"… as a general rule, *any measurement of a social science concept that relies on a single indicator should be viewed as dubious.*" (their italics) - Etzioni and Lehmann 1967.

Toward a Better Understanding of Community Benefits Assessment Practices

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The Metropolitan Institute at Virginia Tech and the Center for Environmental Policy and Management at the University of Louisville together with partners from The E.P. Systems Group, Inc. and Lazarus LLC were awarded a five-year research grant under the EPA's Brownfields Training, Research, and Technical Assistance grant program to develop and pilot test a Brownfields Community Benefits Assessment Toolkit (BCBAT). This project will re-examine and augment traditional economic benefit models for redevelopment and in-fill to include a broader set of indicators that have until recently been difficult to systematically measure. It will also explore the efficacy and value of including hyper-local community collected data in these models now that technological advances open the door to systematic and consistent collection of that level of information. The toolkit will be based on an easy to use portable app linked with a web-based desktop portal. The system will use accessible national, state, regional and local data and hyper-local data as the foundation for benefit calculation formulas we develop.

The primary goal of this project is to enhance community decision makers' capacity to measure and track the benefits of redeveloping brownfields and thus expand the number of abandoned, vacant, and under-utilized properties that get cleaned up and considered community assets. We want to provide brownfields redevelopment practitioners with the means to gather valid and reliable data and compare alternative redevelopments that transcends the narrow perspectives of cost-benefit analysis and of reduced risk to humans from prior contamination. (See for example, Howland, 2007 and Hula & Bromley-Trujillo, 2010).

This review of the literature and discussion of theoretical, methodological, and operational approaches to identifying and measuring community benefits is the first output of this project. This interdisciplinary literature spans decades. We compiled and abstracted a data base of over 200 relevant articles from a variety of fields. The most relevant are included here and will be used to inform our construction of models for calculating and/or projecting a variety of community benefits that we will eventually test and recommend in the resulting toolkit. Our goal is to provide well researched, substantive methods to help communities identify and place value on positive outcomes that are not adequately captured by traditional economic cost-benefit analyses. The push to go beyond measuring economic benefits is crucial to community sustainability goals and is evident in the trend in business to account for the "triple bottom line". We therefore briefly summarize the types of benefits originally tracked as results of brownfields redevelopment and then provide a discussion of the significance of "triple bottom line" accounting that expands the analysis. We then address methodological issues related to selection of units of analysis, the difference between indicators and measures, and appropriate uses. We continue

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the review with a discussion of the value of documenting and using community perceptions as a way to weight specific measures of benefit. We explore literature about aggregating measures into rankings and indicators of change over time and we examine questions that specify in more detail issues surrounding the design of appropriate indicators. Finally, we conclude with some suggestions for possible community indicators that we will test in the BCBAT.

Arguably, when brownfield redevelopment was first placed on the national agenda by the Northeast-Midwest Institute in 1992, the issue was the need for economic development on myriad abandoned or underutilized sites that did not measure up to the problems associated with those on the CERCLA National Priorities List (Bartsch et al. 1991). Thus, it is not surprising that the main rationale the EPA provided for its brownfield grants has been the economic benefits remediation and reuse could offer.

The dominance of the early economic emphasis is evident in an analysis of development in the Chicago metropolitan area conducted in 1995 that concluded that greenfield development was preferable to the reuse of brownfield specifically because the greenfield conversions raised land values more than reuses could do (Persky & Wiewel 1996). At the same time, EPA itself had a unit concerned in part with brownfields that remarkably had no environmental issue or objective in its title, the Urban and Economic Development Division. Nonetheless, the over-emphasis on economic impacts gradually waned and other factors came into play, both in EPA's internal considerations, its justification for expenditures to Congress, and in broader public understanding of the issues.

By 1997, however, in addition to commentary about jobs created, new tax bases generated and other economic considerations, a study funded by EPA was tasked specifically with addressing the scale of 'greenfield conversions avoided' and found that, on average, 4.5 acres of greenfield remained in non-urban uses for every acre of brownfield successfully reused (Deason, Sherk & Carroll 2001). Such generalized findings thus are not useful for specific community impact derivation, for all that they are useful in connecting brownfield regeneration to efforts to promote more sustainable development. (Dorsey, 2003) The same can be said for the OBLR study on Air and Water quality impacts of redevelopments, which found significant quality gains, largely due to reduced commuting by car, averaging results across five areas. (EPA/OBLR, 2011). States also justified their Voluntary Cleanup Programs (VCPs) using economic improvements more often than environmental (Wernstedt et al. 2012:554).

