Industrial Area Management, which is under the direct control of the [national] Commerce-Industry Ministry" (*Korea Herald*, 9 May, 1973 8). There is little difference between Civilian and Provincial IEs, other than the fact that the latter were intended to disperse industry throughout the country and to provide employment for Koreans living in provincial cities and rural areas.

industrial products (GROK, 1976 61). Specifically, this plan announced the construction of Civilian IEs in Changwon for machinery, Yeocheon for chemical products and Onsan for oil refining and the manufacture of non-ferrous metal products. The only Provincial IE mentioned by name is the Banweol IE[39] in Gyeonggi Province, which was intended to relocate polluting industries from Seoul and support development in satellite cities of the capital (GROK, 1976 61).

In *the Fifth Five-Year Economic Development Plan* (1982-1986) and *the Revised Fifth Five-Year Economic and Social Development Plan* (1984-1986), there is little mention of IEs other than the promotion of the Daeduk Science Park, located some 150 kilometres south of Seoul near the very centre of the country and the overland transportation hub of Daejeon City. A number of government research institutes and universities were established there to promote industrial innovation in prominent industrial sectors (such as heavy machinery, electronics, and chemical products) and promising industrial sectors (such as aerospace, biotechnology, and nuclear energy). In many ways, the Daeduk Science Park represented (and continues to represent) the crowning achievement of production innovation in Korea that occurred in various IEs, EPZs, universities and research institutes. It also demonstrates that technological knowledge did spill over to the greater Korean economy, and that the acquisition of foreign production technology in EPZs and IEs throughout the country was instrumental in the innovation of indigenous production technology. Choi and Kim (2004) document the "industrial absorptive capacity" (4) of the Daeduk Science Park in reverse

[39] This is now known as the Ansan IE. Because various polluting industries were targeted for relocation to Ansan, the makeup of firms became decidedly miscellaneous. This estate experienced explosive growth in the 1980s and the size of its production employment increased nearly nine-fold in that decade, thus becoming one of the most successful IEs in all of Korea at that time (Park and Markusen, 1995 89-90; see also UNIDO, 1988 59; B.G. Park, 1991, 402-04).

engineering foreign technologies available locally, which resulted in the creation of internationally-competitive Korean products and production machinery.

Unquestionably, IEs were intended to play a vanguard role in Korea's development, despite the little mention of them in the economic development plans. This is made clear by the constant construction and organization of them, by the generous amount of land reserved for their location, and by the constant, successful efforts to upgrade the sophistication of products being assembled in newer IEs and the technology employed therein.

Saliently, laws were provided to allow foreign investment in the IEs, and the rights and obligations of foreign investors in these zones were clearly articulated in related legislation, as they were in legislation governing business in MAFEZ. This raises important questions: were the roles of Korean IEs and Korean EPZs the same in the government's development plan for Korea? If not, how were these roles different? Does legislation governing business within IEs and EPZs demonstrate important differences between the two? These questions will be addressed in the next section.

Defining Differences Between Korean EPZs and Korean IEs

By the time MAFEZ was established in the port city of Masan in 1970, much legislation and government subsidies were already in place to ensure the success of such an export platform. The law establishing the zone and its sister EPZ, the Iri Free Export Zone some four years later, did little to distinguish Korean EPZs from IEs (GROK, 1970). The wording of the establishment law and related supporting legislation are vague – perhaps purposely so. For example, any investment in these zones is welcomed that

develops "key industries ... [which] contribute to the development of the national economy and social welfare" (GROK, 1973 61). On these laws, Derek Healey, writing for a UNIDO publication, argues,

> [t]he question thus emerges in what way/s EPZs in the Republic of Korea can be considered to be 'special'? Not a great deal of attention is paid in official government publications or in the publications of commercial institutions to the special nature (if any) and operations of the EPZs and, often, where mention is made they are lumped in with 'Industrial Estates' in general. (UNIDO, 1988 10)

One wonders how much the Government of Korea wanted to insert some 'wriggle room' in its laws. That is, perhaps a lack of exactly-worded legislation would encourage the greatest amount of FDI, and would allow the Korean government to adapt the law to changing trends in international investment. At the very least, the lack of precise, firm legislation might not have *discouraged* FDI. Despite the vague language, there were incentives in the law governing EPZs that *did* distinguish these zones from IEs.

The substance of the collected laws governing Korean EPZs distinguish these zones in that they collectively create a legal regime governing the zones that is separate from the legal regime governing all other business activities and transactions in Korea, including those in IEs. Also, an EPZ is a customs outland, while an IE is not.[40] Products manufactured in EPZs are always intended mainly for export, whereas products manufactured in IEs are not necessarily.[41] Another important difference is that EPZs are designed to attract mostly foreign investment. This is not the case for IEs.

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[40] It should be noted, however, that some firms manufacturing for export within the IEs were able to recoup expenses paid in importing raw materials and intermediates through the 'drawback' system mentioned above. For more information on this, see UNIDO, 1988 and Healey, 1991.

[41] As mentioned earlier in the chapter, Export IEs did have to export 70% of their products. In this regard, they are similar to Korean EPZs.

More specifically, Korean EPZ firms were exempted from all corporate, income and property taxes, and they paid no tax for the first five years after their foundation on dividends and profits. After the initial five years, they only had to pay tax on fifty percent of such profits for an additional three years. EPZ firms in Korea did not have to pay any customs duty on imported industrial inputs. Korean IE firms and firms throughout Korea involved in the manufacturing of exports did have to pay duty on imported inputs, but were able to receive a complete refund through a customs drawback.

Another import advantage afforded to EPZ firms is that they were provided with simplified administrative procedures and a zone administration office which specializes in streamlining all import, export and business formalities for foreign and domestic investors in the zone. Therefore, the substance of advantages afforded to investors in Korean EPZs are that they do not pay any money up front for imported inputs, all formalities are simplified, and while the Korean government insists on 50-50 foreign and domestic investment in IEs after a period of time,[42] foreign EPZ investors are not required to find Korean partners. These are important differences, and thus Korean EPZs would be considered 'special' despite Derek Healey's assertion that they were not (UNIDO, 1988 7-10).

Other governmental sources clarify reasons for specific export promotion policies, from which may be gleaned important information pertaining to the establishment of MAFEZ. The Economic Planning Board (EPB), for example, published information in 1969 (the year before the establishment of MAFEZ) explaining why twenty national export promotion measures were promulgated in law – these, in turn, clarify the logic behind the establishment of MAFEZ. Amongst these measures are the following five:

[42] For a full description of this stipulation, see *Korea Herald*, 3 March, 1973.

first, laws permitting the establishment of EPZs in Korea, $60 million USD made available to export industries for procurement of equipment and the exclusion of three industries (cotton, woollen and silk fabrics) from certain export-oriented industries "in order to modernize production facilities and to facilitate mass production" (EPB, 1969 as cited in UNIDO, 1988 9-10); second, the utilization of domestically produced inputs was given financial and administrative support; third, efforts were made to diversify export markets and develop new commodities; fourth, administrative and financial support was provided to export industries throughout Korea, including in EPZs; fifth, foreign exchange credits were made available to designated export-oriented industries to facilitate the increased production of exports and to import industrial facilities (EPB, 1969 as cited in UNIDO, 1988 10; for a more comprehensive list of these measures, see Annex Table 2).

From the first measure we can extrapolate that since fabric production was excluded from certain export-oriented industries 'in order to modernize production facilities,' the Korean government worked under the assumption that fabric production would not modernize production facilities, and that other export-oriented industries would build more technical spillover with the domestic economy. Thus it is not surprising that fabric production in MAFEZ eventually languished while electronics, electrical and precision machinery flourished. The subsidizing of domestically produced inputs mentioned in the second measure suggests the government wanted to encourage backward linkages through the local sourcing of such products. Thus, the use of domestic inputs was much higher in Korean EPZs than in the EPZs of other countries, although it eventually levelled out at approximately one-third of total inputs for reasons

that will be documented in the next chapter. The third measure demonstrates the Korean government's interest in not only developing new manufactures, but also that such manufactures met international standards and specifications. As a result of this, then, Korean technicians, working in EPZs or those working in firms given subcontracts by zone firms were required to learn new production methods and foreign product criteria, encouraging knowledge spillover. The fourth measure articulates the desire to support export industries in obvious ways[43]. The objective of the fifth measure was to financially support foreign direct investors, wherever they choose to invest in Korea. In addition, this last measure mentions the *import* of industrial facilities for export industries, outlining the benefit of technology transfer to export industries. All of these measures are targeted to create the greatest number of production linkages and technology spillover, arguably the most important incentive for countries to establish EPZs and induce foreign direct investment. The results of these policies to create production linkages and spillover will be examined in the next two chapters.

[43] Note should be made here of the 'accelerated depreciation...to promote capital investment of export industries. Battacharya and Linn estimate that "the real effective exchange rate [in Korea was] depreciated by 29% between 1965 and 1973" (1988 79) by the Korean government in order to support export industries. Balassa *et alias* estimate that, excluding exchange rate effects, export incentives as a percentage of export value in Korean *won* increased from 12.8% in 1965 to 30.3% in 1971 (1986 44).

Chapter 3

Quantifiable Linkages from MAFEZ

While the benefits to local economies caused by linkages between EPZ firms and out-zone subcontractors is complex and difficult to define, it is fairly easy to quantify and relate transactions between zone and out-zone firms. The nature of regional integration that developed around Masan was such that often subcontractors outside of the hub were relied on when orders became more than zone enterprises themselves could handle. During slack periods, out-zone subcontractors were not given as many work orders since the companies inside the EPZ were able to fill production quotas themselves. Regional subcontractors benefited greatly, however, when they were able to create product-specific intermediates to international standards, and were able to deliver such intermediates on-time and on-spec. It was then that subcontracting firms became more than just contingent workforces. It took a number of years for production techniques and technologies to spill over to the greater economy, however, such that subcontractors were able to manufacture inputs to modern, high-tech standards. As will be demonstrated, in the case of MAFEZ, there were times in the early days of MAFEZ's development when the procurement of raw materials and quality intermediates was difficult and unreliable. After a number of years, however, Korean manufacturers of zone inputs and raw materials established themselves where needed in the region to supply parts to zone firms and to benefit from technology spillover from the zone. As will be demonstrated in this chapter, such technology spillover helped subcontractors in eventually developing reliable intermediates. The most immediate quantifiable linkage and benefit to the domestic

economy after the creation of MAFEZ can be seen in the procurement of domestic raw materials.

Backward Linkages Through Demand for Domestic Inputs

Immediately after the founding of MAFEZ, in 1971, local subcontractors supplied only 3.3% of inputs[44] to zone firms (Healey, 1991 5). According to a UNIDO report (1988), that number reached 24% just four years later, and stabilized at around one-third between 1979 to 1985. Thus, MAFEZ firms relied on Korean raw materials from the early days of the zone's existence, and that number stabilized at one-third through

[44] Here, the scholars cited refer to 'raw materials' rather than 'inputs.' Since it is unclear what 'raw materials' the authors here are referring to in resource-poor Korea, the term 'input' will be substituted for the sake of simplicity. Inputs may be used to refer to unrefined raw materials as well as semi-raw materials that have been transformed to some degree in a manufacturing process and that are intended to be used in creating a finished product. Inputs are defined as "a term sometimes used for the amounts of the various factors of production employed by a producer" (Hanson, 1986 217). Raw materials refer to "primary products such as minerals, the skins of fleeces and animals, some products of the soil (cotton, flax, timber, etc.), all of which form the basis of manufacturing in industry (Hanson, 1986 325). Raw materials are untreated basic materials and thus scholars should not confuse raw materials with inputs altered from their initial form. Steel, for example, is not a raw material. Equally, leather and silk are semi-raw materials because they have been treated and prepared before being used to make leather goods or textiles. This notwithstanding, scholars often and consistently make this mistake. Kaplinsky, clearly misunderstanding the distinction, contends that all raw materials are inevitably sourced from abroad, because zone firms "are generally only expected to acquire labor and utilities domestically" (1993 1851). This, however, was clearly not the case in MAFEZ. Peter Warr posits that "two of the anticipated benefits of EPZS were that firms would buy more local raw materials and that such links transfer technology to domestic firms" (Warr, 1989 71). Other scholars that cite the significance of raw material linkages from EPZs to a country's economic growth include: K.K. Cho, 1990; Currie, 1979 and 1985; Din, 1994; Glass et al., 2001; Jenkins, 1992; Lee and Wu, 1993; K.S. Lee *et al.*, 1987; Lester, 1982; Madani, 1998a, 1998b; UNIDO, 1976, 1980b, 1988; Yuan and Eden, 1992; etc.). Sakong Il states that major exports of raw materials in 1961, before the EOI push of the 1970s, were, in order of decreasing percentages: iron ore, tungsten, raw silk, anthracite, squid, other fish, graphite, plywood, grain and animal fur (Sakong, 1993). The CIA World Factbook states that, at present, Korea's top natural resources are: coal, tungsten, graphite and molybdenum (online resource available at: https://www.cia.gov/library/publications/the-world-factbook/). The raw materials listed here that are important to MAFEZ production include: iron ore, tungsten, raw silk, graphite, animal furs and molybdenum. A report from the *Korea Herald* in the first full year of MAFEZ's existence demonstrates Korea's high dependence on raw materials from other countries: "Korea is depending (*sic*) 100 per cent on Japan for the import of mineral ores and zinc ores ... and wholly on the United States for her supply of beef tallow and beans. In addition, Korea is relying on the United States for Indian corn (98.8 per cent) and raw cotton (97.3 per cent). Korea imports 97.1 per cent of its raw sugar from the Republic of China 78.8 per cent of its wool from Australia and 89.4 per cent of its raw rubber from Singapore" (*Korea Herald*, October 6, 1973 4).

