

Best Practices Versus Practices That Work

Rethinking Sustainability Strategies in the Mediterranean Region Using Data

Mary Kombolias

Independent Sustainability Consultant
New Orleans, LA, USA & Chania, Crete, Greece
e-mail: mk@marykombolias.com

Abstract—The Mediterranean region encompasses three continents and a multitude of languages and forms of government. It is also remarkable that this part of the world contributed to the genesis and expansion of three of the world's major organized religions. Despite minimal political integration, there is considerable overlap in terms of lifestyles, diets, climate, history of colonization, and cultural sensibilities between Mediterranean nations. These factors can be leveraged to improve sustainability outcomes, and with contextual data, develop new metrics and targeted and effective solutions for the region. However, before any metrology is created and adopted, there needs to be (1) an assessment of the types of avoided pollution which are a direct result of regional factors and circumstances that may not exist in North America and in Northern Europe where the majority of climate thought leadership is centered and (2) in light of those factors and circumstances, a re-evaluation of the effectiveness of sustainability practices adopted from outside the region.

Keywords—sustainability; Mediterranean; contextual data analysis; green marketeering.

I. INTRODUCTION

Mitigating environmental damage by human activity during the time when humanity is searching for more efficient and sustainable ways to maintain modern life is something that requires global cooperation. A common issue has been in assessing blame for the current state of affairs which have wrought unacceptably high levels of climate change, biodiversity loss, and human interference in the nitrogen cycle [1][2]. For instance, non-Western nations such as China feel that their economic progress should not be stymied by the West's calls for strict environmental regulation when it was the West which benefited the most from the environmentally unregulated activities of Industrial Revolution and the resultant degradation of the natural environment [3]. Less industrialized nations which are experiencing the deleterious effects of climate change more directly are also demanding immediate assistance [4]. While it is understood that everyone must attempt something in good faith, what that course of action is cannot simply be levied by fiat uniformly across all cultures and climatic zones, as culture and climate dictate the extent of human activity in any given part of the world.

No part of the world is more intersectional than the Mediterranean, the nexus of Africa, Asia, and Europe which is bound together by climate and culture. But because this area is (1) not politically contiguous, (2) contains numerous overlapping transnational political bodies (i.e., the European Union, the Arab League, the

African Union, and the Union for the Mediterranean), and (3) also includes non-aligned nations and nations engaged in deep adversarial relationships or active conflicts with neighboring states, it is often difficult to assess the true state of affairs in terms of sustainability and to coordinate efforts. Applying sustainability practices and metrics developed by wealthier nations outside of the region obfuscates reality further.

Incentivizing both individual and collective behavioral changes that have the power to eliminate longstanding impacts toward the environment in the Mediterranean will require confronting the root causes of the worrying current state of affairs in the region. On the other hand, it is also important to expressly acknowledge and promote throughout the region the indigenous cultural practices which are already environmentally beneficial but are not necessarily measured well or measured at all. The purpose of this paper is thus to outline common cultural factors of the Mediterranean which do not necessarily exist in the countries where thought leadership on sustainability resides, to explain the impacts of them be it positive or negative, and to explain the barriers to properly collecting and assessing such contextualized data in the Mediterranean region. Remedies to poor, inefficient, and incomplete data collection and why strategies from outside the region may not be effective also are discussed.

II. CULTURAL FACTORS

The two main categories of cultural factors that have an impact on sustainability but which are not properly quantified and therefore not discussed relate to diet and commercial activity. These cultural factors are discussed in detail in subsections A and B below. Table 1 provides a summary of factors within each category.

A. Food and the Culture and Infrastructure which Surround It

Throughout the Mediterranean, there is an emphasis on eating fresh foods which are locally sourced and unprocessed. Canned and frozen foods are limited in their ability and are generally viewed as unpalatable. There are immediate benefits to the climate because of this cultural preference in terms of forms of avoided pollution such as emissions related to industrialized food processing in factories and transportation to market.

Lack of processing also results in a relative lack of food packaging waste. Together, the food and beverage, pulp and paper, and rubber and plastics industries in Europe comprise over 20% of the customer base of the EU chemical industry [5]. As food packaging itself is produced through industrial processes such as

papermaking and plastic manufacturing, the net positive effect, or at least an effect which does not compound an already negative effect of these processes, is compounded. Also, as a result, food packaging (excluding beverage containers) does not dominate the recycling streams.

