Does It Pay to Be Green?
Some Historical Perspective

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> A*Will it Pay?@ then is, after all, the question usually put when any attempts is made to introduce a new product, or to utilise in an new way any of the residue material used in our popular industries.*
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> - Peter Lund Simmonds. *Waste Products and Undeveloped Substances: A Synopsis of Progress Made in their Economic Utilisation During the Last Quarter of a Century at Home and Abroad*. London: Hardwicke and Bogues, 1875, pp. 11-12.

A widespread belief among contemporary writers on sustainability is that past economic development was characterized by wasteful practices. For example, Worrell (2000: 1) writes: AHistorically, society and industry have operated as an open system, transforming resources to products or services and emitting wastes and pollutants to the environment at all stages of the life cycles@ (Worrell, 2000: 1). Nath, Hens and Pimentel (2000: 1) similarly believe that Ait is hard to find any human activity or intervention for economic development that has been beneficial, benign or cost-free to the natural environment.@ In their best-seller *Natural Capitalism*, Paul Hawken and Amory and L. Hunter Lovins's (1999) indict traditional capitalism as a Afinancially profitable [but] nonsustainable aberration in human development@ (p. 5) rooted in wasteful practices that result in ecological strain causing not only the loss of forests, topsoil, fisheries and freshwater, but also Apoverty, hunger, malnutrition, rampant disease, crime, corruption, lawlessness, anarchy and refugee populations@ (pp. 8-9). In short, as Florida and Davison (forthcoming) argue in a book sponsored by *Resources for the*

Future: ASince the dawn of the industrial age, the goals of economic growth and enhanced environmental quality have been at odds.@

In recent years, however, many authors have documented numerous cases where the profit motive led to so-called Awin-win@ situations where firms improved their bottom line while reducing their environmental impact.[1] As the incentives behind such behavior are as old as market economies, could it be that it has always paid to be green? This article provides historical evidence to make this case. It is structured as follows. The first three sections illustrate that pollution prevention, Agreen@ technologies and loop-closing, the main components of Aeco-efficiency,@ were a reality long before they drew the attention of sustainable development theorists.[2] The final section discusses why it is now widely believed that past industrial development was characterized by a linear model of extraction, production and disposal.

Pollution prevention

The goal of Apollution prevention@ is to reduce pollution from existing plants and processes by implementing one or more of the seven following practices: 1) equipment modernization and modification; 2) improved maintenance; 3) improved operation practices; 4) better inventory control; 5) process and/or product modification; 6) substitution of inputs; 7) in-process recycling (Hertwich, 1997). Much evidence indicates that this behavior has always been typical for competitive firms. Thus in his classic *On the Economy of Machinery and Manufacture*, Charles Babbage (1835: 217) pointed out: AAmongst the causes which tend to the cheap production of any article, and which are

[1]See, for example, Resetar (1999) and the recent compilation of the *Harvard Business Review on Business and the Environment* (2000).

[2]For a more detailed survey of the historical evidence, see Desrochers, 2001.

connected with the employment of additional capital, may be mentioned, the care which is taken to prevent the absolute waste of any part of the raw material.@ The British authors of the *Descriptive Catalogue of the Collection Illustrating the Utilization of Waste Products* of the Bethnal Green Museum[3] (1875: 4) concurred with this observation two generations later.

> Few among the minor tendencies of industries are more worthy of note than that shown in the utilization of waste materials. As competition becomes sharper, manufacturers have to look more closely to those items which may make the slight difference between profit and loss, and convert useless products into those possessed of commercial value, which is the most apt illustration of Franklin=s motto that Aa penny saved is twopence earned:@ our manufacturers have not been slow to appreciate this truth, as is shown in more than one branch of trade...