Those findings were based on a limited number of case studies examined, and case study examples have provided the bulk of the evidence on brownfield impacts other than the purely monetary ever since. While a case study, or even a linked series of them, cannot definitively value brownfield redevelopment impacts in diverse locations, the measures used can still be adapted for application elsewhere. What follows is an examination of the literature on community benefit indicator research that will inform and legitimate our selection and construction of measures of indicators (including those used in case studies) as we develop the community benefits assessment toolkit.

Triple Bottom Line: Measuring and Aggregating Local Impacts

The "triple bottom line" is a concept that was developed in the 1990s in response to an over-emphasis on the business bottom line – profit or return on monetary investment. The three elements of the enlarged bottom line are sometimes referred to as the three legged stool of sustainability:

encompassing economic, social and environmental returns (Rogers & Ryan 2001; Norman & MacDonald 2004; Savitz & Weber 2006; Hacking & Guthrie 2008; Slaper & Hall 2011).

Cost-benefit analysis is claimed by some to encompass all three elements, putting a price of social and environmental impacts to add them to financial returns (Hacking & Guthrie 2008). The problems with such an approach are legion, beginning with the fact that the prices or values assigned to social and environmental effects cannot be determined by market measures and is thus arbitrary. Those valuations, moreover, are likely determined on the basis of national or regional norms and fail to reflect the values of particular communities or neighborhood populations. The norms used for pricing may not be consistent with each other across an array of impacts, and, finally, there are many impact that are simply not measurable along a quantitative scale and thus cannot be monetized.

Triple bottom line accounting, then, tracks three distinct sets of aggregate impacts, economic, social, and environmental, without attempting to aggregate across them. Not having a single measure undermines the potential for mathematically optimizing the impacts since maximizing any one type of impact may undermine the positive returns in one of both of the other two dimensions of effects. The triple bottom line perspective demonstrates the inadequacy of municipal scale data for measuring the highly localized impacts of redevelopment and reuse of brownfield sites. For example, the opening of another grocery store in a city may be treated as having no net economic or social benefit at the municipal scale, since the shoppers at the new store will be assumed to have moved from shopping at an existing store, so profits and employment would simply be spread across one more location with no more money spent on shopping in grocery stores. No social benefit would accrue since shoppers were buying groceries as they did before. However, if the new store opens in what was previously a "food desert" neighborhood, then there might be significant economic and social, not to mention health impacts locally that would be insignificant or effectively invisible at the municipal scale.

The same argument could be made for the insignificance of adding a few acres of parkland in a city with a major park system as compared to the value of green space in a part of the city that had none. New employment or training opportunities that could have a major social as well as economic impact in a small depressed neighborhood might also rank as of little value at the municipal scale.

The strongest argument for the need for localized community impact measurement, however, arises in those situations in which what may be seen as a municipal gain is seen as a loss at the neighborhood level. In-migrant population that adds to mean wealth and income statistics for a city, for example, may be producing gentrification in a neighborhood, destroying social ties that are ignored in city cost-benefit analyses (and might be minimal in total impact even if the city used a triple bottom line approach). By contrast, an exceptionally successful neighborhood commercial revitalization might take place at the expense of retail sales elsewhere in a city, creating dispersed vacancies and declining shopping areas that pose a bigger problem than a single decayed neighborhood.

The social indicators efforts in the United States and other countries had their roots in a recognition that such purely economic measures as the Gross Domestic product (GDP) and other economic accounts did not adequately reflect the societal consequences of different growth paths (Cobb & Rixford 1998). The issue of collecting data at the hyper-local level of neighborhoods and small communities was of little concern since there seemed to be myriad social change measures available for nations, states and

regions (Land & Ferriss 2007; Gahin & Patterson 2001; Department of Health, Education & Welfare 1969).