MAFEZ's mature phases. Willmore claims that use of Korean raw materials increased to 25% by 1975, and "eventually reached 44%" (Willmore, 1995 532; see also Healey and Lutkenhorst, 1989 24-32; UNCTC, 1991 331-34). The numbers presented by UNIDO, however, are borne out by statistics compiled independently by K.S. Lee *et al.* (1987 138; Table 4.9), who exhaustively examined contracts and work orders placed with raw materials and intermediate-producing firms available in the MAFEZ Adminstration Office, as well as by newspaper articles published by the two regional newspapers, the *Kyungnam Maeil* and the *Kyungnam Shinmun*. To take the most conservative estimate, total usage of domestic raw inputs hit one third in 1979 and seemed to stabilize around that number in the years after (Healey, 1991 5). Total raw material usage fluctuated along with fluctuations in international trading markets and elasticity of demand for imports, but total *domestic* raw materials as a proportion of total raw materials remained steady at approximately one-third (UNIDO, 1988 73). In addition, while total materials costs and local raw materials costs soared along with the expansion of manufactures in the zone, the costs of local raw materials as a percentage of total raw materials costs hit one-third in 1977 and remained more or less stable at that percentage in the years following (Healey, 1991 56; see also Warr, 1984 Table 1). The UNIDO report of 1988 (Table 18) demonstrates that one-third equilibrium ratio in a national context: while there was an enormous jump in the amount of total domestic inputs used in non-EPZ exporting firms throughout Korea between the years 1977 and 1978, that number remained roughly the same for EPZ firms. Consider the significance of this in an international context: there were large fluctuations in the same years in Taiwan and Malaysia, and the data demonstrate similar instability in the Philippines between the years 1978 and 1981 in the

share of total domestic material inputs (Tsui, 1987 343). Why would Korean EPZs have the largest percentage of domestic material inputs, and why would that number remain so steady in contrast to other Asian EPZs and Korean non-EPZ exporting firms? There is no legislation suggesting that EPZ firms could use no more than one-third of domestic raw materials. Recall that the Economic Planning Board in 1969 asserted that the Korean government would start subsidizing domestically produced raw materials as a mainstay of its export promotion policy. EPZ firms would want to use more and more domestically-produced raw materials since they would be subsidized (thus, one would assume, be cheaper) and would not need to be imported at great cost from abroad.

A review of newspaper articles in the 1970s and 1980s gives one an idea of the problems faced in procuring a domestic supply of raw materials and semi-finished goods. One firm identified as "T" company in a provincial daily newspaper, the *Kyungnam Maeil*, reports of MAFEZ firms' difficulties in procuring a regular supply of electronics parts in the late 1970s because of the sudden boom in electronics manufacturing. A spokesman for "T" company claimed that the company was only able to work at 87% capacity because of a lack of reliable domestic supply. The spokesman also claimed that distance from parts suppliers was also a problem. Most of the electronics parts for this company came from the Gumi and Guro Industrial Estates. While Gumi is located in the same province as Masan, it is still a few hours' drive. The Guro estate is located in the suburbs of Seoul, thus a six-hour drive at minimum.

The Ministry of Trade and Industry, at the time of the article's publication, was devising emergency measures to ensure an adequate supply of electronics parts to electronics manufacturers throughout the country (*Kyungnam Maeil*, November 2, 1978

2). The article outlines, then, that there was a lack of inputs from large Korean IEs, that the inputs did not meet MAFEZ exporters' specifications, and that distance between the IEs and the EPZ also played a factor in lack of supply. It is not surprising that within ten years, the greatest number of electronics & electrical input manufacturers and subcontractors for MAFEZ (105) were located in Masan City. Only eighty-nine such firms were located in other urban areas throughout Korea, and fifty-one in all other rural areas (K.S. Lee, 1991 74). This clustering of input manufacturers suggests a high degree of cooperation between the manufacturers of inputs and electronics & electrical manufacturers in the EPZ.

In other MAFEZ production sectors, the stagnation of domestic inputs continued well into the mature stage of the zone's development. The percentage of domestic inputs reached one-third in 1978, during MAFEZ's 'takeoff stage' and the percentage remained the same six years later during the 'mature stage.' A number of newspaper articles shed light on reasons why domestic inputs idled at one-third.

First is the stagnation of steel inputs as reported by the *Kyungnam Shinmun*. Small and medium-sized enterprises that manufacture inputs for MAFEZ firms were unable to receive a steady procurement of steel from the Pohang Steel Company in the northern part of Kyungsang Province, and thus electronics and precision metal manufacturing companies in MAFEZ were particularly hard hit by the shortage. Pohang Steel had difficulties in filling orders for steel due to the constant increase in orders for steel correspondent to the increase in manufacturing nationwide. As a result of this situation, the MAFEZ Administration Office organized combined orders from SMEs operating in

the zone, thus to realize economies of scale zone-wide and to prioritize MAFEZ orders at the Pohang Steel Company (*Kyungnam Shinmun*, September 22, 1984).

A second article published a year later in the same newspaper argues that the poor quality of Korean inputs was an important reason why percentage of domestic inputs to MAFEZ remained low. In the article, it is stated that electronics products like semi-conductors that have the Made in Korea branding are seen as intermediates of low-quality in Korea and abroad. Reliance on foreign-manufactured goods means higher costs for zone firms, but these higher costs can not be helped should the quality of domestic inputs remain low. Contributors at the *Kyungnam Shinmun* use the example of selenium drums, a vital part used in the manufacturing of photocopiers by MAFEZ and Changwon firms. Selenium is in no short supply in South Korea, yet the quality of the manufactured selenium drums in 1985 was poor. Thus photocopier manufacturing companies, such as the Ashin Electric Company in the Changwon complex, were forced to pay out vast sums of money to repair recalled photocopiers that had faulty selenium drums. After using the more expensive, better-quality selenium drums imported from England and Germany, the costs of manufacturing the copiers actually decreased because they no longer had to contend with factory recalls and defective parts (*Kyungnam Shinmun*, April 18, 1985).

The problems revealed in the *Kyungnam Shinmun* are very complex to resolve. The manufacturing sector in the late-1970s and early-1980s grew precipitously, forcing domestic suppliers of intermediates to adapt their production methods to meet international standards while increasing production. These, in addition to the energy crises of 1973 and 1979[45] significantly hampered the flow of inputs to the zone. All of

[45] This problem was exacerbated by the fact that Korean manufacturers often could not purchase petro-chemical by-products from suppliers in Japan, since there was significant hoarding of such by-products

these problems resulted in the stagnation of domestic inputs and thus a reducing of production linkages in Korea. It is worth noting, however, that when there was a need for electronics & electrical input manufacturers for MAFEZ, Korean entrepreneurs responded by clustering close to the zone itself, suggesting a high degree of cooperation and integration of production processes. As will be seen, this regional clustering of electronics & electrical inputs manufacturing aided in the ascendancy of electronics & electrical manufacturing as the dominant sector in the zone.

Quantity and Quality of Zone and Out-Zone Linkages

While domestic inputs flowing into Korean EPZs seemed to stabilize at one-third, there was greater variation in raw material and intermediate sales to other zone firms and out-zone firms. Recalling that EPZ firms used a much higher percentage of domestic inputs than did non-EPZ exporting firms (UNIDO, 1988 Table 18), one can state categorically that there was a high degree of cooperation between zone manufacturers and domestic suppliers. But what of the cooperation between zone firms and between zone and out-zone manufacturers in the production of intermediates? According to the UNIDO report stated above (1988 Table 22), sales to other EPZ firms as a percentage of EPZ manufacturing output fluctuated between 13.2% and 19.6%. One can assume that these sales consisted of intermediates, since zone manufacturers would not be interested in purchasing finished products; the UNIDO report furthermore states that "frequently...it is only components which may be sold locally and not the finished products" (1988 37). Sales of finished goods to the domestic market of zone

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between the oil shock of 1973 and the energy crisis of 1979 by Japanese companies (*Kyungnam Maeil*, May 22, 1979 2).

manufactures peaked at a negligible 0.6% of total output (UNIDO, 1988 Table 22). Clearly, zone firms were far more interested in exchanges of intermediates between zone firms than sales to the local market, even though they were permitted to sell up to 30% of their output locally as established in the Law of the Free Export Zone. Given the information provided by UNIDO (1988), Healey (1991), and Warr (1984), the linkages within Korean EPZs were indeed strong, especially in MAFEZ and IFEZ's formative years. The linkages stretching beyond the perimeter of the zone, however, are not as well documented in the above-mentioned reports. For evidence of the strength and quality of these linkages, one must consider the data of scholars that compiled evidence of interactions between zone, 'trusted,' and 'entrusted' firms.[46]

The reports prepared by K.S. Lee *et al.* (1987), K.S. Lee and C.T. Wu (1993), K.S. Lee (1991), K.K. Cho, the Korean Economic Planning Board (EPB, 1986) and UNIDO (1988), combined, give a much clearer picture of the number and quality of intra- and extra-zone linkages. All of the reports in which K.S. Lee is involved are especially useful since they were compiled by calculating the number of work orders between MAFEZ firms and subcontractors of these firms. K.S. Lee and associates have exhaustively explored the degree of extra-zone linkages to local service industries, as well, giving an even greater picture of regional integration.

The number of MAFEZ firms peaked in the very first year after it was fully functional – in 1973 – and continued to decline consistently to reach just 79 in 1984 (J.N. Kim, 1983 Table 3 and MITI, 1986). The number of IFEZ occupant firms jumped in its

[46] Healey, Cho and K.S. Lee and associates all use the term 'entrusted firms' when indicating subcontractors of EPZ firms outside the zone. Cho and Lee, however, make a careful distinction between 'trusted firms' and 'entrusted firms,' the former being zone firms that receive subcontracts from other zone firms.

second year of full functioning, 1976, and continued to rise from there. It is not surprising that MAFEZ would reach full occupancy shortly after operations commenced, given the limited land available. MAFEZ was built on a piece of reclaimed land dredged from the ocean at enormous cost. The drop in number of occupant firms, however, is curious. Occupant firms in IFEZ, built inland where property was cheap and available, continued to increase as would be expected. While resident firms in MAFEZ decreased, the number of trusted firms increased proportionately and entrusted firms skyrocketed, especially after 1985. There was a 550% growth in entrusted firms between the years 1976 and 1988 (K.K. Cho, 1990 31). The slight increase in intra-zone transactions with trusted firms suggests that, over time, there were fewer firms in MAFEZ, subcontracting work to other resident firms. The boom in transactions between the decreasing number of resident and the increasing number of entrusted firms indicates that manufacturers in the zone became dependent on out-zone processing. This is supported by the fact that the number of employees in MAFEZ firms stagnated while the number of entrusted subcontracting employees steadily increased, not to mention total subcontracting payments (K.S. Lee, 1991 72).

Korean policymakers clearly intended production sharing and the formation of linkages to the domestic economy to be a part of their nation's industrialization drive, and thus promulgated laws that allowed some 40% of the total production process to be completed outside of EPZs (Basile and Germidis, 1984 55). A snapshot in time demonstrates the effectiveness of this law. K.S. Lee (1991) asserts that there were 58 MAFEZ firms actively entrusting 361 subcontracting firms in March of 1988 (73). In 1988, during MAFEZ's mature stage, there was great diversity in the number of

subcontracting firms for every MAFEZ firm. For example, eight MAFEZ firms had relationships with only one subcontracting firm, while one firm had subcontracted orders to twenty-four Korean non-EPZ firms (K.S. Lee, 1991 73). Looking at the size of MAFEZ entrusted firms according to the number of employees (K.S. Lee, 1991 84) gives one a sense of the kind of subcontracts that MAFEZ firms were involved in. The lion's share of entrusted contracts were given to smaller firms, suggesting a diversity of needs and backward linkages caused by the establishment of the zone. The need for the largest subcontracting firms was clearly limited, accounting for only 1.1% of employment linkage effects outside the zone. According to data provided by K.S. Lee (1991) the smaller the MAFEZ firm, the larger the dependence on out-zone processing. In addition, the smallest MAFEZ firms employed the greatest number of large subcontracting firms in 1987 (K.S. Lee, 1991 75). This implies a production sharing arrangement, crystallized organically by market pressures. For legal and geographical reasons, MAFEZ could not expand beyond the perimeter of the reclaimed land from Masan Bay. The picture of MAFEZ establishments that became clearer over time was that there were fewer very large firms operating in the zone, and many small and medium-sized enterprises (SMEs). The large firms were fairly self-contained and self-sufficient. SMEs, which accounted for a much larger portion of total employment in MAFEZ, needed the aid of out-zone processing to complete their orders.

Dependency of Zone Enterprises on Out-Zone Subcontractors

Over time, small, mostly independent entrepreneurial subcontractors opened shop in the area surrounding MAFEZ to avail themselves of the opportunities created by the

establishment of zone firms. The linkages between zone and out-zone firms were solid, because they needed one another in order to complete orders to international standards and speculations, and to production deadlines. K.S. Lee (1991) best expresses this symbiotic relationship in the data she collected from MAFEZ firms and subcontractors, demonstrating production linkages in terms of U.S. Dollars for the first six months of 1987 (K.S. Lee, 1991 77, Table 6).[47] MAFEZ firms employed an average of 3.4 subcontracting firms, with 80.6 out-zone work orders per zone firm. Each zone firm spent an average of USD$324,800 in the six months on out-zone contracts, or USD$4,024 per work order contract. There were 23.4 work orders per zone subcontractor in those six months, with revenues of USD$94,900 per subcontractor for each contract they had with a zone firm. Keeping in mind that there was an average of 23.4 work orders for every subcontractor, that totals USD$2,220,660 in revenue from out-zone processing for every subcontractor for just the first six months of business in 1987. There is no question that this would entail a high degree of dependency between zone and out-zone enterprises. Zone and out-zone enterprise could not exist but for the existence of the other. It should be noted, however, that since the number of out-zone contracts fluctuated from year to year (K.S. Lee, 1991 84, Table 10), subcontractors were, to a certain degree, treated as a contingent workforce. Whatever the reality of the relationship, the need for work to be carried out outside of the zone spurred positive employment linkage effects.