The German engineer Koller (1918 [1902]: vi) was to make similar comments at the turn of the century based on his observation of the Reich=s industries: ACompetition is so keen that even with the most economical - and therefore the most rational - labour it is difficult to make manufacturing operations profitable, and it is therefore only by utilizing to the full every product which is handled that prosperity for all may be assured.@ Looking back to the middle of the nineteenth century, the American economist Clemen (1927: vii) would later write: A'The development of by-products in industry is one of the most outstanding phenomena in our economic life@ and that Afrom the viewpoint of individual business, this manufacture of by-products has turned waste into such a source of revenue that in many cases the by-

[3]The Bethnal Green Museum was located in London=s South Kensington, a cultural quarter funded from the profits of the Great Exhibition of 1851 (which featured the renowned ACrystal Palace@). It is now part of the Victoria and Albert Museum.

products have proved more profitable per pound than the main product.@ He credited market forces entirely for this state of affairs by pointing out that the development of by-products was done simply in order to avoid being overwhelmed by the competition of other industries, or of other corporations within the same industry.

> Modern conditions make it almost impossible materially to cut production and distribution of expense for the majority of commodities; hence one of the most important opportunities for gaining competitive advantage, or even for enabling an industry or individual business to maintain its position in this new competition, is to reduce its manufacturing expense by creating new credits for products previously unmarketable...
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> Indeed, the materials from which the by-products in nearly all industries are manufactured today were formerly partially or wholly wasted, and the change to intensive utilization of these materials for by-product manufacture has been brought about by the ever-increasing force of competition in American business, both between individual concerns within a single industry and among different ones (Clemen, 1927: vii and 2).

Max Muspratt, a past-president of the Federation of British Industries, almost simultaneously summarized what he perceived to be typical industrial behavior: AIn the days of my childhood, Awaste not, want not@ was a lesson inculcated upon all young people. Whether there was at once a suitable response in the nursery I am now too old to remember, but the same wise saying has had the constant consideration of every progressive manufacturer for at least a century@ (Kershaw, 1928: vii). APollution prevention@ has obviously been around for a long time. As will now be illustrated, the same can be said of Agreen@ technologies.

Green technologies

The importance of technological change for environmental protection has been increasingly appreciated in recent years, mostly in studies and anecdotes on Acleaner@ or Agreener@ technologies. Yet, if one agrees with Carter (1939: 143) that the goal of most technological innovations has always been to save time, lower costs, make a product last longer, do more or work better, then the environmentally beneficial impact of most innovations seems to be a given. For example, the fact that new technologies were essential in creating resources out of by-products was well understood by Simmonds (1876: 5): AModern science has pointed out the uses of many substances which were formerly regarded as offal, and thrown away; and the result is, that in England, and on the Continent, scarcely anything is entirely wasted.@ The Austro-Hungarian Archduke Rainer Ferdinand von Habsburg made similar comments a few years earlier: AAn extensive and refined use made of the waste of materials of industry and housekeeping might be considered [a good] measure of the degree of industrial development and capability. It would also scarcely be possible to find in the processes of Manufacture and in Agriculture an instance which shows to the same extent the really creative force of Science@ (quoted by Simmonds, 1876: 1). The authors of the *Descriptive Catalogue of the Collection Illustrating the Utilization of Waste Products* of the Bethnal Green Museum (1875: 3) also pointed out: AOne of the greatest benefits that Science can confer on man is the rendering useful those substances which being the refuse of manufactures are either got rid of at great expense, or when allowed to decompose produce disease and death.@ He added: AA large number of such are now used in various ways which were formerly regarded as offal, and cast away, but many others still exist inviting the ingenuity of men of science to find for them useful applications@ (idem).

Karl Marx, building on the work of Babbage, also argued that one of the general requirements for the re-employment of industrial Aexcretions@ was Aimproved machinery whereby materials, formerly useless in their prevailing form are put into a state fit for new production: scientific progress, particularly chemistry, which reveals the

useful properties of such waste@ (quoted by Rosenberg, 1994: 104). Another radical European economist, John Hobson (1917: 75), made similar observations a few decades later:

> New industrial arts owing their origin to scientific inventions and their practice to machinery arise for utilising waste products. Under Awaste products@ we may include... the refuse of manufacturing processes which figured as Awaste@ until some unsuspected use was found for it. Conspicuous examples of this economy are found in many trades. During the interval between great new inventions in machinery or in the application of power many of the principal improvements are of this order.