Local Agenda 21 impact measurement efforts, emerging from the Rio conference on sustainability, did focus on the community scale to a limited degree, but were mostly municipal in focus, since they were intended to provide data for planning at the local government level (Freeman, Littlewood & Whitney 1996; Lafferty & Eckerberg 2013). Those largely European planning efforts were complemented in the US by efforts to promote "sustainability" in the planning process (AtKisson 1996; Brugmann 1997; Guy & Kibert 1998; Hoffman 2000; Valentin & Spangenberg 2000; Holden 2007). Efforts to assess the success of the two streams of effort were confounded in part by analytical ambiguities, with key factors, notably 'sustainability' itself, defined in many different ways at the local level (AtKisson 1996; Brugmann 1997; Roseland 2000; Holden 2007; Mascarenhas, et al. 2010; Davidson 2011). Aggregation across localities to a larger scale was not a serious consideration since the work was intended to serve local government planning needs.

The Environmental Protection Agency, however, has a national mandate and scope. The Brownfields grant programs provide support to local efforts across the nation. As a result, impact measures that cannot be aggregated to the national scale cannot support efforts to improve the effectiveness of grants and other support programs, nor the policies and guidance for cleanup standards and longer-term monitoring of sites redeveloped under Risk-Based Correction Action (RBCA) standards. This literature review, therefore, is focused on identification of data and of methods for data collection that will permit community groups and neighborhoods to compare alternatives for brownfield redevelopment on a triple bottom line basis while assuring that their methods of data collection are amenable to aggregation to inform national policy choices.

The historical record on successful efforts to promulgate sustainability standards and to measure "progress" more broadly than through GDP and other economic measures is spotty at best (Cobb & Rixford 1997; Gahin & Paterson 2001; Land & Ferriss 2007). The efforts to add a Council of Social Advisers to the existing Council of Economic Advisers were predicated on the assumption that good national social change data were available – and that those data permitted unambiguous interpretation that a change in value implied a rise or fall in social well-being, much as a rise in GDP was associated with improved economic conditions (Cobb & Rixford 1997). Such data, however, were not readily available at the national level. Preference findings, based on surveys or on observation of behaviors, were collected, but the national numbers ignored the highly diverse local conditions that shaped the individual responses that were aggregated (Cobb & Rixford 1997; Gahin & Paterson 2001; Land & Ferriss 2007; Dluhy & Swartz 2006). Those differing conditions meant that the national aggregates were not adding up apples and apples, but apples and other fruit – or perhaps even vegetables. The differences between localities could not be determined in a systematic way from the national perspective, especially because all local conditions were changing over time and actual conditions at the point of data collection could not be ascertained. That meant that the aggregates were not merely distortions, but that the nature of the distortion could not even be determined.

The specific local conditions that have bedeviled past efforts to aggregate, however, should be an element in efforts to derive a triple bottom line for changes at the community or neighborhood level. Those hyper-local (sub-municipal level) conditions may only be identifiable by neighborhood residents and property owners who know – or could collect – information not known by outsiders. Local people

may respond to outsiders' questions by telling them what they want to hear. This is a well-recognized problem with surveys, and can be compounded by locals trying to stimulate a desired policy response to their situation by skewing their responses (Dluhy & Swartz 2006). Admittedly, even if they generate information for policy debates themselves, local people may still overemphasize certain conditions in order to influence decisions. However, if they do so, the findings may be relied upon as accurately reflecting the community's priorities. More importantly, only the locals in a given setting can actually produce detailed data about their situation that may not be observable by others and they become empowered and more engaged in shaping their community's future. Finally, and perhaps the underlying reason to emphasize reliance on neighborhood members as data collectors, is the cost factor: they can collect the information more cost-effectively, especially if CBOs and their members volunteer to inform decision-making in recognition of the power they can acquire in the process.

Aggregation from the local level to a regional or national scale is not an impossibility. It requires consistent measurement and data collection at the local level. Where indicators of changing conditions are based on data collected and reported in the same manner, those changes can be reported. However, what may differ from one locality to another that requires special attention in the aggregation process is the relative weight or importance assigned to each change indicator by the affected populations. Perceptions and preferences will vary across neighborhoods due to cultural and other factors, so the locally collected data need to include both nominally objective indicators of changes in economic, social and environmental conditions and the clearly subjective indicators of the impact of those changes on perceived well-being on the part of local residents and businesses.