The United Nations Centre on Transnational Corporations and the International Labour Organization (UNCTC and ILO) suggest a coarse ratio of one indirect job created

[47] 'Table 6' refers to a table in the original work cited. All tables available within this thesis are referred to as 'Annex Tables,' and may be referred to at the end of the thesis.

for every five EPZ jobs created. "Given the fact that there are no data for other countries, one could use this 20 per cent ratio as a means of making a first estimate of the total number of jobs indirectly created through their backward linkages with the economies of the host countries" (UNCTC and ILO, 1988 76). Thus, for the 33,080 employees working in MAFEZ in 1988 (Annex Table 3, column 1), one could expect 6,616 indirect production jobs (column 6). In fact, 16,686 such jobs were created (column 5), two and a half times the number of expected linkage jobs, using the ratio suggested by the UNCTC and ILO. MAFEZ, as a regional development tool was very successful – at least in the manner in which it created indirect employment – not to mention support service industry jobs created, for which reliable data are not available.

Having established that there was a high dependency between zone manufacturers and out-zone subcontractors and supplying firms, it is important now to establish the manner in which such dependency varied by manufacturing sector in the zone. 'Supplying firms' refers to those manufacturers involved in making inputs used in finished products. These inputs would be used without significant transformation by the producers of the finished products – the zone firms. Lee and Wu (1993) present data from seven major electronics & electrical inputs suppliers to MAFEZ firms (6; Tables 1 and 2). The firms are identified as Firms 1 through 7 and information is presented in terms of the number of transactions, the total employment of the subcontracting firms, and total transaction values in US Dollars between zone firms and suppliers. Of these firms, 'Firm 3,' producing various moulding and cassette tape intermediates demonstrates the highest percentage of value-added in terms of the final demand, at more than three-quarters of the final export value. Cassette tapes would need little transformation in the

factories of final production, besides packaging perhaps. 'Firm 6,' employing only 35 workers, added only 3.6% of total value added and supplied one zone firm. In contrast, 'Firm 1,' producing inductor coils and motors of various kinds, provided inputs to the largest number of zone enterprises: eleven. Inductor coils, components that facilitate the flow of electrical currents, are used in most electrical and electronic goods. It goes without saying that motors are used in many products. Thus, it is not surprising that this supplier was able to find an abundance of enterprises to which they could sell their goods, and were able to employ the highest number of workers. Lee and Wu (1993) help to make an obvious, but important point: firms involved in manufacturing inputs used in diverse manufactures are able to do business with a variety of zone firms, while those involved in specific manufacturing, like watch component making, would not have such a healthy relationship with zone firms. The watch component manufacturer, it is recalled, was employed by only one zone enterprise. Thus, the supplier depended completely on the one zone manufacturer of the finished product. If the MAFEZ watch company were to go bankrupt, so would the captive watch component manufacturer. On the other hand, the firm involved in inductor coil manufacturing would be much more resilient in the case of a zone contractor's failure.

Zone firms involved in the manufacturing of complex electrical equipment and machinery seem to create the healthiest backward linkages, as demonstrated by UNIDO's (1988) report. They all employed a good number of suppliers and a healthy number of subcontracting relationships were forged through these linkages. Such zone firms employed the majority of zone workers by the mid-1980s (61.9%), and created out-zone employment equal to approximately one-quarter the number of zone jobs. The

comparatively low-tech, labour-intensive garment sector employed a much higher percentage of out-zone labour at 60.9%, while the percentage of total MAFEZ employment in this sector was a negligible 2.9 (UNIDO, 1988 Table 20). Korea's export promotion policy, as told by the Economic Planning Board in 1969, excluded certain cotton and woollen fabrics and raw silk from designated export-oriented industries (EPB, 1969). In addition, garment manufacturing except for leather products was excluded from the list of eligible types of industry for zone occupancy, according to the Law for the Establishment of a Free Export Zone (GROK, 1970 article 8), but ineligible types of industry "may be allowed with the approval of the Minister of Trade and Industry [MITI] if necessary" (UNIDO, 1988 61). The Korean government wanted to forge maximum technology spillover (and the textile & garment sector afforded little), and backward linkages to raw material and input suppliers (which were almost non-existent in this sector). The Korean climate is too cold and wet to support cotton agriculture, necessitating the import of all raw materials for cotton garment manufacturing. The government had the foresight to realize that garment manufacturing would result in few, if any, backward linkages. Foreign direct investors, however, wanted to avail themselves of cheap Korean labour and high profit margins in this sector. Thus, garment manufacturers, being excluded from certain foreign investment concessions in MAFEZ, set up small factories employing only 2.7% of all MAFEZ labourers, while out-zone employment as a percentage of total MAFEZ employment was a whopping 60.9% in 1985 (UNIDO, 1988 Table 20).

The heavy reliance by zone garment manufacturers on subcontracting represents production linkages more akin to the employment of a contingency workforce than

production sharing that might forge linkages and technology spillover. Since there weren't heavy concessions given to zone garment manufacturers and no subsidies for materials like cotton, which had to be imported, there was no reason to keep the manufacturing process within the perimeter of the EPZ. Basic facilities were installed for administrative simplification, 775 workers were employed in the zone and 472 through subcontracts outside of the zone (UNIDO, 1988 Table 20). While garment manufacturing was definitely present in MAFEZ, it was not a core industry and thus it may be stated that the government's attempt to exclude the textile & garment sector, to a certain degree, was successful.

The Predominance of the MAFEZ Electronics & Electrical Sector and Implications for Production Linkages

By 1985, the electronics & electrical sector had become dominant in MAFEZ, though it was by no means a monoculture (UNIDO, 1988 Table 20). The precision machinery and footwear sectors were also successfully entrenched and had created healthy out-zone linkages. K.S. Lee *et al.* (1987 138) also reveal that MAFEZ shoe production created a strong backward demand for material inputs with a dependency ratio of 87.2% and ferrous metal product manufacturers relied on 70.2% of their material inputs from Korea.

By MAFEZ's stage of maturity in the 1980s, the electronics & electrical sector had created the greatest backward employment effects, employing 7,047 workers through subcontracts in 1986. The precision machinery and shoe manufacturing sectors also provided significant out-zone employment through subcontracting linkages, though nowhere near the employment linkages created by electronics & electrical

manufacturers[48]. It is also worth noting that half of the firms employed by manufacturers of final electronic & electrical demands in MAFEZ were other MAFEZ firms, demonstrating a strong linkage effect within the EPZ itself in 1986 (K.S. Lee *et al.*, 1987 119). The number of overall trusted firms reached 55 in 1980 and levelled out at that number, while the number of entrusted firms rose to 291 in 1986 (K.S. Lee *et al.*, 1987 117). In other words, electronics & electrical subcontracting work done outside of the zone eclipsed work done within the zone over time. The escalation of the electronics & electrical sector coincided with the establishment of domestic inputs' manufacturers and subcontractors in Masan City and areas nearby MAFEZ. This clustering of electronics & electrical entrepreneurship is unique to this manufacturing sector, with the possible exception of the precision machinery sector which saw the establishment of domestic suppliers in the Masan City area equal to the number of domestic suppliers in all other areas of the country (K.S. Lee, 1991 74; see also *Kyungnam Maeil*, November 2, 1978). The proximity of suppliers, subcontractors and zone firms has implications for the exchange of information and production methods. In other words, in certain manufacturing sectors, geographically tight production linkages and technology transfer go hand in hand.

A report by the UNCTC and ILO (1988) posits, "there are good reasons to believe that quite a lot of know-how and information is transferred informally between unrelated firms in an EPZ. This transfer is facilitated by the geographical proximity of EPZ enterprises" (ILO and UNCTC, 1988 119). In the case of MAFEZ, firms related through

[48] This trend is not surprising considering that in 1972, the first year of MAFEZ's full operation, electronics and machinery were in high demand on the international market. They accounted for 56 and 13 percent, respectively, of total U.S. imports from developing countries under Tariff Items 807.00 and 806.30 (APO, 1978 7).

subcontracting relationships and in close proximity to one another outside the perimeter of the EPZ would likewise transfer a lot of know-how and information. Given such statements, it is not surprising that firms which typically generate the highest technology transfer – that is high-technology and precision machinery firms, are characterized by the greatest number of trusted and entrusted subcontracting firms in geographical proximity to the manufacturing hub – the zone itself. Such technology transfer will be dealt with in greater detail in Chapter Four.

Diffusion of Linkage Effects Throughout the Greater Korean Economy

While production linkages from the electronics & electrical sector seemed to cluster around MAFEZ, production linkages from other zone sectors tended to diffuse over a much wider geographical area. The dispersal of contracts over a wider area is a trend that can be observed over a period of years. From 1978 to 1987, urban areas outside of Masan received a much higher percentage of overall contracts from MAFEZ than did rural areas and Masan City itself (K.S. Lee et al., 1987 121-27; 79 Table 8; 124 Table 4.5). Detailed statistical analysis by K.S. Lee (1991 79) demonstrates that in 1987, nearly twice as much total value was added to MAFEZ outputs in the provincial areas surrounding Masan than in Masan itself, even though the number of work orders in the province and in the city were virtually the same. Regional integration caused by the establishment of MAFEZ was considerable. Employees were hired indirectly for MAFEZ work over a wide area, and money, supply and product flows were large, diffused and continuous.

In 1978, there was more production sharing from MAFEZ in the major metropolitan city of Busan than in Masan (K.S. Lee *et al.*, 1987 125). Busan, located

some fifty kilometres from Masan City, is the capital city of South Kyongsang Province, and has a much larger population than Masan, as well as a much more active port and central business district. The Port of Busan, in fact, was the most active in the country in the 1970s and -80s, and thus an enormous amount of raw materials and semi-finished products entered through this port to supply manufacturers throughout the country. MAFEZ manufacturers thus availed themselves of the concentration of imported materials and inputs in Busan by commissioning subcontractors to add value to these intermediates at their port of arrival to the country. By 1980, an industrial belt had been created between Busan and Masan and beyond (K.S. Lee *et al.*, 1987 126). This belt included the Changwon Machine Complex, the Ulsan Petro-Chemical Complex and smaller regional industrial estates that added value to final products exported from MAFEZ. Some production sharing had diffused to cities throughout the country, including Seoul and the adjacent port of Incheon, but there were fewer employment linkages with rural areas. In 1985, one sees a multiplication of employment linkage effects throughout the country and further benefits to rural areas, especially in Kyongsang Province.

This distribution of subcontracting and sourcing of inputs is also quantified by K.S. Lee (1991 79, Table 8) and K.S. Lee and associates (1987 140, Table 4.13) in terms of value-added in U.S. Dollars. This distribution of value-added throughout the country tells a different story than the employment linkage effects and production sharing agreements. Subcontracting from MAFEZ, and the attendant employment linkage effects could be found in every province of Korea by 1985 (K.S. Lee et al., 1987 127-40), though the lion's share of such agreements were to be found in South Kyongsang

Province. In terms of value-added, however, as much value was added in Seoul as in Masan City and more was added in Busan. In summary, production sharing created strong *regional* employment effects and strong *national* economic distribution. More jobs were created in South Kyongsang Province through linkage effects, but this does not correspond to the distribution of value-added through subcontracting; as much value was added to final MAFEZ products in Seoul as in Masan City.

The picture that emerges from this analysis is clear: supply, value-added, and employment linkages began soon after the establishment of MAFEZ and increased through the three stages of the zones' development. Such linkages dispersed throughout the country, but formed especially strong regional linkages, as supported by the government-sponsored establishment of adjacent IEs. Zone and regional out-zone firms had particularly strong relationships, with a mutual exchange of goods within the zone itself. Production sharing firms located in the region had a strong bond with zone factories, but, for the most part, diversified enough so that they could withstand individual factory closures. In addition, the Korean government's policy of selective support for export industries that would create the maximum amount of backward linkages was effective.

Lee and Wu (1993) provide a schematic diagram illustrating the actual linkages within MAFEZ and beyond (7). The tightest bonds, involving a mutual exchange of goods, are found close to the centre of the diagram, in this case representing the nucleus of the zone and firms located directly outside. The diagram is 'busiest' here, indicating frequent and continued exchanges of goods. Immediately surrounding this nucleus are firms involved in sending only, or receiving and sending. At the periphery are zones

involved in receiving only, demonstrating the transportation of final goods to the periphery where they are sold. This diagram calls to mind the commodity chains described by Hopkins and Wallerstein and, of course, the backward and forward linkage effects as described by Albert O. Hirschman. This is, of course, an oversimplification of the actual process in creating manufactures of final demand. In some cases, individual subcontractors may themselves subcontract further to other firms. Some outzone subcontractors may be involved in several steps in the stages of final preparation of a product. An individual MAFEZ firm has been shown to employ as many as twenty-four subcontractors, and one cannot even estimate the degree of secondary subcontracts that this may create. Nonetheless, it is useful to visually represent these linkages in a simplified form.

The inevitable result of such production sharing and diffusion of demands for intermediates and raw materials throughout the country, especially in manufacturing exports, is that domestic companies will learn to create products that conform to international standards. Korea in the 1970s and 1980s, constantly evolving and developing, was always trying to catch up to the First World. Korean manufacturers knew that they needed to upgrade their technical knowledge and production techniques if they were to be given contracts by zone enterprises manufacturing for export. Zone enterprises needed to rely on the constant quality of the inputs being installed into their products, thus they had to ensure that their Korean counter-parts were capable of producing world-class inputs. Both parties were interested in the development of production capabilities and technology advancement in the input-producing domestic

sector. As a result, foreign zone enterprises became technological teachers and domestic input-producing firms became technological learners.