The famous, heavily plant-centered Mediterranean diet is one that has been developed taking into account various cultural influences, including the indigenous religious faiths of the region. Some faiths, such as Judaism and Islam, prohibit the consumption of certain animal proteins all together. Orthodox Christianity stipulates that believers should consume a vegan diet every Wednesday and Friday and throughout the weeks of Lent and Advent; a strict adherent would then consume a vegan diet for over one-third of the year.

Matters of personal conscience are by their very nature difficult, if not impossible, to quantify. Although faith is a cornerstone of culture in the region, economic constraints have a strong influence on daily dietary choices as well. Though meat and fish are widely available from local producers and preferred over those sourced from factory farms, most households are economically constrained to the point that most days are, in fact, meatless for many people consisting of meals prepared from whole foods instead of industrially-produced, soy-derived meat and dairy substitutes. Typically, meat and fish are reserved for small children to sustain their growth and intellectual development. The main daily household animal protein sources are eggs and dairy, typically yogurt and cheese, which are more easily digestible among populations in the region which have varying degrees of severity of lactose intolerance. A gallon of milk as it is sold in the US would be regarded as an obscene volume in Mediterranean countries.

Dietary suggestions touted from outside the Mediterranean as critical to lessening humanity's impact on global warming, such as "Meatless Mondays," which originated in the United States during World War I, are simply ludicrous in this part of the world [6]. It has been proposed that if the whole United States (population: ca. 300 million people) went without meat and cheese one day a week, this would have the same effect as removing 7.6 million cars off the road [6]. If so, a means of calculating the avoided emissions across Mediterranean countries due to the indigenous, plant-centered diets with much smaller portions of meat and animal products due to cultural, religious, and economic factors is in order.

While the overall food culture can be praised for its contribution to environmental sustainability, the consumption of prepackaged beverages, especially water, has created a major issue which is quite nuanced and typically only discussed superficially. Plastic water bottles are by far the most pervasive type of litter and are poorly recycled across the region. Recent estimates of plastic pollution from coastal areas into the Mediterranean Sea are approximately 500,000 tons per year, excluding the contributions from tourism and shipping [7].

The root cause for the consumption of so much bottled water in developed countries is that there is little faith in the ability of the local public authorities in the region to produce clean, good tasting tap water suitable for drinking. Many freshwater sources are badly polluted along both the northern and southern shores of the Mediterranean Sea.

The sources of pollution include inappropriate disposal of municipal wastewater, infiltration from onsite sanitation facilities, excessive use of fertilizers and pesticides in agriculture, and industrial run-off containing heavy metals and polycyclic aromatic compounds [8]. Lack of trust in the public authorities is a longstanding legacy of colonialism in the region; it is also the foundation for corruption. Water treatment is one of many public services administered at the municipal level. Throughout the Mediterranean, corruption in the forms of favoritism in public procurements and nepotism is endemic at local levels of government, resulting in overall low confidence in the abilities of the people responsible to properly administer public works like water treatment, as well as waste management, recycling, and sanitation programs [9].

B. Commercial Activity and The 3 R's: Reuse, Repurpose, and Resale

With the exception of the issue related to beverage containers, the sale of food in the region has a lower carbon footprint and negative environmental impact than in other developed nations because of the way it is sold. There is a higher prevalence of open air street markets, mini-markets, and fewer and smaller supermarkets overall. For instance, the EU average share of supermarkets within the retail food market is 62%; for Italy, Cyprus, and Greece the market share of supermarkets within the retail food market for each nation is below 40% [10]. Open air street markets take place in most neighborhoods at least one day per week in which farmers and producers sell directly to the public, without burden of running lights and air conditioning. Food waste is generally low because nutritious, fresh food is available in every neighborhood and accessible by foot; people generally buy only what they know they will need for the next 24-48 hours. This type of commercial environment is the antithesis of what is seen, for example, in the United States, where access to farm-fresh foods and the people who grow it is considered a privilege of the well-to-do classes.