Measuring Change in People or Place: Deciding on Units of Analysis

As discussed above, measures and indicators get used by a variety of decision makers to assess current conditions, predict future conditions, and assess the impacts of a variety of interventions. At the neighborhood level, this becomes difficult for several reasons. First, sub-municipal areas are subject to a host of complex social, political, economic, and natural systems. This makes identifying drivers of neighborhood change cumbersome. The drivers of neighborhood change are numerous and research about drivers of neighborhood change is broad and varied. Changes in national, state, and local policies and systems affect the distribution of or access to economic and social resources at every level and have potentially major impacts on neighborhoods. Furthermore, changes at the neighborhood level can in turn impact local, state, and national measures of change. Models of the complexity of this interaction identify national, regional, local agents of short and long-term change and include feedback loops between the change agents. However, they ultimately end with the perceptions and actions of the local residents and institutional actors (Mallach 2015:9, citing Tempkin and Rohe 1996). This project recognizes those dialectical relationships and feedback loops while focusing on how local developments, brownfields reuses specifically, affect neighborhoods that operate within a specific set of national, state, and local policies and conditions.

Neighborhood change is multi-dimensional and most policy efforts and research tend to focus on one dimension to determine how much change can be explained by the one factor or intervention. As communities address things like neighborhood revitalization plans, comprehensive plans, or sustainability plans, they tend to define multi-dimensional areas of focus with a wide variety of methods for documenting changes that result from the implementation of some element of the plan. The HUD Sustainable Communities Initiative that funded regional and local planning efforts to devise sustainability plans provides some great examples of how local and regional consortia developed their

own measures of progress toward goals identified in their plans. (See https://www.hudexchange.info/programs/sci/resources/ for examples of plans resulting from this program.) HUD offered some general ideas for using available secondary data and communities adjusted and in some instances collected their own local data relevant to the areas of sustainability they found to be relevant. All had to address measures of fair and affordable housing, some focused on health outcomes, while others focused on job creation or educational attainment, and still others developed some measure of increasing green-space or green infrastructure. These are just a few examples. The diversity in plans demonstrates that having flexibility in determining which dimension of neighborhood change is valued guides the selections of how one explores the drivers of neighborhood change. The BCBAT will therefore incorporate enough flexibility in the suggested benefits calculation tools for a community to be able to prioritize which dimensions of neighborhood change they deem most relevant to their brownfields project and offer up clear methods for selecting and collecting data for the appropriate measures.

Another issue that complicates documenting neighborhood change is that of unit of analysis. Indicators and measures of change are used to evaluate the impact of an intervention or to help identify drivers of change; identifying the appropriate unit of analysis of what is changing is crucial. It matters if one measuring changes in the status of individuals who live in a geographic area, or changes in the built environment or condition of the population that ends up living in the area (Edel 1980). Program or policy evaluation researchers do not always have access to individual level data, so one can document changes in demographics or other variables associated with a geographic area but those changes may not have anything to do with the individuals who initially lived or worked in the area thus committing an error of ecological fallacy. For instance, the early evaluations of the U.S. Hope VI programs measured demographic changes in the geographic area in which a Hope VI project was implemented such as crime rates, unemployment rates, and income levels. These studies documented improvements to the neighborhoods based on these measures but were not able to document if the individuals who lived in the neighborhood prior to the implementation of the program remained in the area or if they benefited as individuals in any direct way from the implementation of the program (National Housing Law Project 2002). Conversely, others blame Hope VI programs for increases in crime rates in neighborhoods outside of the Hope VI geographic area without documenting that the individuals who once lived in the Hope VI area had moved into the other areas or were those who were committing the crimes (Suresh and Vito 2009). More recent evaluations have recognized this ecological fallacy and have made efforts to track changes in the lives of individuals directly impacted by a Hope VI program as well as measuring neighborhood and community impacts (Popkin, et al. 2004).