Chapter 4

Technology Spillover from MAFEZ: Teachers and Learners

A number of scholars and organizations (e.g. APHD, 1986; Kaplinsky, 1993; Rondinelli, 1987; UNCTAD, 1993; Warr, 1986, 1989a, 1989b, 1990, 1991; Y.S. Lee 1999a) have criticized EPZs as a development tool on the basis that little or no technology is transferred from zones to the domestic economy or to the domestic workforce. In the specific case of MAFEZ, Dennis Rondinelli has claimed that MAFEZ has "imparted virtually no new technology to the Korean economy" (1987 97) while Y.S. Lee claims that, based on information supplied to her by the MAFEZ Adminstration Office, no more than one technology transfer occurred in any given year during MAFEZ's maturity stage (1999a 355). A table published in the MAFEZ Administration Office's *Fifteen-Year History* lists imports of new technology by foreign firms into the zone, and it does, indeed, mention only one new technology imported to the zone per year between the years 1979 and 1986. However, it is revealed that in the same table that more than a hundred zone firms adapted and used the new technology (MAFEZ Administration Office, 1987 397; Table III-50).

The fact that Yong-Sook Lee even employs the compound word 'technology transfer' as a countable noun underscores a common misconception amongst scholars as to what constitutes technology transfer. Technology transfer occurs when a new machine is employed on a shop floor, when an employee learns a new skill, how to use production equipment (be it old or new) or attends a vocational school. It also occurs when a

manager learns new management techniques. In this chapter, all such instances will be referred to as 'spillover.'

The term 'spillover' as defined in the introductory sector of this thesis accurately illustrates the phenomena of knowledge and technology being transferred to the domestic economy and to domestic workers in that it is a direct consequence of the establishment of an EPZ, and it necessarily spills over the physical confines of such a zone, as water over a cup's brim. Just as water cannot be counted, neither will spillover in this chapter. Instead, this chapter will demonstrate the prevailing industrial and educational policies within Korea in the 1970s and 1980s that encouraged technology transfer throughout the domestic Korean economy as well as special laws that made obligatory technology transfer from foreign zone enterprises to domestic outzone enterprises. That established, this chapter will then illustrate examples of spillover emanating from MAFEZ, the manner in which technology and job skills were deliberately taught to MAFEZ workers, and the ultimate benefit to Korea of such spillover.

Koreans as Technological Learners and National Policies that Facilitated Technological Learning Nation-Wide

The prevailing attitude during Korea's EOI drive was one that favoured the sharing of technological knowledge. This is made clear in the national policies of the time. Alice Amsden (1989, 1990) also demonstrates how exchange of staff, cooperation between large and small businesses, and the involvement of production engineers in high-level business decisions in Korea all aided in the diffusion of technological knowledge throughout Korea. The cornerstone of Korea's industrialization drive, however, lay in the exchange of technocratic staff, according to Amsden. This author details how the

chaebol's policy of transferring salaried managers and engineers to supplier firms "has tended to raise the overall education level of Korean business" (1989 188). She also provides several case studies which demonstrate how *chaebol* were actively involved in the training of subcontracting firms (1989 179-88). She writes,

> HMC [Hyundai Motor Company] expanded its managerial support staff at the company level to provide its subcontractors with technical assistance. Thus, the establishment of a subcontracting network did not altogether preempt the need for an in-house managerial support staff. Nevertheless, it probably reduced the size that such a support staff would have had to assume in the absence of subcontracting. (Amsden, 1989 180)

Throughout *Asia's Next Giant* Amsden provides evidence of a tight relationship between production engineers and high-level management. Engineers played a key role in the Republic of Korea's rapid industrial expansion, not only as technical support staff, but as management. Key decisions, both on the floor and in the board room were usually made by engineers or in consultation with them.

Salaried engineers, then, became the facilitators in Korea of technology transfer and they enabled learning backward to the shop-floor and beyond to subcontracting firms, according to Amsden. Korean legislation also spurred the growth of subcontracting as such businesses were seen as technological learners. The Korean government, for example, "pressured HMC to patronize the small-scale firm in the interest of wealth sharing" (Amsden, 1989 180). For example, the government began to rigorously promote linkages between large conglomerates and small and medium-sized subcontractors in 1978 with the revised Small and Medium Enterprises Sub-Contracting Promotion Act which designated some industries and their products as sub-contracting products. "The large firms whose business areas belonged to these designated industries were requested to procure those designated products through outsourcing rather than in-

house production" (N. Baek, 2002 62). Such designated items increased from 41 in 1979 to 1,533 in 1984 (N. Baek, 2002 62). Further entrenching this national policy, Article 5 of the Small- and Medium-Industry Systemization Law (1982) permitted only small subcontractors to manufacture certain items that are commonly used as intermediates by larger businesses (Amsden, 1989 187). In addition, the government introduced tax incentives to encourage plant modernization and technical learning and it "introduced a scheme to reduce the risks they [small subcontractors] faced in commercializing new technologies" (Amsden, 1989 188). From this a "subcontracting system arose that was a microcosm of Korea's industrial economy" (1989 187).

Other important legislation that aided in technology transfer from large firms to smaller subcontractors not mentioned by Amsden include the Act on Fair Transactions in Subcontracting (1984),

> extending the government's supervisory authority to monitor contracts. By 1987, the Ministry of Industry and Trade had designated (through regulatory directive) 337 large enterprises as primary contractors and 2,188 SMEs as subcontractors in 41 industrial subsectors. Selected industrial subsectors were reserved for exclusive development by SMEs. In 1985, the Linkage Guarantee System was established and extended preferential guarantee service to those firms subcontracting for primary contractors. As a result, subcontracting has grown rapidly, accounting for 42 percent of the value of the manufacturing sector by 1986, and over 70 percent of electric machinery and transport equipment. Hyundai now subcontracts over 60 percent of its production costs, or 80 percent of its material costs from 437 vendors, most of which are SMEs that have benefited from Hyundai's financial, managerial, and technical support. As incentives, financial and fiscal support are available to SMEs involved in subcontracting, as well as the necessary funds for process and product development. Subcontractors are ... [given] a tax deduction ... for a preset percentage of investments in laboratory and inspection equipment. Expenses incurred for technical guidance by the parent firm is treated as a loss. The Korean Federation of Small Business has built up considerable expertise in subcontracting, and plays a mediating role in subcontracting problems. (EDIWB, 1994 11)

It is important to note that the promotion of SMEs by the Korean government began as early as July, 1961 with the promulgation of the Small and Medium Industry Bank Act. This was followed by the Small Business Cooperative Act in December of 1961, and the Small Business Basic Act of 1966 (J.S. Woo, 1986 115). However, "all these were not sufficient for developing the small medium industry which was weak compared with large industry" (J.S. Woo, 1986 115). In fact, a review of the literature suggests that government initiatives to support SMEs were not successful until the newer, product-specific laws, were passed in the late-1970s and early-1980s.

Nakki Baek's (2002) study of the role of subcontracting in Korea's development demonstrates the success of these latter government initiatives. National policies encouraged large businesses to patronize small and medium-sized subcontractors, initiating an increase in nation-wide manufacturing employment and value-added generation by small subcontractors "from 49.6% and 35.2% in 1980 to 61.7% and 44.3% in 1990, respectively. These ratios increased further to 69.3% and 46.5%, respectively, in 1997" (N. Baek, 2002 62).

Throughout Korea, there were interactions between large businesses and smaller subcontractors, to a degree that managerial and technical support became a foundation of the relationship between contractor and subcontractor. The larger companies would furthermore subsume the cost of improving technical expertise in the subcontracting company, thus technology transfer and the cost of such helped to integrate Korean conglomerates with Korean SMEs. As will be demonstrated, the MAFEZ 'enclave' was no exception to this rule. Foreign companies operating in the zone proved to be more

than just co-operators in Korean development, they in fact assumed the role of technological teacher over time.

Indicators of Technology Transfer Between MAFEZ Firms and the Korean Economy

The Government of Korea was heavily involved in promoting relationships between large Korean corporations and SMEs. But how much would this have affected the integration between zone firms and outzone subcontractors? According to the UNCTC and ILO, corporate *and* national policies play a key role in creating linkages and technological spillover:

> some enterprises, as a matter of corporate policy, make much greater efforts than others to integrate themselves, economically and technologically, in the host country – but experience shows that this also depends a lot on the policy, or absence of policy, on the part of the host country with regard to local sourcing and the importation of machinery, components and semi-finished goods. (UNCTC and ILO, 1988 108)

In the last chapter, it was established that there was a high degree of interaction between zone firms, subcontractors and suppliers, suggesting an interest in zone firms to integrate with the wider domestic economy. This would have prompted some degree of technology transfer regardless of the sector. As previously demonstrated, the electronics & electrical sector became dominant in MAFEZ, followed by the precision machinery sector, and both were very active in creating subcontracting linkages to the domestic economy. Numerous scholars have argued that these sectors create the most backward linkages and the highest degree of technology transfer (see, e.g., K.K. Cho, 1990; H.S. Choi, 1986; Dunning, 1993; Enos and Park, 1988; Jeong and Park, 1999; Pack and Westphal, 1986). The garment industry, in contrast, creates few linkages and spillover

(Basile and Germidis, 1984; ILO and UNCTC, 1988). The Asian Productivity Organization (APO) established that the electronics and machinery sectors forged the greatest number of linkages in the greater Korean economy in the late-1970s. Extensive survey research revealed that for every large electronics manufacturer, there was an average of 73.4 subcontractors providing inputs. Electronics subcontractors were employed by an average of 11 parent firms. In the machinery sector, large companies employed 11.7 subcontractors on average, and subcontractors worked for an average of five parent firms each (APO, 1978 14).

Given Amsden's assertion that technology transfer enabled by strong technical training and government policies was present throughout Korea in its drive toward EOI, as well as the fact that many subcontracts were awarded to outzone firms by high tech zone enterprises, it is hard to accept Dennis Rondinelli's claim that MAFEZ "imparted virtually no new technology to the Korean economy" (1987 97; see also Shorrock, 1981 8 and Takeo, 1977 for similar statements and arguments). Is one to assume that all prevailing business trends throughout South Korea in the 1970s and -80s had no influence on the EPZs and that important incentives introduced by the Korean government to encourage patronage of small domestic suppliers[49] had no impact on

[49] The Third and Fourth Economic Development Plans (1972-1976, 1977-1981) and the Revised Fifth Economic and Social Development Plan (1983-1986) all promote the patronage of Korean SMEs by larger companies and *chaebol*. For example, the third plan encourages the alignment of "medium and small enterprises with large enterprises ... in order to enable them to specialize in the production and supply of specific parts needed by the large enterprises to help reduce procurement costs. In order to expedite this industrial alignment, eligible medium and small enterprises will be encouraged to locate themselves in industrial estates and standardize their products" (GROK, 1971 64). The fourth plan asserts that "a number of steps will be taken to promote small and medium-scale enterprises and to improve their economic position. Business areas which are suitable for these enterprises will be protected, complementarity (*sic*) between small and large scale enterprises will be encouraged, and linkages with large scale enterprises through specialization will be promoted. These policies will strengthen the economic *raison d'etre* of such enterprises" (GROK, 1976 42). Furthermore, "by actively enforcing legislation promoting small and medium industries, these industries will be induced to specialize in the production of components, parts and semi-processed goods. These goods will then be supplied to large industries, which in turn will be induced

decisions made by zone firms?[50] Rondinelli's statement, which is based upon numbers crunched by Peter Warr in 1984, is unreasonable.

That said, it is necessary to attempt to quantify technology transfer, however approximate the measure. Recall that the UNCTC classified eight types of spillover: informational, technical, financial, procurement, locational, managerial, pricing and others (UNCTC, 1991 5-6). According to the definitions of each as found in Chapter Two, managerial and technical spillover provide the highest and most sustained transfer

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to transfer their technologies to the smaller firms" (GROK, 1976 47). The revised fifth plan refers to an inter-industry imbalance between large businesses in Korea and SMEs, and thus "small and medium industries, particularly those manufacturing parts and components, will be fostered through government support, geared at rectifying the inter-industry imbalance" (GROK, 1983 41). This plan was specific in detailing the policy measures that would support SMEs: "Policy measures will be undertaken to prevent the intrusion of large firms into the small and medium industry areas and to promote a cooperative division of labor between the large enterprises and small and medium businesses. To that end, the lines of trade suitable to small and medium industries and the products items designed for subcontracting will be increased. In order to support the status of small and medium-sized firms in subcontracting with large firms, sanctions on unfair price determination and undue payment delays will be strengthened. Contractors will be encouraged to conclude long-term contracts with subcontractors.... Separate legislation to promote fair subcontracting practices between large and small businesses will be sought. Under the new law, various existing rules and regulations on subcontracting will be streamlined with a view to strengthening supervision of subcontracting practices. A government agency with exclusive responsibility for developing cooperative subcontracting procedure and practices will be established.... 'The Council on Promotion of Subcontracting' currently operating on an item-by-item basis, will be expanded to work on industry types and steps will be taken to promote the formulation of a 'Consultative Council' at each subcontracting relations (*sic*). This will encourage establishment of sound subcontracting system between the large firms and small and medium-sized parts producers. The number of product items designated for further subcontracting will be increased annually for increased spilt-over (*sic*) effects of close subcontracting linkage.... A quality rating system will be introduced for use in the selection of small and medium sized firms to be developed as specialized producers. The selected companies will be given priority in receiving the benefits of small and medium industry support measures, such as government quality assurances and designation as promising small and medium firms. This will help the selected small and medium firms improve their product quality through specialized production.... To ensure close cooperation among the supporting agencies for small and medium industries, the Small and Medium Industry Policy Council will be come more active; and the Small and Medium Promotion Corporation will set up provincial and city branch offices so that they can provide local companies with better extension services on technology and market information" (GROK, 1983 50-52).

[50] Zone firms were not governed by the same legislation as companies in the domestic economy, however, all policy measures set out in the five-year plans documented in the above footnote, including those encouraging SMEs to locate near industrial zones and other industrial bases, would have impacted the decisions of small- and medium-sized start-up companies in clustering around the zone, especially as documented in the case of small electronics parts suppliers. The planned, nation-wide division of labour between SMEs and large companies was such that SMEs naturally assumed the role of parts suppliers to larger companies, and the quality of such parts were regulated by the government. This would have, and did, directly affect the business of zone firms, and thus patronage of SMEs by zone firms was simply a matter of course.

of knowledge to subsidiary or subcontracting firms. Therefore, it is these two that will be examined in the greatest detail in the case of knowledge transfers caused by the implantation of foreign firms in MAFEZ. The same study by the UNCTC (1991) also outlined the intensity of spillover as minimal, intermediate and high, and thus technological and managerial transfer from MAFEZ will be examined based upon these criteria.