The only downside, of course, to this otherwise highly sustainable means of commerce is the ubiquitous use of plastic bags. For example, in Greece, a plastic bag tax has been implemented, but in reality, only large chain stores impose it, as the penalty to them from the government would be severe and easy to collect. It has been cited that in Greece each individual will use 300 plastic bags per year [11]. While it seems plausible for an individual to conduct sales transactions which would result in the accumulation of almost one plastic shopping bag per day, the reuse of plastic bags in the Mediterranean region is not discussed. It is common for households to maintain a stash of plastic bags separated by size. The most common and ultimate reuse of plastic shopping bags is for trash disposal, and the purchase of rolls of plastic garbage bags by households is limited to businesses. Individuals and households are primarily motivated by financial constraints, especially in light of the financial crisis of the past decade, more than environmental considerations, as reusing a bag results in one less thing to buy. Sturdy and well-constructed plastic and glass containers for the few

pre-packaged foods that households consume (namely, ice cream, margarine, yogurt, and pickles) enjoy a long life preserving leftovers in the refrigerators of Mediterranean kitchens. Aluminum foil is washed and reused until it is punctured with cracks and holes. Thus, it is safe to say that waste generation, at least by households, is generally low, and investigations across the Mediterranean support this observation [11]. Fig. 1 also shows that the waste generated in kilograms per capita in northern Mediterranean countries is significantly less than in other EU countries [12].

A phenomenon which also is not adequately discussed is the overall culture of reuse, repurpose, and resale that is pervasive throughout the region. While declaring publicly that one has purchased an item secondhand or has modified and repurposed something for another use carries a big stigma, as that is regarded as an admittance of one's personal poverty, it is something that is done without fanfare and is seen as an intelligent and sensible to do. Like with diet, real economic constraints motivate this behavior more than environmental activism. Because commerce within the greater economy of individual nations in the region, and especially the circular economy, is mainly transacted in cash [13] and executed at the individual level by sole proprietors or small businesses, many people involved in these activities are able to routinely evade paying a considerable portion of the rightful sales and income taxes related to their business activities [14]. This ultimately creates a metrological issue in quantifying the underlying impacts of these commercial activities that support the circular economy on regional environmental sustainability.

Automobiles in the Mediterranean are generally driven until they are no longer serviceable, generally at around 20 years after the date of manufacture, although in some countries, even older vehicles remain serviceable due to economic difficulty of buying a new car. Greece maintains the oldest busses and trucks in all of Europe, whereas Italy and Spain operate the oldest van fleets on the continent [15]. While older cars are less fuel efficient and do not necessarily meet the most stringent fuel emission standards, the repair and resale of older vehicles leads to less waste in the form of automotive junkyards full of components which cannot be adequately reused or recycled, such as the plastic interiors and electronic components. Although the region as a whole is far behind in the adoption of electric and hybrid vehicles, currently there is no adequate, economically viable industrial process available anywhere in the world to recycle the rechargeable batteries of these vehicles. This means that this is a category of waste which is effectively not being produced here at present time, in addition to the avoided emissions related to producing these new vehicles and the deleterious environmental impacts of lithium and cobalt mining to produce the batteries for them [16].

Repair shops for consumer electronics, which are nearly extinct in wealthier Western countries, flourish in this region, as nearly all electronics are imported. Tailors, seamstresses, and cobblers can also be found in every neighborhood. Used clothing stores, predominantly for

women's fashion, have sprung up in recent years due to the economic crisis. Children's clothing is not often featured in these shops because it would be embarrassing to be perceived as someone who could not afford the best for their children. However, for other items, two main avenues of resale which provide some level of privacy exist: Facebook Marketplace and the Roma.

Facebook Marketplace is popular for people with only a few items to sell, whereas the Roma deal with bulk goods. The Roma are a minority group throughout the Mediterranean region who live on the fringes of the dominant society. Though subject to racist stereotypes as thieving and lazy, the Roma are whom members of the dominant society rely upon to liquidate all manners of surplus goods off the books. In turn, the Roma resell these goods for cash back to members of the dominant society. One common area of resale is used furniture and household appliances. Roma merchants particularly scour well-to-do neighborhoods with their trucks and via megaphone announce their availability to haul away furniture, mattresses, cabinetry, and any other large, unwanted household items. The discrimination against the Roma, who experience major barriers toward entry into other types of work, ultimately fuels the shadow economy and vicious cycles of money laundering and tax evasion throughout the Mediterranean.