The British economist Alfred Marshall (1986 [1920]: 232) also wrote during the same period that Amany of the most important advances of recent years have been due to the utilizing of what had been a waste product; but this has generally been due to a distinct invention, either chemical or mechanical.@ Another contemporary, Frederick Talbot (1920: 13-14), was even more explicit.

> It is distinctly interesting, if not actually amusing, to follow what may be described as the utilitarian conjugation of waste. It remains an incubus, if not an unmitigated nuisance, until the chemist, or some other keenly observant individual possessed of a fertile mind, comes along to rake it over and to indulge in experiments. Such efforts are often followed with ill-conceived amusement... In due course some definite conclusion is reached, and the fact becomes driven home that, if such-and-such a process be followed a particular spurned refuse can be utilized as raw material for the production of some specific article. Then scepticism and amusement give way to intense interest and

> speculative rumination. The new idea is submitted to the stern test of practical application upon a commercial basis, while the financial end of the proposal, which is the determining factor, is carefully weighed.

As numerous examples illustrate,[4] this pattern was common to all industry, a point that Talbot (1920: 17-18) summarized concisely: ATo relate all the fortunes which have been amassed from the commercialization of what was once rejected and valueless would require a volume. Yet it is a story of fascinating romance and one difficult to parallel in the whole realm of human activity.@ As will now be illustrated, loop-closing, i.e., the idea that the by-products of one industry can become the valuable inputs of another, which is hailed by many modern-day writers to be a form of Anew thinking,@ was also deemed widespread in the last two centuries.

Loop-closing

The idea that firms should reduce their aggregate environmental impacts by turning waste into feedstock has been actively promoted in recent years by so-called Aindustrial ecologists@ (Graedel and Allenby, 1995) and Anatural capitalists@ (Hawken et al., 1999). Once again, however, it can be argued that contemporary ideals are only trying to catch up with past practices. For numerous such illustrations, one can look at books devoted to industrial resource recovery that were written long before the advent of modern environmental consciousness and regulation. Countless other examples can also be found in ancient technical books dealing with specific kinds of waste, patent records, graduate dissertations and trade journals (Desrochers, 2001). Indeed, the practice of industrial resource recovery between otherwise unrelated firms was deemed widespread by many past commentators. Simmonds, 1862: 2) thus observed: AIn every manufacturing process there is more or less waste of the raw material, which it is the province of others

[4]See, among others, Bethnal Green Museum (1875), Kershaw (1928), Koller (1918), Simmonds (1862; 1876), Talbot (1920) and Desrochers (2001).

following after the original manufacturer to collect and utilize. This is done now, more or less, in almost every manufacture, but especially in the principal ones of the [United Kingdom] - cotton, wool, silk, leather, and iron.@ Some years later, the organizers of the waste exhibit of the Bethnal Green Museum (1875: 4) wrote that many ingenious individuals were busily devising Ameans by which [the] rubbish may be worked up into a useful product@ and that there were Afew... great manufactures now which have not one or more of these dependent industries attached to them.@ Following the First World War, Talbot (1920: 19) wrote: AThe German, when he encounters a waste, does not throw it away or allow it to remain an incubus. Saturated with the principle that the residue from one process merely represents so much raw material for another line of endeavor, he at once sets to work to attempt to discover some use for refuse.@

A few years later, Kershaw (1928: ix) replied to some criticisms of his attempt to cover, in one volume, the waste in all branches of manufacturing industry in the United Kingdom and the United States by pointing out: AIt is a mistake to imagine that our industries can be carried on efficiently in water-tight compartments, for the waste material or by-product of one manufacture is quite often the starting-point or raw material of another.@ There is thus little ground to believe that widespread loop-closing is either an utopian goal or a modern idea. Yet, if contemporary thinking on sustainable development was so clearly anticipated by previous thinkers and practiced by past industrialists, why is it now believed to be a radical departure from past behavior? This issue will now be examined in more detail.