More policy and program evaluation experts recommend ensuring that individual or household benefits or impacts are considered alongside of place-based measures of area, or neighborhood changes that can be linked to the interventions. See for instance, Smith's (2011) recommendations for evaluating Choice and Promise Neighborhood efforts. Attention to this issue of identifying benefits or changes to area attributes versus those that are changes in individual or household attributes will be addressed in the BCBAT toolkit.

Identifying geographic boundaries that can be accurately measured and have meaning is an additional salient methodological issue in documenting neighborhood change by place or person. U.S. Census. Census data boundary changes make it problematic to measure change over time in any one Census defined geographic unit. Entities such as Geolytics (2015) produce Census data files for a fee that

address these boundary changes with normalized geographic boundaries that allow for comparison of demographic measures over time. However, those normalized data collections do not always have measures at the appropriate geographic unit available or easily accessible. Perhaps even more important is the fact that neighborhood boundaries are defined by residents or perhaps local government policies, but those boundaries do not necessarily comprise exact aggregates of any Census-defined areas. Therefore, when neighborhoods are the desired unit of analysis, that too becomes difficult to measure and define in a manner that does not change over time or does not have contested boundaries. There is no consensus by academics or policy makers about defining neighborhoods so it is generally accepted for instance for cities receiving federal funds to improve a neighborhood or area to self-define that area. Mallach (2015) posits that neighborhoods are NOT economic entities but rather physical and social entities that contain social actors that engage in the broader economy (p. 4).

As mentioned above, once a boundary is established around an area of interest in which benefits are to be measured, it remains the case that what gets measured as a benefit and identifying to whom the benefit accrues is guided by the values and priorities of those measuring. Specifying those values and priorities, rather than leaving them as assumptions, empowers communities and neighborhoods to identify those benefits that matter most or have most relevance to their specific situation. In the context of brownfields redevelopment, to whom do the benefits of redevelopment 'intervention' accrue has most often been left as a measure of community-wide or municipal benefit measured at an aggregate. Benefits to individuals in an area can only be estimated using community or area level changes in measures such as unemployment rates, median income, poverty rates, level education, and homeownership rates using Census data if there are also measures that document the stability of the population and levels of in or out migration. Often though, these kinds of measures of change to document overall neighborhood improvement are used without regard to whether those who lived in the area prior to the redevelopment experienced any measures of improvement. Some cities recognize this such as Philadelphia where their Independent Neighborhood Plans include measures of neighborhood revitalization plan success. These track neighborhood status (housing market, business activity, crime rates, income, education) as well as impacts on current residents by looking at household mobility rates, availability of affordable rental housing, and business turnover. See specifically, the Chinatown Neighborhood Plan 2004, Chapter 6 (Seymour 2004). The measures of impacts on current residents are intended to speak to whether existing residents and businesses benefitted from the revitalization plan or if they were pushed out because collecting data from the specific individuals is time and cost prohibitive.

No matter what the unit of analysis, the geographic area or the individuals in the geographic area, there will always be values that drive what kind of data get collected based on what types of things are considered benefits or what priorities drive the organization or entity collecting the data. What people consider to be important in the health and wellbeing of their community informs what kind of information gets tracked and developed as measures of improvement. For example, an agency might put measures of economic development as a valued priority over other areas such as community development or environmental health. However, even within economic development, values guide the kind of measures that get tracked: short-term items versus long-term returns on investments, housing starts without attention to affordability, job creation that does not include type of job or who gets the job, or increases in income without attention to widening gaps between rich and poor are a few examples of how values shape what kind of data get included as a measure of a benefit or improvement.

It should be noted that risk perceptions and realities inform community values and priorities and shape their sense of well-being. The history of the failure to adequately address environmental justice concerns is a direct reflection of this issue. Accounting for benefits of a redevelopment end use that are purely economic and do not account for real and perceived risks to adjacent residents and stakeholders is the equivalent of the stacked so-called cost-benefit analyses that some developers present in support of zoning change applications. Such proposals often list the new tax revenues from the change in use, but never addresses the increased traffic, demands for police and fire protection, and other municipal costs they may generate. The BCBAT is intended to be a *net benefits* tool to measure changes in well-being, which is more than just a matter of economics. Fear undermines well-being, so perceived community risks, not just real demonstrable threats need to be considered. These perception concerns may be particularly important in the context of selection of site mitigation approaches: dust from removals pose a risk, but so does containment of contaminants on site – and neighborhood perceptions of those alternatives should have weight in development decisions.