Because no recording keeping and no tax is properly assessed on these activities, it is difficult to estimate the scale of the positive impact on the environment of the Roma's refurbishing and resale of discarded consumer goods across the region. Rather than be maligned and reviled as black marketeers, the Roma should be recognized, respected, and rewarded for the green marketeering that they do perform, a type hyper-efficient, human-driven materials recovery.

III. THE PROBLEMS WITH APPLYING EXTERNAL PRACTICES BASED ON WHAT IS QUANTIFIABLE ELSEWHERE

In addition to the gaps in metrology due to what is currently not quantified, there is a problem with applying externally-developed best practices based on what is easily quantifiable elsewhere. What is quantifiable elsewhere is based on assumptions and conditions which may not be applicable to the Mediterranean. Namely, these can be reduced to two factors which are not prevalent in the region: (1) high levels of efficient and equitable tax collection and (2) high levels of trust in the public authorities to do the right thing with the public's money. Strategies developed from outside of the region based on these two factors will naturally result in initiatives which will be executed with less efficacy and less efficiency and will produce data from which an accurate assessment of the impact cannot be deduced. It is not that Mediterranean people are less trustworthy and more corrupt than other people in the world, but the legacy of hundreds of years colonialism in the region does not exist in most parts of the world which dominate thought leadership on environmentalism. People who have been colonized by another power, regardless of the identity of the colonizer,

be it British, French, Ottoman, etc., view tax evasion as the ultimate act of patriotism because taxes collected by the occupier from the occupied population are, of course, used to maintain the occupation. These days, in the minds of many people in the region, the role of the occupier has been replaced by politicians at all levels of government who are assumed to be corrupt by default, regardless of party affiliation or ideology.

Two particularly problematic external strategies are plastic bag taxes and municipal mixed recycling streams.

A. Plastic Bag Taxes

Numerous countries in the region have instituted plastic bag taxes at points of sale. In Greece, for instance, between 2018 and 2019, the use of plastic bags has dropped 85% as a result of levying the tax [17]. While this statistic is encouraging it does not tell the full story. This data is based upon merchants who properly charge for bags and issue receipts, and as it was mentioned in previous sections, the vast majority of sales transactions in Greece and throughout the Mediterranean are cash only and most merchants, especially within the otherwise eco-friendly open-air markets, are individuals. The true reality cannot be depicted from data collected from the minority who do comply with the law. Using tax receipts to measure the extent of individual behavioral changes can only work well in societies which trust the government to properly use public funds for the public good and where penalties are evenly applied against those who break the law.

A common argument is to then substitute paper bags free of charge in the place of plastic bags for shoppers. The relative scarcity of water and forests in comparison to Northern Europe and North America places physical limits on how much paper manufacturing infrastructure can be established domestically in any given Mediterranean nation. The use of paper bags is not very widespread because many paper products are, in fact, imported and are somewhat expensive. Also, practically speaking from a materials standpoint, paper bags simply do not have the same reuse capacity as plastic bags. Even in areas where a plastic bag tax has been instituted and is reliably collected and paper bags are provided to consumers without charge, problems can still arise. For example, in July 2021, the residents of Linköping, Sweden were requested to stop using these free paper shopping bags to dispose of their trash because of problems that loose, leaking, and broken paper bags create for waste collectors [18].

B. Municipal Mixed Recycling Streams

Nations like Sweden, Germany and Japan are often lauded in the media for their successes in recycling and deservedly so. Countries such as these aggressively sort their recyclables by type and class, preventing contamination, which is the key factor in retaining the value of recyclable waste as commodity [19]. Also, it should be noted that in Germany, for example, the recycling apparatus is financed by industry rather than the state; Germany has also already reached the 2030 EU target for packaging recycling of 70% fourteen years early in 2016 [20]. This is not necessarily the case in Mediterranean countries. Municipal recycling systems in Greece, for instance, mirror those found in some major

US cities like Washington, DC, and rely upon mixed recycling or single streams where there is no sorting performed by the consumer—paper, metals, and plastics are all comingled together. These single stream systems are attractive to municipal governments which finance them through taxpayer money due to supposedly lower costs of administration and higher rates of collection of recyclables [19]. However, the true costs of administration are actually much higher due to the lower quality and value of recyclables collected in comingled schemes due to contamination and the resultant lower market demand for them [19]. In a Canadian study it was determined that single stream recycling only increased municipal recycling rates by 4% and on average is actually 28.5% more expensive than multi-stream recycling in which residents and businesses presort their recyclables [19]. Relying upon tax revenues to fund a recycling system which by its very nature is inefficient does not make sense in a wealthy country like Canada or the US much less in Mediterranean nations like Greece in which tax money is itself also collected inefficiently and significantly less of it is available to fund government projects.