Economic development and the linear model of production

Why is it so widely believed today that Aeco-efficiency@ is an epochal break from past practices? Assuming that the information provided in this essay describes accurately past practices, the question is indeed a puzzling one. While there are no easy answers, a few hypotheses can be suggested. The first is that while environmental,

technology and business historians have in recent years shown increased interest in the past environmental behavior of firms, most of them usually begin their inquiry assuming that by-product recovery did not make much economic sense (Desrochers, 2001). For example, environmental historian Cumbler (2000: 314) writes: AHistorically business has tended to look on the pollution costs of production as an external cost to be born by society in the form of dirtier water or air or depleted natural resources. Externalizing environmental costs encouraged economic expansion and employment by reducing costs to the manufacturer.@ As a result, they have ignored the authors mentioned in previous sections and have focused their energy on Progressive Era governmental conservationists and proponents of Ascientific management@ who widely believed in the obsolescence of laissez faire and the urgent need to Aorganize@ society along Ascientific@ lines.[5] While it is true that many of these latter thinkers declared a Awar on waste@ a century ago, they had comparatively little to say on industrial by-products recovery. For one thing, the conservation movement political leadership was mostly concerned with the exploitation of raw materials. Thus when governmental forest manager Gifford Pinchot ascribed Apreventing waste@ as one of the three principle goals of the conservation movement, he usually referred to natural occurrences such as forest fires (Riukulehto, 1998: 51). For their part, advocates of scientific management who advocated the creation of Awealth from waste@ through centralized scientific planning were primarily concerned with, on the one hand, the unnecessary duplication of work in the anarchic marketplace, and on the other, wasteful behavior such as conspicuous consumption and luxury that diverted resources away from more pressing needs (Chase, 1926; Riukulehto, 1998). While some proponents of scientific management, such as Spooner (1918: 198) in his book *Wealth from Waste*, gave Ashort accounts in simple language of how such unpromising substances as sweepings, scourings, dross, dregs,

[5]See Desrochers (2001) for a review of current historical work on the topic and the authors selected by Neimark and Mott (1999) in their documentary history of the environmental debate.

scum, scoriae, flue-dust, sediments, lees, offal, etc., have been economically utilised,@ most of their effort was targeted toward things such as Awaste time,@ Awaste due to traditional methods in management@ and the Autilisation of waste land.@[6] Thus, for example, many authors viewed American reticence in adopting the metric system as a considerable source of waste. As Stuart Chase, now best remembered for having coined the expression ANew Deal,@ put it in his *The Tragedy of Waste*:

> The American Metric Association has estimated that one year of school life for every American child could be saved if the decimal system of weights and measures replaced the pints and feet and acres and rods, the quires and reams, the bushels and pounds of the present immemorial usage. We confess it is with sorrow that we see a child enter upon this uncorrelated, illogicalBalmost mysticalBdesert of mathematics. And certainly, in later life, 50 per cent of all clerical labor dealing with weights and measures could be saved by the introduction of the metric system. The Metric Association puts the total loss at $800,000,000 a year, the equivalent of 400,000 man-power (Chase, 1926: 174).

Indeed, Chase (1926: 263) argued that, viewed in the light of widespread industrial inefficiency, by-products were not a serious issue: AOn the wholeY this >garbage pail= aspect of waste B despite its prominence in the public mind B is, in our eyes, a minor matter. Compared with such losses as spring from the military establishment, super luxuries, unemployment, excess plant capacity, the retail store traffic, and oil drilling, it isCrelatively speakingConly a drop in the bucket.@

[6]Thus Spooner (1918) spends less than 40 pages out of 300 on the topic of industrial by-product recovery in his *Wealth from Waste*. The same can be said of Chase (1926).