Developing a model to measure community benefits that a specific population deems appropriate based on their values and/or priorities suggests that incorporating unique contexts will not result in generalizable results nor does lead to a uniform set of indicators that all communities should use. The value however in crafting a set of indicators from which communities would select those they identify as relevant means there will indeed be some collected at the local level that are consistent, reliable, and generalizable to a higher level. The model used to determine the overall benefits accrued may remain relevant only to the locality, but the data collected to measure each of those benefits will be comparable across communities.

Using Indicators and Measures

One obvious lesson from the experience with efforts to derive social indicators dating back to the 1960s is that a measure is not an indicator. A measure is an accounting of a quantifiable or classifiable status, condition, process, possession or sentiment such as the distance of an occupied residential parcel to the nearest park. An indicator represents an effort to assess real, expected, or potential change in whatever is measured and reflects an interest in the phenomena that are changing. That is, the indicator reflects a purpose or an intent to do something about what is measured. A decrease in the distance of that parcel to a new park that is the result of a nearby brownfield conversion is a measure that can be used as an indicator of increased access to recreation.

The myriad measures accumulated in the "Social Indicators" compilations of the old federal Department of Health, Education and Welfare were published counts that served no discernible purpose other than the counting (U.S. Department of Health, Education and Welfare 1969; U.S. Office Management and Budget 1974; U.S. Bureau of the Census 1977; U.S. Bureau of the Census 1981). While the assembled measures were intended to help focus the nation's attention on social, not just economic change, their lack of focus, and the absence of any effort to connect particular measures to policies that were implemented or proposed, meant that the data collection effort, extensive and impressive as it was, accomplished nothing (Johnston 1987; Innes 1990; Cobb & Rixford 1998).

Having many measures is not necessarily preferable to having only a few – or even one. The "bottom line" orientation of businesses, focusing only on profits or net revenues, is an example of the great power of a single indicator. It also reflects the potential damage associated with ignoring other relevant indicators: profits may be driven up in one quarter through the sale of assets, but that action may result

in a decreased ability to continue to generate profits in the future. The public sector equivalent also exists: sales of public assets such as roads, bridges and buildings to private parties may help balance budgets – which many governments are forced to do annually – and may even eliminate future public maintenance costs. However, those sales, necessitated in part by unwillingness to raise taxes in order to provide needed public facilities, result in private profit returns at the expense of possible public benefits.

Documents produced by the federal government, such as annual reports, request for funding proposals, and grantee reporting requirements, provide insight into the types of measures the federal government values as means to justify public investment in specific programs. For instance, the 2015 Federal Brownfields Program Guide, the grant application guidance for each of the brownfields grant programs, and the brownfields clean-up and assessment grantee reporting systems, all include measures that reveal that measuring and tracking benefits has been primarily focused on the economic with only recently a nod to valuing other elements such as improving civic engagement, public health, and education. Research on brownfields redevelopment impacts has long bemoaned the dearth of valid and reliable data that allow analysis that moves beyond property value increases, leveraged funds, and jobs created, beyond case studies, to those that can be compared across communities, and aggregated to a higher level (Greenberg 2002; Meyer 2003, 2010; Greenstein & Sungu-Erylmaz 2004; DeSousa 2005, 2006; Heberle & Wernstedt 2006; Gallagher & Jackson 2007). Part of the frustration can be attributed to the type of data, the measures, collected and used in the federal program application and reporting requirements. Here, as an example, we elaborate on the Assessment, Cleanup & Redevelopment Exchange System (ACRES) since this is the primary reporting tool for brownfields assessment and clean-up grantees.

-**ACRES as a Possible Source of Local Area Impact Indicators**

The Assessment, Cleanup & Redevelopment Exchange System (ACRES) is the database into which brownfield grantees are required to report their property information. A separate Property Profile Form (PPF) is required for each property addressed with EPA financial support. ACRES Part I data include the basic information about the EPA funding stream(s) involved, site location and size information and coordinates for GIS plotting. Those data are accumulated for Agency managerial purposes, as are the approval signatures in Part IV. Parts II and III contain both project tracking data and a variety of other information that may comprise useful measures and may be able to contribute to derivation of impact indicators. The measurement approaches and data recording may need to be modified to provide better indicators. In some instances, pursuit of impact indicators may necessitate that grantees accumulate more, or different information about their projects.