IV. SYNTHESIZING PRACTICES THAT WORK

The key to synthesizing practices that work is to adapt the best practices from elsewhere with practices that are already successful locally which take into consideration cultural nuances and constraints. Publicly available data can assist with targeting hybrid initiatives. Key pieces of data are unemployment figures, levels of tax collection (or lack thereof), and utilities usage.

The areas in which unemployment is most severe are naturally going to have less taxes collected. In cash-poor areas with high numbers of unemployed people, free market solutions, like reverse vending machines returning beverage bottle deposits make more sense than using limited public funds to empty mixed recycling receptacles, the contamination of which has rendered them into ersatz trash cans (Fig. 2). Reverse vending machines are ubiquitous in within grocery stores in places like Sweden and Germany for the mechanized collection PET beverage bottles and aluminum cans and are capable of distributing payment to consumers in real time. Paying people for recyclables can go even further – for instance, the recycling of paper is extremely high in India, a nation with low and unbalanced levels of tax collection. No clean, dry paper is thrown out as door-to-door merchants will pay households by weight for their waste paper separated by grade (newsprint, writing, magazine, kraft, corrugated, etc.) Post-consumer paper collection accounts for 95% of total recyclable waste in India [21]. This strategy makes more sense than dumping unsorted paper into a bin contaminated with all manners of items.

Data on electrical and water usage should also be utilized. These will demonstrate which areas suffer the greatest fluctuation in demand in public resources due to the tourism industry and can be used as a basis to rebalance public services for optimizing sustainability. It

is unfair to full-year residents of touristic areas to assume the full tax burden of funding municipal waste management systems, water treatment, and sanitation when the population throughout the region swells by one-third and the marine litter can increase as much as 40% [11]. Tourists should bear responsibility for the stresses their presence creates on the public infrastructure and the natural environment, and they are a population from which it is far easier and more reliable to collect taxes. These taxes, so long as oversight systems are put in place to ensure their conscientious administration by local governments, could be applied toward efforts that make sense, such as national and transnational capital improvements on infrastructure related to water treatment, sanitation, and waste management. Private enterprises should be incentivized to install water purification systems for drinking water, solar panels, and energy efficient appliances, and free market solutions should be encouraged to commoditize uncontaminated recyclable waste like corrugated board and beverage containers generated in large volumes by the hospitality industry rather than businesses paying employees and taxes in order to dispose of these items unsorted where they ultimately lose value due to contamination. One such organization which has had success is Enaleia, a Greek startup that pays fishermen for marine plastics, which are then recycled into durable consumer goods. Since 2016 Enaleia has recruited ca. 1,300 fishermen who have collectively removed over 180,000 kg of plastic and over 20,000 kg of used fishing nets from the Mediterranean Sea as part of their day-to-day work [22].

Above all, Mediterranean nations should actively seek out the best practices amongst themselves before applying a solution from elsewhere. To that point, the lidded blue mixed recycling bins work well in cold climates with lots of snow and rain in order to keep recyclables dry, but in hot climates, they are breeding grounds for pests and vermin and smell badly in the summer months. Israel has a source-separated recycling system that utilizes simple and inexpensive metal cages with orifices sized to capture plastic bottles [23]. Contamination with other materials is prevented, maintaining the value of the materials, and air is allowed to circulate, eliminating odors and discouraging the nesting of pests.

While measuring the positive impact of the Roma people's business activity on the environment may seem nearly impossible, an indirect measure could be through measuring the sales and installation of new household goods and building materials, like doors and windows. A steady or lowered demand for new items correlated with an increase in building permits from local authorities may suggest the availability of acceptable used goods in the marketplace. Governments should also seek solutions to reward this commercial activity and drive it out of the shadows so it can be adequately quantified.