Perhaps another reason why Aindustrial loops@ were not deemed prevalent in the past by proponents of central planning, and are indeed often believed to be absent from contemporary market economies, is that they spontaneously appear without any central authority being in charge and that few people have taken the time to study them in any depth. This argument becomes more plausible when one considers that the few research projects that have tracked them using a Asnowball@ approach have documented sophisticated linkages. For example, Schwarz and Steininger (1997) chose a basic goods company in the Austrian province of Styria and followed the waste streams coming into the plant site as well as originating from it. For each new supplier and recipient thus identified, the procedure was repeated until the geographic system boundary was reached. The result was the Adiscovery@ of a very sophisticated case of Aindustrial symbiosis.@ These findings triggered further research in the Ruhr region of Germany, which resulted in qualitatively similar results (idem).

Perhaps also another part of the answer lies in the fact that most individuals are more familiar with municipal waste disposal practices than industrial behavior towards by-products. For a number of reasons, ranging from Acity machine politics@ to the fact that domestic waste has always been more difficult to collect and of a lesser Aquality@ than industrial waste, municipal officials turned to a Atax and bury@ approach to waste long ago, a pattern that rapidly killed the entrepreneurial instincts of their administrators and employees. As Talbot (1920: 302-4) pointed out:

> Ostensibly, in [the United Kingdom] we have the very finest machinery in existence for the reclamation of waste of every description B the municipal and civic authorities. But, as results have conclusively demonstrated, they are the least efficient institutions in that respect. The few cities which are able to point to great achievements in this field are the very exceptions which serve to confirm the rule... The system is responsible for this deplorable state of affairs. The average municipal engineer, even if anxious to excel in this province,

> finds himself hampered at every turn. He is not vested with sufficient authority or freedom to carry any carefully prepared scheme into operation without the sanction of this, or that, Committee which, as a rule, is notorious for its lack of practical knowledge, more particularly in all matters pertaining to the value of waste. Then the multiplicity of officials and their salaries reacts against every possibility of a scheme being turned into a financial success.

One last possible explanation is that over the years a number of policies actually discouraged industrial resource recovery, most notably through the erection of various institutional barriers, transport cost discrimination against secondary materials, subsidies to the primary sector, Aset aside@ programs and minimum content laws (Kneese and Bower, 1979; OECD, 1994). Current environmental regulations, which are squarely based on the notion that industrial by-products are a nuisance to be destroyed rather than potentially valuable inputs, are a case in point. Indeed, in modern environmental statutory law the designation of a by-product as waste can often prevent further productive uses. Frosch (1997: 45) gives the following illustration:

> A characteristic tale from industry is illustrative of the problems facing those firms that attempt to use materials more efficiently. The corrosion coating of auto bodies is accomplished by passing the cars through a zinc phosphate bath. After a period of use, the bottom of the bath contains a slurry rich in zinc. At one plant, this slurry was for many years removed periodically when the tanks were cleaned and then sent to a zinc smelter, which processed it and put the resulting zinc metal back into the industry supply stream. In the course of regulatory actions not aimed at this material, the slurry became classified as a hazardous waste. When the smelter became acquainted with the regulations that would

> now apply, it refused to accept the material any longer. At the time this anecdote was told, the slurry was being sent to a landfill.

Actually, it is now widely admitted that environmental statutes typically define pollution prevention in a way that excludes recycling and reclamation while often instituting pervasive biases against technological innovation (Davies and Mazurek, 1998; Environmental Law Institute, 1998; 1999).

Conclusion

Virtually all contemporary experts on sustainability assume that traditional economic development was characterized by a linear approach in which materials and energy were extracted, processed, used, and dumped in a linear flow into, through, and out of the economy. Much historical evidence, however, indicates that industrial resource recovery was much more widespread than currently thought. To understand the basic error underlying current assessments of past practices, we must realize that our ancestors did not expand their economics much by simply doing more of what they had already been doing, but by inventing new kinds of goods and services and by creating wealth out of what had hitherto been considered valueless things. It therefore seems fair to say that all of today=s recyclables were considered waste at one point in time before value was created out of them through the use of human creativity and entrepreneurship. The market process is, of course, not perfect and some potential linkages certainly were and currently are overlooked on occasion. In the end, however, it may be that in today=s economies, regulatory barriers and price-distorting subsidies are more serious obstacles to creating value out of by-products than traditional market incentives.

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