Government Policies and Prevailing Business Practices that Supported Spillover from MAFEZ

The Government of Korea went to great lengths to ensure technology transfer from foreign companies importing their advanced technologies into MAFEZ to the economy at large. While some specific objectives for Korean EPZs are not made clear in the legislation establishing these zones, the government's position with regard to technology transfer from EPZs is unambiguous. The criterion for obtaining permission to be occupant enterprises in Korean zones was that foreign companies had to import a:

> higher standard of manufacturing technology compared to that available locally.
> (i) Technology to be made available to local enterprises for a minimum of one year to allow comparable industries to acquire the technology.
> (ii) Technology which can contribute to the improvement of product quality and lead to an increase in exports even though the technology is used by local industries (Law for the Establishment of a Free Export Zone, Article 8 and Article 8 of the Enforcement Decree of the Law for Establishment of a Free Export Zone as cited in UNIDO, 1988 61-62).

Korean policymakers clearly intended production linkages and the spillover of technology to be part of the country's industrialization drive, and that such linkages and spillover would be aided by the support of out-zone processing.

In 1986, there were 23 electronics & electrical firms and 8 precision machinery firms in MAFEZ (MITI and MAFEZ Administration Office, as cited in UNIDO, 1988 15, Table 4), underlining the heavy co-dependence between MAFEZ enterprises and subcontractors in certain industrial sectors. In the same year, the electronics & electrical sector in MAFEZ employed 180 subcontracting firms and the precision machinery sector employed some 57 subcontracting firms (K.S. Lee, 1991 74, Table 4). There were an average of 7.8 electronics subcontracting firms for every MAFEZ electronics firm, and 7.1 precision machinery subcontractors for every zone precision machinery firm.

It has been established in the previous chapter that close cooperation between MAFEZ firms and subcontractors resulted in the establishment of a contingent workforce that would have had to produce inputs to international standards and specifications. What needs to be established now is how the technology and skills necessary to support manufacturing for the world-market was passed on to the workforce, zone and contingent, in the domestic economy, and how the cooperation between foreign and domestic firms played a part in transferring technological and managerial knowledge to the domestic workforces. This will be presented mostly in the form of case studies which document powerful examples of such spillover. The most common and sustained technology transfer, according to newspaper articles consulted in the MAFEZ Administration Office's archives, occurred between MAFEZ foreign-domestic joint ventures. Such business arrangement resulted in an upgrading of workforce skills and necessitated formal training of workers and managers. Evidence will be given to support the conclusion that Koreans were astute technological learners and zone firms, foreign and domestic, were effective in educating their workforces. The upshot of all of this

technological learning and teaching will then be presented in terms of case studies outlining the clear benefits of this spillover.

Technology Transfer Between Foreign-Domestic Joint-Venture Firms in MAFEZ

The first case of technological spillover usually occurs between foreign-domestic joint-ventures in an EPZ. It is this kind of business arrangement that encourages close cooperation from the first, according to a UNCTC and ILO report (1988). A high degree of cooperation in joint ventures necessarily results in technology transfers within the zone and "some transfers probably also take place between foreign owned and domestically owned enterprises as a result of their physical proximity within the EPZ" (UNCTC and ILO, 1988 113). Joint ventures are diverse; some are truly equal partnerships between foreign and domestic companies, and others are "convenience marriages between a dynamic innovator and a sleeping partner who contributes no more than an important share of the joint venture's capital base" (UNCTC and ILO, 1988 113-14). Equal partnerships, of course, contributing equally in terms of "capital, equipment, technology and management" (UNCTC and ILO, 1988 113) usually create the best linkages and spillover from zones to the domestic economy. Each part of the partnership provides the best technology and know-how to complement the technology and know-how of the other partner. In the case of Korean-foreign joint ventures, the Korean managers often bring to the table know-how of local business practices, technology and production support networks. The foreign managers often (and are usually required by Korean law) to import advanced technology from abroad and foreign business practices. The UNCTC and ILO posit that much spillover occurs between the partners of a joint venture:

> What is often overlooked is that they [equal joint ventures] are also a major channel of transfer between the two participating firms themselves: the technology, managerial skills, organizational knowledge and marketing experience transferred to the joint venture ... will gradually spill over, by capillarity or through deliberate learning processes, to the other partner.... (UNCTC and ILO, 1988 114)

Joint ventures in MAFEZ accounted for 24 of 78 firms in 1986 (UNIDO, 1988 16), some 31% of total investment in the zone. From the beginning, there was keen interest from abroad in creating joint-ventures with Korean companies. A Korean company in Seoul in the early days of the zone's creation registered some 2,009 enquiries from foreign companies regarding the feasibility of creating joint ventures with Korean companies in MAFEZ between June, 1972 and June, 1973 (*Kukjae Shinmun*, July 4, 1973). By the end of 1973, there were 28 joint-venture companies with Korean and foreign joint shareholding in the zone. In the first ten months of 1973 alone, there was a six-fold increase in Korean investment in such joint-venture companies in MAFEZ (*Kyungnam Maeil*, November 23, 1973). As part of a regional stimulation package for South Kyongsang Province, joint venture electronic manufacturers in MAFEZ were given support by the Korean government provided that the firms were involved in "Koreanizing" their products. For example, *Hankuk Dongkyung* Electronics, a Korean and Japanese joint venture, was given domestic letters of credit in the amount of USD $350,000 to upgrade their line of Korean electronics and wristwatches, and thus they were able to survive unfavourable market conditions for such products (for a list of all MAFEZ companies and the main products they manufactured, as of November, 1987, see Annex Table 4). Through the organization of original product lines using Korean native technology, the company eventually registered record profits (*Kyungnam Maeil*, May 2, 1975).

Another joint Korean-Japanese venture that flourished under equal ownership was the *Hankuk* ISI company. Founded in 1977 in MAFEZ, almost all of the original technical specialists manufacturing electronic microscopes used in medical research and diagnoses were Japanese. By 1981, all such technical specialists were Korean and the optical technology had improved dramatically over just two years. The technology used to magnify images 60,000 times comprised 70% Korean technical content, according to the *Kyungnam Shinmun*, and the microscopes sold to universities and hospitals in the United States had captured 65% of that country's market share (*Kyungnam Shinmun*, 26 May, 1983).

A Korean-American joint venture was also established in the zone as early as 1972. The ownership was 45% American and 55% Korean, however, the Americans imported the larger share of the technology used to manufacture aluminium-hulled yachts and other ocean-going vessels, technology which enhanced greatly the burgeoning native shipbuilding industry[51] (*Sanop Kyungjae Shinmun*, 6 April 1972).

These are only a few cases of technology being transferred to the Korean economy through joint-ventures established in MAFEZ. An entirely different dimension of spillover is the direct training of Korean workers by foreign enterprises and joint ventures. Such technology transfer was pervasive in MAFEZ, and companies, foreign and domestic, needed to ensure the inculcation of job skills in the workforce so as to ensure the continued profitability of the company and the continued manufacturing of technologically competitive products.

[51] This company was no longer listed as a MAFEZ company in 1987 (see Annex Table 4). The article mentioning this company in the *Sanop Kyungjae Shinmun* did not provide the name of the company, and thus the author is uncertain what became of this company.

Technology Transfer through Formal Technological and Vocational Training

The argument that technology was transferred to the Korean labour force working in MAFEZ is strongly supported by three pieces of evidence: first, the overseas training of Korean technicians resulted in strong scouting practices, as various EPZ and non-EPZ firms competed to attract skilled workers, which resulted in a further diffusion of knowledge; second, the education of zone workers in formal vocational schools (with 50% tuition paid by zone firms) resulted in an encouraging increase in the overall academic attainments of zone workers; third, the constant improvement in technical skills by Korean workers and managers in MAFEZ resulted in the indigenization of the Korean technical and managerial workforce.

Examination of Korean newspapers from the 1970s and 1980s reveals that Japanese wholly-owned and joint-venture firms were particularly invested in upgrading the technological skills of Korean workers in MAFEZ. One Japanese firm started sending Korean workers to Japan for technological training in the very first year of its tenancy in the zone. In 1972, this Japanese electronics company (the name of the company is withheld in the article) sent 133 Korean technicians to Japan to learn advanced technological skills from Japanese parent companies for one to six months. This same company dispatched as many as 617 Korean workers to Japan in 1979 (*Kyungnam Maeil*, March 14, 1980 2). It should be said, however, that this vocational training got off to a rocky start in many cases. For example, this same company that sent 617 Korean workers abroad to learn technological skills became reluctant to continue such practices after realizing that their skilled workers were being poached by domestic

companies in and outside the zone upon these workers return to the EPZ from training sessions in Japan (*Kyungnam Maeil*, March 14, 1980 2).

The scouting and recruiting of skilled workers from zone firms became a problem early in the zone's existence and continued through the mature stages. As Mills and McDonald point out, modern industrial firms "that are growing quickly need to be able to recruit specialized, experienced and skilled professionals who can meet specific requirements" (1992 42). The attrition of skilled zone workers and poaching of these technicians caused unique problems for the zone. For example, it was reported in the *Kyungnam Maeil* in 1977 that workers with two to three years' experience, especially in electronics or precision machinery firms, and workers that had trained abroad were being poached by larger firms at an alarming rate. According to zone regulations, workers of any skill level only needed to give sixteen days' notice in order to leave one firm and join another or to quit working in the zone completely. Zone administrators convened a meeting to discuss this problem and started to establish tougher regulations to deter such scouting practices (*Kyungnam Maeil*, February 16, 1977). Even the less skill- and capital-intensive sectors within the zone were affected by recruitment of skilled workers by other zone firms. It was reported by the *Kyungnam Maeil* in 1979 that the garment & fibre sector was being affected by the recruitment of skilled workers between zone firms. The article states that eight skilled workers from a company identified as "G" firm were recruited by a competitor zone firm identified as "S" firm. In all, about twenty of the most highly skilled garment and fibre technicians were being circulated throughout different zone firms because of the high demand for their skills, and constantly increasing salaries and benefits being offered for their services (*Kyungman Maeil*, June 18, 1979 2).

In 1983, MAFEZ and the adjoining government-sponsored Changwon Machinery Industrial Complex were designated special zones in which the recruiting of skilled workers became illegal, according to laws enacted in Seoul. The government responded to complaints by firm managers of an alarming shortage of skilled workers in zone companies because as soon as workers became skilled enough, they were recruited by domestic companies that would offer better pay and benefits for their services (*Dong-A Ilbo*, April 12, 1983). In 1984, electronics & electrical firms were not able to keep up with the 25.3% year on year increase in orders from abroad because of a shortage of skilled labour. Again, it is reported that skilled technicians were leaving small zone firms *en masse* to join large Korean firms because of the better remuneration. This notwithstanding laws forbidding illegal scouting practices and recruiting of skilled workers from zone firms (*Maeil Kyungjae Shinmun*, June 21, 1984).

The consequences of legal and illegal scouting clearly created a problem for many firms in MAFEZ which were competing with large Korean conglomerates to keep their skilled workforce. The benefit to the individual worker, however, who may gain from on-the-job training and apprenticeship in foreign technologies and manufacturing practices is inestimable. Many workers who did not even have formal secondary education before starting work in the zone found themselves in demand and commanding constantly increasing salary offers from various manufacturers within Korea. The technology transfer, in the form of technical knowledge embedded in the workers when joining domestic firms, was also immeasurable. While MAFEZ administrators and Korean politicians were responding to the complaints of zone investors by promulgating laws forbidding the poaching of skilled workers, Korea as a whole benefited by having

these skilled workers move from the MAFEZ production enclave into the greater economy, thus diffusing technical knowledge further. The recruitment of workers may have made the hub of production less viable, but it helped to make Korean non-EPZ manufacturing firms more efficient and technically conversant.

Independent studies have found that formal training of Korean workers at all levels by foreign and Korean managers occurred often throughout the zone's existence, thus prompting an increase across the board of general production skill levels. Concerns raised by social and religious activist groups prompted foreign and joint-venture zone firms to start enrolling some of their younger employees in vocational night schools. MAFEZ administrators, along with firm administrators from a variety of firms started setting up vocational programs in middle and high schools throughout Masan and nearby Changwon. Starting in 1977, hundreds of workers from MAFEZ and the adjoining Changwon Machine Industrial Complex started attending these schools to receive a basic education, as well as practical job skills that could be exercised every day on the job. Ten vocational curricula in ten different classes were developed for the benefit of these young workers (*Kyungnam Maeil*, March 4, 1977). Positions reserved for zone workers in these specialized classes were quickly filled, however, and zone workers were forced to do their schooling in regular schools located at a distance from the EPZ. A report in the *Kyunghyang Shinmun* in 1983 revealed that MAFEZ firms were reluctant to dispatch their young workers to vocational middle and high schools outside of the Masan City for a number of reasons. First, high schools in areas outside of the city did not offer specialized education useful to their work. Second, workers had difficulty managing their time between job commitments, long commutes to and from school and completing

homework assignments. At the time of the report, some 1,200 young workers from 60 zone firms took night school courses in middle and high schools distant from the zone, and the firms were required to pay fifty percent of their tuition. The number of zone workers attending these schools, it should be noted, started to decrease precipitously in the late 1970s and early 1980s due to work demands and distances to schools, notwithstanding laws decreeing it illegal for EPZ firms to employ workers of a certain age not attending school.[52] Starting in 1981, MAFEZ administrators began to establish more vocational classes for students in the environs of the zone and registration rates in these schools began once again to climb steadily (*Kyunghyang Shinmun*, December 18, 1983 10).