V. CONCLUSION AND FUTURE WORK

What ultimately should be landfilled is the notion that something from a "wealthy" or "Western" nation is automatically superior to a homegrown system or

methodology. As the Roman philosopher Seneca, a native of what is now Spain, once said, "The law is general but each case is specific." Each nation and each culture is doing something positive, and the focus should be on learning from each other, leveraging data contextually through an understanding of culture, and innovating to enhance sustainability and the metrology of sustainability in region-specific ways that can identify inefficiencies and shortcomings, as well as provide markers of progress. The next steps are to begin designing a model to estimate the positive contributions of the unmeasured aspects highlighted in this paper, particularly the green marketeering of the Roma merchants.

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Figure 2. Photo montage illustrating state of municipal recycling in Chania, Crete, Greece. Photo A (above) is of a waste management truck clearly depicting the types of items which are acceptable for municipal collection. Photos B and C (below) depict blue recycling receptacles on the street in the “Kentro” (“Center”) neighborhood of Chania contaminated with trash and improperly disposed recyclables. Photo credit: M. Kombolias

TABLE I. SUMMARY CULTURAL, ECONOMIC, AND LIFESTYLE FACTORS WHICH AVOID OR MINIMIZE EMISSIONS, POLLUTION, OR WASTE

Category	Factor	Summary of Factors which Avoid/Minimize Emissions/Pollution/Waste		
		Description	Areas of Avoided or Minimized Emissions/Pollution/Waste	Challenges to Quantification
Food and Diet	Meat Consumption	Generally low with cultural preference for meat of smaller animals over beef. High availability of locally raised meat and minimal packaging (wrapped in paper). Cultural preference for fresh meat versus frozen or processed meat products (cold cuts, canned meat).	Packaging waste Methane Emission Transport to market	Some black market activity; sales receipts may not produced by small-scale producers or may not accurately reflect a sale to avoid taxation.
	Dairy Consumption	Preference for and higher availability of cheese and yogurt over fresh milk. Dairy products are more often sourced from smaller animals (sheep and goats) than cows.	Food waste due to spoilage of milk	Some black market activity; sales receipts may not produced by small-scale producers or may not accurately reflect a sale to avoid taxation.
	Produce Consumption	High with preference for locally sourced fruits and vegetables.	Packaging waste Transportation to market	Some black market activity; sales receipts may not produced by small-scale producers or may not accurately reflect a sale to avoid taxation.
	Religious Dietary Restrictions	Some restrictions are cyclical/temporal (Orthodoxy, Islam, Judaism). Others are mandatory (Islam, Judaism).	<i>See meat and dairy consumption factors</i>	Levels of religious observance are deeply personal and vary; some nations do not collect population statistics on religious identity.
	Limited Consumption of Factory-Produced Foods (i.e., canned and frozen products with the exception of ice cream)	Low – culturally unpalatable	Packaging waste Industrial food manufacturing processes Transportation to market Refrigerants (frozen food only) Electricity (frozen food only)	Needs to be reported in comparison to another population.
Commerce	Open air street markets	Located within walking distance of residential neighborhoods and present 1-2 times weekly. In addition to fresh produce, clothing, shoes, and miscellaneous household items are also available for sale.	Refrigerants Packaging waste (except for plastic bags) Electricity consumption Transportation by consumer to reach market	Some black market activity; sales receipts may not produced by small-scale producers or may not accurately reflect a sale to avoid taxation. Plastic bags are main form of packaging. Plastic bag taxes often not levied against consumers.
	Mini Markets	Located within walking distance in every neighborhood. Smaller stores catered specifically to the items most popular among local residents. High turnover of fresh products.	Transportation by consumer to reach market Food waste Electricity consumption (compared to large supermarkets)	Some black market activity; sales receipts may not produced by small-scale producers or may not accurately reflect a sale to avoid taxation. Plastic bags are main form of packaging. Plastic bag taxes often not levied against consumers.
	Repair over Replacement	Mainly driven by economic necessity and high price of imported goods, especially electronics and automobiles.	Packaging waste Transportation to market Industrial processes required to manufacture a new item (mining, petroleum drilling/refining, etc.)	Some black market activity; sales receipts often not produced.
	Local Salvaging and Resale of Large Household Goods (furniture, appliances, etc.)	Mainly driven by economic necessity and high price of imported goods	Packaging waste Transportation to market of new goods Industrial processes to manufacture a new item	Nearly exclusive black market activity.