Data are required to be recorded about “environmental cleanup” activities as the PPF is updated over time. Since there is no distinction made between contamination removal, neutralization through various means, and containment through engineering controls, no information of use to assessing neighborhood trust in the redevelopment’s safety can be gleaned from this information alone.

The measures of contaminants identified and media affected have classification data only, identifying presence of different contaminants and media involved. Those measures permit EPA to determine what percentage of sites remediated involved, say, PCBs and indoor air issues, but nothing about the severity of the initial contamination, nor about the health risks that the particular site posed to human health. No indicator of the effects of a site response on the health impacts (or just risks) avoided can be derived

from these measures, though the Agency can report the numbers of sites with particular risk types remediated. In other words, the measures may permit determination of what EPA considers to be *outputs*, but they are inadequate to the task of assessing *outcomes*.

Clean up activities are also tracked in ACRES, but the information is not recorded systematically in such a manner as to assure that the actual activity on any one site can be determined. There is a field for entry of "activity funded" but there is no standardized list of activities to record, only a list of examples – a list which does not encompass many of the activities associated with containment of contamination. Moreover, the activity information is not collected for those activities funded by EPA, only for those that were paid for by other parties. The clean-up activity record, however, does permit a potentially important measurement – that of the areal size of the contamination relative to the size of the entire property being addressed.

Consistent with its need to report on the cost-effectiveness of its programs, EPA collects information on both the site mitigation jobs and investment leveraged by its grants, asking grantees to provide the data. Their counts, however, are underestimates since they include only the non-EPA-supported investment and jobs associated directly with the cleanup, not the additional jobs generated by that economic activity, including the jobs leveraged by the EPA grantee's spending on payrolls and materials that would not otherwise be part of the local economy. This measurement issue can be addressed in the course of deriving indicators of local area-wide impacts.

In the case of recording institutional and engineering controls, the measures used are standardized, unlike the data on cleanup activities, with a limited set of different items grantees have to select. In terms of the adequacy of these measures for impact assessment, however, there still seem to be some data missing – and data collected under "additional information" that, because the information is in the form of a narrative from different grantees, that may be almost impossible to use. Most notably, there is no direct way to derive an indicator of the extent to which the institutional and/or engineering controls limit future uses in ways that reduce the property value or value growth potential of the site once it is deemed reusable. This means the economic *potential* realized by the site response, not merely the immediate jobs and investment generated, cannot be assessed and included in project benefits.

The ACRES sections on redevelopment investments, other leveraging and future uses are a data collection exercise that may burden grantees and, in its current form, provide little useful data for derivation of indicators.

- It is not clear what purpose is served by collecting the redevelopment start and end dates. The latter, in particular, may burden grantees with having to engage in otherwise unnecessary updates of the PPF.
- The leveraged funding is of value to OBLR and EPA in reporting to Congress in crude cost-benefit analysis terms, with the emphasis on "crude." The reported activities on the brownfield site may simply be relocations of activities that would have taken place elsewhere in the region anyway and not constitute really new economic activity. On the other hand, the amount funded directly for the activity does not include the business and payrolls that may be leveraged off-site.
- The number of redevelopment jobs generated similarly ignores off-site employment generated by the local multiplier. Economic benefits are thus understated, even if good data are available

from subcontractors and others over whom the grantees may have little control, since they do not provide the funding.

- The future use data collected is likely to be of little value to local decision-makers.
    - The acreage and square footage information is useful for reporting, not decision-making.
    - The distinction between planned and actual uses is not clear – and plans may not be realized in the time period in which grantees are required to update their PPFs.
    - The usage categories are too generic for many important decisions. (E.g.: Is the residential use high end, reflecting gentrification, or affordable housing? Does the commercial help overcome a food desert condition? Is the multistory building 2-3 stories, fitting into an established neighborhood, or high rise, altering the local built environment?)
    - The anecdotal property narratives collected as "Property Highlights" may provide much of the information needed to address the questions above, as may some of the property history and past uses data gathered. However, since these answers are collected in narrative form, they offer no consistent measures and thus are difficult to use.