The numbers of young workers given basic and vocational education while working in MAFEZ is encouraging. Between 1977 and 1987, 6,724 workers entered middle and high schools, with 50% of their tuition paid by their employers. Of these, 261 graduated from middle school and 4,493 graduated from high school (MAFEZ Administration Office, 1987 274-75).

Some zone firms went even further, by encouraging on-the-job training aimed at diffusing technical knowledge to the community as well as to their own workers. Hankuk TC is a case in point. In 1984, this MAFEZ firm invited some 67 college and university engineering students from fifteen post-secondary institutions throughout the country, including the prestigious Seoul National University and local vocational colleges, to join in a practicum at their factories. These students worked on the factory floor alongside factory workers from 8 A.M. to 6 P.M. while taking specialized technology classes at night. The idea was that technicians could learn from the engineers

[52] The article does not state that EPZ firms prohibited or hindered school attendance.

and vice-versa in a very practical way and, according to the report, the program was highly successful in diffusing technological knowledge to both student and worker (*Kyungnam Shinmun*, July 26, 1984).

Through initiatives such as those mentioned above, general technical and technological knowledge improved and specialized knowledge was diffused amongst the general workforce. Van Byung-Gil states that by 1980, the number of skilled workers had increased to 4,000, most of which had received advanced technology training in MAFEZ or in Japan. Of this number, between 700 and 800 were skilled engineers or technicians in electronics alone[53] (Van, 1980 23, 70). Of these 700 to 800 skilled electronics technicians, about "400 of them . . . left MAFEZ to join large Korean electronics firms carrying with them advanced technological knowledge" (Van, 1980 70). Approximately one third of the workers classified in 1976 as 'apprentices' (12,607) had acquired some kind of certification as a technician by 1980. The MAFEZ Administration Office asserts that between 1976 and 1986, 3,950 workers received formal vocational training, as well as 1,030 managers and 166 zone administrators (MAFEZ Administration Office, 1987 259).

In 1988, Manik Hwang surveyed a sample of some 1,038 MAFEZ workers and discovered that 373, or 36%, were currently involved in some kind of job-training program. Although nearly half of these responded that they were currently involved in job-training that would last a week or less, some 24 or 6.4% of respondents indicated that they were involved in training that would last for more than six months (M. Hwang, 1988 18, Table 9). It is quite telling that, at the time of the sample, 17.7% of all respondents

[53] There is no accounting in this study of the number of skilled engineers or technicians in other zone sectors.

were involved in short-term training lasting less than a week, almost all of which was sponsored by their employers (M. Hwang, 1988 19). Since a considerable portion of employees' short-term training was carried out at the behest of zone firms, it can be deduced that employers were actively involved and concerned with the maintenance of technical knowledge embodied in their work-force. After all, little technical knowledge would be transferred to technicians in that time; one could assume that the majority of this training was knowledge-maintenance related. That is, related to re-training, safety procedures or upgrading of employees' general technical knowledge.

For their part, Koreans working in MAFEZ proved to be astute technical workers. In the very early days of the zone's existence, 50 Japanese technicians working in MAFEZ were replaced by Korean technicians that had learned their trade on the job. The Japanese companies preferred employing the Korean technicians because they paid them much less than their Japanese counterparts and the Koreans were just as skilled (*Seoul Shinmun*, April 25, 1974). The same newspaper reported a year later that Korean technicians were given training in sophisticated technology used to produce colour televisions, coils, steel wire and eight other high-technology or precision products (*Seoul Shinmun*, March 12, 1975). In the *Kyungnam Maeil*, it was reported that 225 people were being trained on the technology used to produce the products mentioned above, an increase of 47% compared to the year before (*Kyungnam Maeil*, March 10, 1975).

The upshot of this on-the-job training, formal schooling and overseas training programs was an increased ability for Korean managers to conduct the business of mostly Japanese-owned firms. This in turn facilitated mass takeovers of Japanese establishments

in MAFEZ beginning in the early 1980s and the development of Korean products using native technology and know-how.

The Results of Technological and Managerial Learning

Towards the end of the 1970s, Koreans in MAFEZ firms were developing completely native technologies and exporting them to world markets. A case in point is the *Hankuk Dongyang Tongshin* company that spent two years making a domestic model stereo system, the STIJ-60. Using entirely Korean research, technicians and technology, the audio equipment was developed and produced onsite. The export from MAFEZ of the STIJ-60 marked the first time such entirely Korean-produced audio equipment was sold on world markets. This technology, as well as advanced computer equipment, was imported to Japan by Sony Corporation and sold on the Japanese market under the Sony label (*Kyungnam Maeil*, October 19, 1979).

Another case in point is the *Hankuk Kenyon* Corporation, a 100% Japanese-owned concern. In 1983, the managers and most high-level officers for the firm were Korean, and they had learned most of their managerial skills from past Japanese management. These Korean managers circled the globe engaging in world-market and production technique studies for household cleaning sprays. After extensive research, the firm developed a new household cleaning spray using Korean technologies and patented the product under domestic patent laws. After obtaining the patent, the managers used the knowledge that they had acquired during their business travels to modernize production techniques, and they gave specialized training to 30% of their workforce in production techniques and quality control. As a result of this diligent market research

and staff instruction, they were able to produce a world-class cleaning spray. Foreign orders for their product increased three times in 1983 alone over the preceding year, resulting in a hiring spree by the managers and record profits for the company (*Kyungnam Shinmun*, October 13, 1983).

Between 1977 and 1987, only seven new Korean exporters entered MAFEZ (M. J. Cho, 1990; Administration Office of MAFEZ, 1995a). There was little room for Korean firms because new foreign firms entered MAFEZ in response to the quick recovery of the economy in the early 1980s. However, since 1987, 27 Korean firms have replaced foreign MNCs leaving MAFEZ, with the permission of the Korean state (Administration Office of MAFEZ, 1995a). Many small Korean firms in the Masan area have chosen to move into MAFEZ to use pre-existing industrial sites and enjoy all kinds of tax benefits that the national state provides.[54] However, the lack of industrial land in MAFEZ has limited opportunities for small Korean firms to move into MAFEZ, and the opportunity has only been available when foreign MNCs have left (*Kyungnam Shinmun*, February 23, 1982; March 10, 1982; April 29, 1985).

The strength of these new entrants is that, unlike the departing firms, they are technology intensive and produce higher value-added goods. Their weakness, from the point of view of replacing what departing firms contributed to the regional economy, is that until 1999 their total employment was extremely small. The average employment of the new firms in 1999 was only 49 people, while the total average employment of firms in MAFEZ was 496 people (Y.S. Lee, 1999b 191-94).

[54] Completely Korean-owned firms were only allowed to establish factories in MAFEZ as of 1980 when the law governing the zone was amended. The first wholly-Korean owned firm established business on June 24, 1981 (*Kyungnam Shinmun*, February 23, 1982).

Wholly-owned Korean firms within the zone and Japanese firms taken over by Korean interests became very profitable in the 1980s. In 1980, the free export zone law was revised, allowing Koreans to fully own businesses within MAFEZ and IFEZ. Before the enactment of the law, the number of firms within the zone had declined steeply by 8.5% since 1979. The government responded to new vacancies, decreasing viability for foreign firms within the zone, increasing labour costs and the poaching of skilled technicians by allowing Korean firms to invest in the zone. At this time, the very nature of the EPZ started changing from a platform to attract foreign direct investment, to one that would attract both foreign and domestic investment for export manufacturing.

Japanese businesses bought out by Korean interests became highly successful within the zone, starting in 1981. A fine example is *Shinhan Kongeop*, Inc. Originally established as a Japanese wholly-owned concern in 1973, it was bought by Korean investors in 1981. Under the Japanese, *Shinhan* produced optical equipment, including telescopes and microscopes in the 1970s. The business was successful until the late 1970's when demand for exports began to stagnate and profits fell sharply. After Koreans took over the business, they used the capital facilities to create new technology and new lines of optical machinery. Under Korean control, exports increased 400% and there was demand for the machinery in the USA, Canada, Hong Kong, Australia, the Netherlands and a host of other developed countries (*Kyungnam Shinmun*, August 9, 1984). In 1985, the same company branched out in an entirely new direction and started manufacturing handguns and weapon scopes for export to Sweden (*Kyungnam Shinmun*, May 10, 1985).

Another company started by the Japanese and then taken over by Koreans is *Keukdong Hausner*. Employing precision turning machinery to manufacture screws, nuts, bolts and other precision metal fasteners, the company fared well under Japanese control until the late 1970s. Taken over by Korean investors in 1982, with 10% Japanese ownership, the capital facilities were upgraded and Korean managers began to improve the technical skills of the firms' workers. In 1983, a number of Korean managers and technicians were sent to Japan for further intensive training in technology and managerial practices. In 1984, ten technicians and managers were sent to Western Europe to inspect the application of the latest technology and precision turning equipment. According to company president Lee Young-Kun the transfer of technology from the Japanese before and after the Korean takeover, as well as the proactive training of employees in Korea and abroad helped greatly to make the company solvent and indeed to prosper in recent times. Without the basic foundation of technical knowledge given to them by the Japanese and the continued support by Japanese minority-share investors, this company could not have produced precision metal parts to international standards. By 1984, the company was exporting to the American and British market, amongst other advanced nations (*Kyungnam Shinmun*, September 20, 1984).

The *Kyungnam Shinmun* also reports of five other Korean takeovers of Japanese companies in MAFEZ. All were insolvent or weak before the takeovers, but registered growth rates of between 50 and 100% in the first two to three years after the takeovers. According to the article, a lot of the success was due to mechanization of production and re-investment of profits in upgrading capital facilities and technology (*Kyungnam Shinmun*, April 29, 1985).

In almost all cases, Japanese maintained low stock-ownership in companies taken over by Koreans. Even in new businesses started by Koreans in MAFEZ, low stock-ownership by Japanese concerns seemed to be a formula that worked. In fact, Korean MAFEZ companies that maintained low stock-ownership by Japanese seemed to fair even better than wholly-owned Korean companies in the zone. The establishment of the first wholly-owned Korean venture on June 24, 1981 was quickly followed by the takeover of Japanese companies by Korean interests that had ten percent or less Japanese ownership (*Kyungnam Shinmun*, February 23, 1982). These and other majority Korean-owned domestic-Japanese joint ventures seemed to profit from Japanese interest in their development, aid in generating new lines, introduction of manufactures to foreign markets and assistance in acquiring technology and production techniques from the more advanced country. For their part, the Japanese seemed more than willing to assume the role of partner in Korea's development, even at the cost of creating market rivals.

A clue as to why the Japanese were so invested in aiding their market competitors is found in Gavan McCormack's excellent exploration of normalization agreements between the Japanese and the South Koreans. He clarifies the

> long-term Japanese strategy for the incorporation of South Korea into a single Japanese-run economic system. This strategy has been clearly set out on a number of occasions. In October, 1965, the two sides actually published a joint report setting out their plans for an 'international vertical division of labour,' and it was stipulated that Japan would subcontract out to Korea part of its labour-intensive, export-oriented processing industry. This principle was greatly extended in 1970 in the memorandum prepared by Yatsugi Katsuo for presentation to the second general meeting of the Japan-ROK Cooperation Committee. It is in accordance with the Yatsugi Plan that important parts of major Japanese industries such as steel, aluminum, petrochemicals and even shipbuilding are being transferred to South Korea. (McCormack, 1978 177)

While this is an important revelation about the division of labour in East Asia, that no doubt is rooted in backdoor war reparations, it should not be dismissed that for reasons of national security, the Japanese had an interest in establishing and maintaining an economically strong South Korea – a country more interested in doing business and making money than in starting wars with its enemy to the north.

It is interesting to note, however, that the clear-cut terms of the agreement stated that the Korean half of the partnership would engage in labour-intensive manufacturing and the Japanese, capital-intensive. Furthermore, a survey conducted of U.S. and Japanese MNCs operating in Korea in the 1970s indicated that the biggest attraction for their investment was abundant and cheap labour (Kim and Harvey, 1976 26-7). It was the Koreans, however, with the aid of the zone's policy mechanism of attracting foreign capital and technologies, that ensured that MAFEZ would not remain a labour-intensive manufacturing enclave, and that many cutting-edge Korean innovations of the 1970s and 1980s originated from the zone.

Conclusion

Learning from the Korean Example

The model of regional development that one sees spreading out from the hub of the Korean EPZ is one of strong linkages between native entrepreneurship and zone firms, and these linkages are strengthened by knowledge and technological spillover. In the case of MAFEZ, the first instance of production linkage occurred immediately after the founding of the zone, through demand for Korean raw materials and simple inputs while a second instance of production linkage occurred when Korean entrepreneurs were able to manufacture more sophisticated inputs, or parts used in final assembly. In fact, the establishment of Korean non-EPZ firms capable of producing such parts prompted subcontracting and production sharing arrangements between MAFEZ and domestic firms throughout the country.

Over time, the electrical & electronics sector became dominant in MAFEZ, and thus created a strong backward demand for parts used in the manufacture of finished products. However, the boom in demand for electrical & electronics goods occurred throughout Korea, and both raw materials' suppliers and producers of semi-manufactures could not keep up with demand from core industries manufacturing mainly for export. For this reason, domestic furnishing of electrical & electronics parts and materials, as well as domestic suppliers in other sectors, stagnated. The problem was that suppliers of semi-finished goods were spread out too far into the periphery areas – that the spokes of the hub-and-spoke model were located too far from the hub. Korean entrepreneurs clearly understood the problem that distance created for zone companies that needed parts

and materials, and thus they established firms in close proximity to the zone. In fact, electrical & electronics parts manufacturers were located much closer to MAFEZ than providers of inputs to zone firms in other sectors.

The location of suppliers in proximity to zone firms seemed to crystallize naturally according to various zone sectors' needs. For example, electrical & electronics supplier firms that required greater integration with zone firms, in the sense that they needed to ensure that their parts fit the specifications of the core zone firms, located close to MAFEZ. Suppliers of inputs to garment zone manufacturers were located at a greater distance from MAFEZ, and, not surprisingly, they require much less cooperation and integration with zone firms. Manufacturers of clothing do not need to constantly ensure that specifications are being met and upgraded according to advances in technology, simply because the technology involved in manufacturing fabrics do not change that quickly and are far more labour- than capital-intensive. In other words, the more capital-intensive the product being made in the zone, the tighter the bond between the supplier and the zone manufacturer.

The preponderance of MAFEZ electronics, electrical and precision metal firms created geographically and functionally tight bonds between the majority of zone firms and out-zone subcontractors. In all zone sectors, however, there was a certain necessity for production sharing , and this necessity became greater as the zone itself matured. Smaller zone firms became more dependent on out-zone processing than did larger firms in the zone, and smaller MAFEZ firms continually increased in number. While large firms in the zone were fairly independent, smaller firms relied on a contingent workforce outside of the zone for value-added production.

In the environs of MAFEZ, electronics-, electrical- and precision metals-specific systems of production sharing evolved. The dependency between zone firm and out-zone subcontractors became entrenched over time. This caused a decrease in the number of zone firms and those that stayed in the zone increasingly relied on production carried out outside of the zone. Within the zone itself, electronics, electrical and precision machinery firms tended to expand their capital facilities and to diversify production lines while the number of precision ferrous & non-ferrous metal, footwear, clothing and textile firms decreased as a result of higher labour costs and relocation to competitive EPZs in other countries. This capital flight caused an administrative restructuring of the zone and wholly-owned Korean firms were permitted to establish factories there. Pre-existing zone firms also expanded capital facilities and started to mechanize production.

While these seismic changes were occurring inside MAFEZ, production sharing continually increased causing greater and greater employment effects outside of the zone. By the late-1980s, when MAFEZ had finished its restructuring, one subcontracting job had been created for every two jobs within the zone. According to a coarse index endorsed by the UNCTC and the ILO, one out-zone production job should be created for every five zone jobs. This suggests a very high dependency ratio between the core and the periphery, and strong regional benefits through the zone's implantation. Indeed, such production sharing arrangements meant higher regional benefits through employment effects than any other EPZ studied during the preparation of this paper.

While employment linkage effects were spread out over a smaller area and within geographical proximity to the zone, patterns of input procurement were spread out nationally, and the pattern of national input procurement suggests a greater dispersal of

input orders emanating from MAFEZ over time. Rather than relying on a few producers of inputs such as the government-sponsored steel works in Pohang, zone firms were eventually able to draw upon a diversity of sources, after such sources became more widely available, along with the development of the country. In other words, when speaking of input procurement, the picture that emerges over time is of an increasingly diffused commodity chain. Conversely, the picture of high-technology production sharing is increasingly nucleated.

The original demand for on-time, on-spec parts and raw materials necessarily meant a diffusion of production know-how, if not technology, throughout the entire country. That is, a demand for parts of an international standard required Korean manufacturers of such parts to quickly learn international methods of manufacturing if they were to avail themselves of the opportunities presented by initial demands from the EPZs. The government of Korea unambiguously declared such diffusion of technology and technical expertise to be a main reason for the establishment of the zone. Understanding that the processes involved in making final goods would be spread out by production steps throughout the entire country, the government ostensibly realized that technological innovation and upgrading would likewise follow, of necessity.

In the case of Korean EPZs, foreign firms that wanted to set up business in the zone were required to import more advanced technology than that available locally, and they were also required to make that technology available to local firms for a period of one year to ensure a diffusion of the technology and knowledge of its use. This policy provided a strong starting point and impetus for a diffusion of knowledge throughout the country. While there were growing pains as Korea's export manufacturing expanded

rapidly, domestic subcontracting continuously increased, suggesting that Korean suppliers and subcontractors were able to learn production techniques sufficiently. A clustering of electric and electronics subcontractors near the zone also suggests sharing of technological knowledge, cooperation in production techniques, and integration of labour management practices.

A review of newspapers articles published in the 1970s and 1980s suggests that foreign firms were strongly interested and invested in the process of educating their workforces. Technicians were frequently dispatched to Japan for technological training. In addition, managers were given vocation-specific training and frequently went on business trips to observe modern production practices in advanced manufacturing facilities throughout the world.

Perhaps the establishment of MAFEZ's greatest contribution to the overall welfare of South Korea was the supporting of the basic education of zone employees. During the 1970s and -80s, basic education progressed to such a degree, that it became rare to find a zone worker that did not have at least a high school education. Research conducted in other countries demonstrates that EPZ workers with secondary education were nowhere near as common as in Korea.

An upshot of this proactive training and constant upgrading of skills was that zone workers in all sectors became a precious commodity in Korea's export promotion drive. Nowhere was this more apparent than in the unparalleled poaching of zone workers by firms in the greater Korean economy and in the zone itself. When skilled workers left the zone to contribute to the domestic economy, there was also a diffusion of key production knowledge to the wider economy.

The training of technicians and managers also had another important benefit to the Korean economy: it enabled a 'Koreanization' of foreign production methods and a patenting of original Korean manufactures that were able to compete in international markets. This set the stage for wholly-owned Korean firms to start setting up in MAFEZ, staring in 1981. In quick succession, Japanese firms were bought out by Korean interests and new Korean firms were established in MAFEZ with a small percentage of Japanese stock ownership.

MAFEZ firms that once languished under Japanese control flourished under Korean management. Yet strangely, many Korean managers learned their job skills under the Japanese. Perhaps crucially, Korean managers seemed far more interested in Koreanizing production, in importing the highest technologies, and in mechanizing production processes – all steps that aided greatly in Korea's development. It should be noted, however, that production mechanization resulted in fewer jobs in the zone. On the other hand, this also resulted in a further diffusion of technical knowledge when Korean firms outside of MAFEZ hired these superfluous technicians because they had acquired important vocational skills.

Using Theoretical Indices to Understand Spillover and Linkages from MAFEZ

To refer once again to theoretical indices of technology transfer from zone enterprises to the host economy, the UNCTC identifies 'high technical [spillover]' as those that "occur when the lead enterprise does more than help the supplier to design a new component or solve technical and production problems, by actually undertaking in-house design and development work to modify the [product] to suit the capabilities of the

supplier" (UNCTC, 1981 44). Newspaper reports on business innovations in MAFEZ make it clear that advanced technologies and exports were developed for the first time in Korea. Having established that high-technology zone firms were strongly linked to and relied upon the production of parts by out-zone suppliers, it stands to reason that zone enterprises coordinated production methods on new manufactures with those of the subordinate parts manufacturers. Parts had to be made to the specifications required by the zone firms, thus zone engineers and designers had to be involved in the production processes of intermediate parts. In short, high technical spillover existed between zone and out-zone firms.

Another theoretical indicator of sequential linkages between zone and out-zone firms is one that Anton Hrastelj specifically applied to out-zone processing in the garment industry in the former Yugoslavia. The four sequential stages that indicate greater and greater reliance on out-zone subcontractors are: haphazard, interdependent, integrative, and advanced (Hrastelj, 1992 18). The data analyzed in this paper suggests that the interdependence between zone contractor and out-zone subcontractor evolved to the integrative stage and probably will not evolve beyond this. Subcontractors were integrated in the conventional business system, as the Korean government had originally intended, and the system of interdependence was such that it could only be deemed 'coproduction.' Cooperation was also intensive, though it is not clear how reversible it was in the sense that out-zone firms may or may not have been involved in production decisions made within the zone. More likely, production decisions made within the zone affected the production techniques of out-zone firms, yet the zone firms could not have received intermediates on spec, but for the cooperation of out-zone firms. For this

reason, it can be stated that the level of cooperation between MAFEZ firms and subcontractors was integrative up to and including the mid-1980s.

Understanding Distinct Problems MAFEZ Faced During its Evolution

There is no question that the Korean government's planning for spillover and linkages from MAFEZ and the corresponding legislation to support industries key to the formation of linkages with EPZ firms were central to the success of the zone as a developmental tool.

The research conducted in the writing of this paper has revealed three significant problems as MAFEZ developed that might have been avoided through different policy measures. They are: first, a lack of continuous, quality domestic raw materials and materials; second, a significant shortage of skilled technicians and thus staffing problems for zone firms; third, legislation keeping wholly-owned Korean ventures out of the zone until 1980.

On the first point, it's clear that Korea's manufacturing sector suffered from an unsteady supply of inputs in the late 1970s and early 1980s. This, of course, coincided with the energy crisis that began in 1979 and the boom in Korean manufacturing that happened around the same time. However, because MAFEZ played such a vanguard role in the export promotion drive of the entire country, it could well have benefited from the government designating it a priority project and to thus ensure a continuous supply of parts and raw materials. In addition, the government's unconditional support of Gumi and Guro Industrial Districts as IEs that would manufacture electrical and electronic components for finished products seems to have badly affected MAFEZ's supply of such components because the IEs simply could not keep up with demand.

On the second point, the recruiting of skilled technicians from MAFEZ, it seems that the Korean government had a dilemma: to prohibit the poaching of skilled workers within and from the zone and thus curtail technology transfer or to allow such recruiting and thus make the zone less attractive to investors that need to retain skilled employees. The government of Korea, of course, chose the former. As a result, a certain degree of technology transfer as embedded in skilled technicians was limited. However, the EPZ retained its attraction to foreign investors who were able to keep their skilled staff.

The third point highlights the fact that Koreans were not permitted to establish wholly-owned Korean factories in MAFEZ until 1980 – a full ten years after the establishment of the zone. When Korean firms were permitted in the zone, and when they took over formerly Japanese owned firms, they seemed to be strongly motivated in transferring technology to the domestic economy, in training staff in the latest production methods, in creating new Korean products, and in mechanization.

Concluding Remarks

Analysts have noted the manner in which the influence of EPZs has burst the confines of their physical enclosure. In South Korea, this is a direct consequence of national development plans and has resulted in the flourishing of domestic entrepreneurship to support zone firms. The willingness of EPZ enterprises to employ domestic subcontractors in manufacturing inputs, and the diligence of Korean suppliers in ensuring compliance to international standards and specifications, has spurred a kind of integration between enterprises inside and outside of the zone. The constant movement

of goods and employees between zone and outzone firms has blurred the boundary between core and periphery in the case of MAFEZ.

Study of the development of zone and subcontracting firms in South Korea reveals that South Korean planners were acutely aware of the dynamic of linkages when they created last industries, being EPZs, first. They deftly introduced a final demand, which spurred a backward demand for inputs, from finished parts to harvested raw materials. Even when such raw materials and inputs had to be imported into Korea, the policymakers had the foresight not to penalize zone and out-zone enterprises in the knowledge that domestic firms would evolve through a process of learning identified in this essay as 'spillover.' Spillover allowed Korean suppliers to adapt and innovate, such that it was possible over time to supply the needed inputs to EPZ firms.

MAFEZ eventually burst the confines of its perimeter economically and technologically. It did so because of the eventual interrelation between zone firms to other zone firms, between zone firms and out-zone firms, and between zone firms and subcontractors throughout the country. Such interrelations would not have crystallized but for the plans of policymakers and the facility of Koreans as technological learners.

Annex Table 1:
Types of Export Incentives and Dates of Operation,
1950-75

1959-75	Tariff exemptions on imports of raw materials and spare parts
1965-75	Tariff and tax exemptions granted to domestic suppliers of exporting firms
1961-72	Domestic indirect and direct tax exemptions
1966-75	Accelerated depreciation
1965-75	Wastage allowance subsidies
1951-55; 1963-65	Import entitlement linked to exports
1957-75	Registration as an importer conditional on export performance
1967-75	Reduced rates on public utilities
1950-61	Dollar-denominated deposits held in Bank of Korea by private traders
1967-71	Monopoly rights granted in new export markets
1965-75	Korea Trade Promotion Corporation
1955-56; 1961-64	Direct export subsidies
1962-75	Export targets by industry
	Credit Subsidies
1950-75	Export credits
1950-54; 1971-75	Foreign exchange loans
1959-75	Production loans for exporters
1950-75	Bank of Korea discount of export bills
1964-75	Import credits for exporters
1964-75	Capital loans by medium industry bank
1964-75	Offshore procurement loans
1964-75	Credits for overseas marketing activities.

(Source: Krueger, 1979 93, based on information provided in Frank, Kim and Westphal, 1975 40 up to the year 1972; data from the years 1972-75 updated by Krueger.)

Annex Table 2:
Explanation of Export Promotion Measures
Enacted in 1969

First, in order to modernize production facilities and to facilitate mass production:
- Three industries (cotton fabrics, woollen fabrics, and raw silk) were excluded from designated export-oriented industries....
- A total of $60 million was made available through the Korean branches of foreign banks to export industries for procurement of equipments....
- To facilitate the establishment of free export zones including Masan, the Law on the Establishment of Free Export Zones was promulgated on 20 December 1969.

Secondly, in order to strengthen competitive power of export industries and to increase foreign exchange earnings:
- Utilization of domestically produced raw materials was given financial and administrative support.

Thirdly, in order to widen export markets....:
- Efforts to diversify export markets were made, developing new commodities and strictly inspecting export goods.

Fourthly, in order to strengthen financial and administrative support to export industries:
- Import of raw materials and equipment for export industries was exempted from customs, and their foreign exchange earnings were also exempted from external taxes. Special accelerated depreciation was allowed to promote capital investment of export industries.
- Export-import link system and export subsidy were adopted by the Government, and administrative procedures were also simplified.
- Despite tight monetary policy and upper reserves base limits, as agreed upon with IMF, a maximum financial support was given to export financing.

Fifthly, foreign exchange credits were extended to develop designated export-oriented industries and to finance the conversion into export industries and the import of industrial facilities for export industries.

(Source: EPB, 1969 as cited in UNIDO, 1988 9-10)

Annex Table 3:
The Basic Composition of MAFEZ Firms
and their Subcontractors, 1976-1988

Year	*No. of Employees (1)*	*MAFEZ Firms (2)*	*MAFEZ Firms with Subcon-tractors (3)*	*No. of Subcon-tracting Firms, Trusted and Entrusted (4)*	*No. of Subcon-tracting Employees (5)*	*No. of Sucon-tracting employees to be expected[55] through linkage effects (6)*
1976	29,953	94	42	94	4,518	5,990
1977	30,719	97	44	96	?	
1978	30,960	95	46	99	?	
1979	31,153	86	49	99	?	
1980	28,532	85	55	108	4,620	5,706
1981	28,016	83	55	114	?	
1982	26,016	80	?	117	?	
1983	30,989	80	57	207	7,782	6,198
1984	33,858	77	59	252	8,521	6,771
1985	28,983	77	52	193	7,509	5,796
1986	34,883	76	55	291	9,766	6,477
1987	36,411	78	57	347	12,364	7,282
1988	33,080	75	56	525	16,686	6,616

(Source: columns 1 to 5 compiled by K.S. Lee {1991 72, Table 2} from various sources provided by the MAFEZ Administration Office; column 6 calculated by the author based upon an index of expected outzone subcontracting jobs per zone job as hypothesized by the UNCTC and ILO, 1976.)

[55] This 'expected number' is arrived at by calculating a twenty percent ratio of jobs created by the implantation of MAFEZ. The UNCTC and ILO (1988) use this "ratio as a means of making a first estimate of the total number of jobs indirectly created through their backward linkages with the economies of the host country" (UNCTC and ILO, 1988 76).

Annex Table 4:
List of MAFEZ Companies
and Other Relevant Information
as of November, 1987

Company no.	*Company Name*	*Major Product(s) Manufactured*	*Percentage Investment*	*Manufacturing Start Date*	**Workforce Men/ Women/ Total**
1 (Electronics & Electrical) ⇩	Hankuk Namsaneop (Inc.)	Decorative Electric Light Bulbs	62.6% Jap. / 35.5 % U.S. / 1.9% Kor.	72.3.12	63 / 209 / 272
2	Hankuk Dongkwang (Inc.)	Various Kinds of Coils	100 % Japanese	71.9.7	285 / 3,301 / 3,586
3	Hankuk Dongkyung Electronics (Inc.)	Tape Recorders / Car Stereos	100 % Japanese	72.8.1	450 / 2,181 / 2,631
4	Hankuk T.C. Electronics (Inc.)	Stereos / Electronics Testing Equipment	100 % U.S.	72.8.18	317 / 1,168 / 1,485
5	Hankuk Sumida Electric (Inc.)	Various Kinds of Coils	100 % Japanese	72.9.14	98 / 1,977 / 2,075
6	Hankuk Dongyang Tongshin (Inc.)	Radio / Stereos / Amplifiers	100 % Japanese	73.1.19	184 / 1,451/ 1,635
7	Hankuk Joongchun Chunhwa (Inc.)	Time Switches / Telephones	100 % Japanese	73.1.3	78 / 704 / 782
8	Hankuk Ilsun (Inc.)	Various Kinds of Coils / Magnetic Wires	100 % Japanese	73.4.17	156 / 235 / 391
9	Hankuk Taeyang Yoojeon (Inc.)	Inductors / Various Coil Parts	100 % Japanese	73.6.22	306 / 1,071 / 1,377

Company no.	*Company Name*	*Major Product(s) Manufactured*	*Percentage Investment*	*Manufacturing Start Date*	**Workforce Men/ Women/ Total**
10	Hankuk Dongkyung Silicon (Inc.)	Silicon Transistors / Hybrid Integrated Circuits	100 % Japanese	73.6.8	335 / 1,194 / 1,529
11	Hankuk Sowha (Inc.)	T.V. Tuners / Modulators / Micro Inductors	100 % Japanese	73.7.25	108 / 972 / 1,080
12	Daehan Electronics (Inc.)	Clock Radios / Cassette Radios	100 % Japanese	73.11.11	45 / 139 / 184
13	Hankuk Sungjeon (Inc.)	Electronic Jacks / Microphones / Socket Switches	100 % Japanese	73.8.10	112 / 388 / 500
14	Hankuk Samyang Kongeop (Inc.)	Various Electrical Cords	100 % Japanese	73.5.20	52 / 97 / 139
15	Hankuk Busa Kongeop (Inc.)	Tape Recorders / Stereo Equipment	100 % Japanese	73.10.16	121 / 165 / 286
16	Hankuk Star (Inc.)	Clocks / Alarm Clocks	100 % Japanese	73.8.16	106 / 714 / 820
17	Hankuk Sammi (Inc.)	I.F.T. Coils / Polyvaricon Components / Electronic Motors / Magnetic Heads	100 % Japanese	73.10.16	102 / 1,455 / 1,557
18	Hankuk Sanyeon (Inc.)	L.E.D. Products	100 % Japanese	74.5.3	17 / 279 / 296
19	Hankuk Dongyeong Electronics (Inc.)	Digital Clocks	100 % Japanese	74.2.25	58 / 141 / 199
20	Hankuk T.T. (Inc.)	Black & White Televisions / VCRs	100 % Japanese	77.7.15	174 / 336 / 510
21	Daedong Jeongmil Kongeop (Inc.)	Cassette Tape Recorders	33.7 % Jap. / 66.3 % Kor	84.1.21	121 /125 / 246

Company no.	*Company Name*	*Major Product(s) Manufactured*	*Percentage Investment*	*Manufacturing Start Date*	**Workforce Men/ Women/ Total**
22	Tandy Mobile Communications (Inc.)	Car Telephones	50.02 % Finland / 49.08 % U.S.	84.12.31	58 / 206 / 264
23	Hankuk Ilshin Yoohwahwe (Inc.)	Microwave Ovens	100 % Japanese	87.6.20	22 / 3 / 25
24	Hankuk Waka (Inc.)	Various Electric Connectors / Pin Jacks	100 % Japanese	87.5.10	8 / 38 / 46
25	Hankuk Isay (Inc.)	Electric Sign Boards	100 % Japanese	87.6.11	Data not provided
26	Daehan Hooji Electronics (Inc.)	Electronic Parts	95 % Japanese / 5 % Korean	87.8.29	Data not provided
27 (Metals)	Hankuk Myeonghoong (Inc.)	Metal Press Products	100 % Korean	73.5.28	89 / 18 / 107
28	Hankuk Hinomode (Inc.)	Wing Nuts / Bolts / Automobile Parts	99.8 % Korean / 0.2 % Japanese	73.9.10	43 / 58 / 101
29	Wooseong Metals (Inc.)	Metal Screws	99.8 % Korean / 0.2 % U.S.	73.12.11	23 / 3 / 26
30	Masan Kangkwang (Inc.)	Steel Pipes and Tubes	100 % Japanese	74.2.5	43 / 5 / 48
31	Hansan Screws (Inc.)	Various Kinds of Screws	100 % Japanese	73.10.30	40 / 34 / 74
32	Masan Jaesun Kongeop (Inc.)	CHQ Wire	100 % Japanese	74.3.15	26 / 2 / 28
33	Keukdong Hausner (Inc.)	Metal Fasteners	90 % Korean / 10 % Japanese	74.3.15	99 / 29 / 128

Company no.	*Company Name*	*Major Product(s) Manufactured*	*Percentage Investment*	*Manufacturing Start Date*	**Workforce Men/ Women/ Total**
34	Handeok Saneop (Inc.)	Various Kinds of Nails	99 % Korean / 1 % Japanese	74.6.1	65 / 13 / 78
35	Ajou Kangeop (Inc.)	Various Kinds of Nails	91.3 % Korea / 8.7 % Japanese	74.2.6	103 / 20 / 123
36	Dongyong Saneop (Inc.)	Various Kinds of Nails	100 % Korean	74.6.7	20 / 3 / 23
37	Jaeil Chulkang (Inc.)	Various Kinds of Nails	99.4 % Korean / 0.6 % Japanese	74.6.1	88 / 16 / 104
38	Hankuk Busa (Inc.)	Steel Pipes and Tubes	100 % Korean	73.12.10	55 / 5 / 60
39	National Hausner (Inc.)	Various Kinds of Nuts	100 % Japanese	78.3.3	44 / 11 / 55
40	Gaya Metal Kongeop (Inc.)	Various Kinds of Nails	99 % Korean / 1 % U.S.	80.12.1	26 / 4 / 30
41	Seongnim Saneop (Inc.)	Drywall Screws	100 % Korean	85.10.25	57 / 5 / 62
42 (Non-Ferrous Metals)⇩	Hankuk Optical Glass (Inc.)	Lenses and Optical Equipment	100 % Japanese	75.2.5	42 / 32 / 74
43	Dongnam (Inc.)	Precision Moulds / Silica	100 % Korean	80.12.19	24 / 11 / 35
44	Fashion Line (Inc.)	Sunglasses	100 % U.S.	81.11.11	21 / 26 / 47
45 (Machinery) ⇩	Grow Moulding (Inc.)	Precision Metal Moulding Equipment	100 % Japanese	72.10.23	29 / 17 / 46

Company no.	*Company Name*	*Major Product(s) Manufactured*	*Percentage Investment*	*Manufacturing Start Date*	**Workforce Men/ Women/ Total**
46	Hankuk T.S.K. (Inc.)	Control Cables	100 % Japanese	73.3.31	31 / 69 / 100
47	Hankuk Wooyeop Jeongmil Keongeop (Inc.)	Mould Plates	100 % Japanese	73.10.20	78 / 8 / 86
48	Korex (Inc.)	Automobile Parts	72.4 % Korean / 27.6 % U.S.	80.10.1	210 / 83 / 293
49 (Precision Machinery)	Samyang Kwanghak Kongeop (Inc.)	Cameras & Camera Lenses	76.4 % Korean / 23.6 % Japanese	73.5.21	644 / 659 / 1,303
50	Shinhan Kongeop (Inc.)	Weapon Scopes	99 % Korean / 1 % Japanese	73.6.4	174 / 210 / 384
51	Hankuk West Jeongi (Inc.)	Cameras & Camera Equipment	100 % Japanese	74.2.25	50 / 278 / 328
52	Hankuk Sanbon (Inc.)	Clock & Watch Parts	100 % Japanese	74.12.1	66 / 269 / 335
53	Saehan Hankuk (Inc.)	Medical Prosthetic-Making Machinery	90.12 % Korean / 9.88 % U.S.	74.7.1	17 / 10 / 27
54	Hankuk Central (Inc.)	Medical & Household Machinery	100 % Japanese	74.9.1	30 / 8 / 38
55	Hankuk I.S.I (Inc.)	Electronic Microscopes / Scales	90 % Japanese / 10 % Korean	77.9.5	172 / 159 / 331
56	Hankuk Citizen (Inc.)	Watches	100 % Japanese	78.8.10	185 / 2,008 / 2,193
57 (Textiles & Clothing)	Jaeil Bongjae (Inc.)	Leather / Synthetic Gloves	81.8 % Japanese / 18.2 % Korean	71.12.10	26 / 95 / 121

Company no.	*Company Name*	*Major Product(s) Manufactured*	*Percentage Investment*	*Manufacturing Start Date*	**Workforce Men/ Women/ Total**
58	Shilla Saneop (Inc.)	Raw Silk & Silk Thread	95.5 % Korean / 3.5 % Japanese	74.6.1	18 / 59 / 77
59	Namseong Saneop (Inc.)	Raw Silk & Silk Thread	93 % Korean / 7 % Japanese	80.3.4	14 / 76 / 90
60	Soyo Enterprise (Inc.)	Equestrian Equipment	50 % Korean / 50 % Japanese	81.5.23	20 / 125 / 145
61	Sangjin (Inc.)	Raw Silk & Silk Thread	51 % Korean / 49 % Singaporean	81.8.18	27 / 115 / 142
62	Gaya Saneop (Inc.)	Raw Silk & Silk Thread	100 % Korean	82.5.25	12 / 61 / 73
63	Yoonam Shilleop (Inc.)	Raw Silk & Silk Thread	100 % Korean	84.1.11	11 / 38 / 49
64	Dong-A Silk (Inc.)	Raw Silk & Silk Thread	100 % Korean	83.4.1	16 / 69 / 85
65 (Footwear) ⇩	Hankuk Panchang (Inc.)	Chemical Footwear	100 % Japanese	73.5.1	64 / 235 / 299
66	Shinheung Chemical (Inc.)	Synthetic Leather	100 % Japanese	73.3.3	255 / 1,089 / 1,344
67	Daeseong Kongeop (Inc.)	Footwear	99 % Korean / 1 % U.S.	76.6.24	620 / 871 / 1,491
68	Hankuk Shoeparts (Inc.)	Footwear Parts & Materials	100 % Japanese	85.9.10	7 / 22 / 29
69 (Other) ⇩	Hankuk Ilgil Choku (Inc.)	Fishing Reels	100 % Japanese	72.11.1	86 / 127 / 213

Company no.	*Company Name*	*Major Product(s) Manufactured*	*Percentage Investment*	*Manufacturing Start Date*	**Workforce Men/ Women/ Total**
70	Hankuk Kenyon (Inc.)	Various Household Cleaners / Sprays	100 % Japanese	72.10.25	23 / 344 / 367
71	Hankuk Olympic Jogu (Inc.)	Fishing Equipment	95 % Korean / 5 % Japanese	73.7.5	152 / 123 / 275
72	Hankuk Jeongsang Hwaseong (Inc.)	Bicycle Tubes & Tires	100 % Japanese	74.1.25	132 / 83 / 215
73	Hankuk Hwaseong Kongeop (Inc.)	Detergent	100 % Japanese	74.3.6	28 / 29 / 57
74	Hansei (Inc.)	Cocoa Products & Chocolate	51.7 % Korean / 48.3 % Japanese	77.12.1	31 / 22 / 53
75	Taeyang Saneop (Inc.)	School Desks & Benches	83 % Japanese / 17 % Korean	80.7.28	14 / 1 / 15
Total Employment in MAFEZ: 8,104 men, 27,963 women, total: 36,067					

(Source: MAFEZ Administration Office, 1987 as translated from the Korean by the author.)

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