The PPF and ACRES encompass needed information, but, since the reporting system is tailored to serve OBLR and EPA reporting requirements, not local decision-making, the data collected are of limited use in assessing area-wide redevelopment triple bottom line potentials and impacts. ACRES appears to serve the Agency's purposes reasonably well, but it fails to be of value to grantees and their communities. That difference may help explain limited grantee compliance with PPF completion and updating requirements.

ACRES' limited value to grantees in a number of instances, especially in terms of local socioeconomic impacts of alternative developments, is due as much to the absence of hyper-local data on neighborhoods and their characteristics as it is to the specific forms of data collection through the PPF. Any redesign of the PPF to assure that data collected serve both local area and EPA measurement needs thus has to be coordinated with the design of procedures for hyper-local data collection on neighborhood conditions and objectives.

-Assessing Neighborhoods and Their Objectives

Beyond the need to have an intent or objective to enable the development of focused indicators, any effort at measuring local impacts needs to be relevant to the community in which the changes are to be assessed if there is to be any hope of collecting hyper-local data about the affected area. The reason is simple: really in-depth, genuinely local information cannot be collected by outsiders. Observations of local conditions and changes cannot be made by those that have not experienced them. Opinions about conditions or expressions of preferences and concerns are less likely to be honestly expressed by local people to non-locals (Andrews 1974). Finally, the people who spend time in an area on a day to day basis are more likely to know about specific sites, events, or conditions that can affect outcomes than would those who only visit a neighborhood or community.

Local area data collection, then, is critically dependent on community support and participation in the process. Planning *with* communities is not just politically correct or ethically appropriate, it is superior to planning *for* communities because only with true local involvement will the full array of impacts be identifiable, and only with local expressions of interest and concern will valuation of development

alternatives be accurate (AtKisson 1996; Brugmann 1997; Cole et al. 1999; Wismer 1999; Roseland 2000; Dluhy & Swartz 2006; Fraser, et al. 2006; Holden 2007). In most instances, that needed support and participation can only be generated through the engagement of one or more community-based organization (CBO).

Such organizations can more readily recruit participants in data collection than any group of outsiders could. They also can provide legitimation, resulting in more honest expressions of hopes and fears by residents and businesses in the area. Moreover, one or more of them may act as the redevelopers or collaborate with others in the remediation and regeneration of brownfield sites and thus have a very direct interest in the outcome of an effort to determine the best possible type of redevelopment and future use.

However, a community is more than a single organization. In some settings, there may be multiple CBOs (churches, community development corporations, clubs, and so on) with competing concerns and objectives. In other words, any effort to gather data in collaboration with any one CBO – or even a group of them – must remain sensitive to the fact that the cooperating institutions are not representative of the community for which triple bottom line impacts are supposed to be derived. That does not mean that hyper-local data collected by CBOs cannot be used and indicators cannot be found.

The fact that the collaborators in an effort to assess alternatives for regeneration of a brownfield site or sites that will produce the 'best" outcomes for an area are not completely representative of the neighborhood is not necessarily an impediment. "Community engagement" has been promoted by many in order to get residents and property owners in an area more involved in planning for proposed changes so as to avoid objections and delays once plans are made (Paull 2008). People who are not sufficiently involved to become members of any CBOs are also not likely to become sufficiently organized to intervene once plans are made by their neighbors. They may have no political voice and that may be unfortunate, but if outreach has pursued all local CBOs, little more can be expected of planners (Rubin 1969; Moynihan 1970).

A problem arises, however, when some CBOs reject participation in efforts to plan for brownfield regeneration from the outset – or drop out of the planning process as it moves in directions that they deem inappropriate. Their political opposition implies that the hyper-local outcome preferences expressed by the collaborators in data collection are inaccurate measures of true preferences (Moynihan 1970). Knowledge of the opposition and its basis may, however, permit analysis to modify preference rankings to reflect non-participants' values. This is an issue to which we will return in discussing actual instrumentation.

-How Many Measures?

If all the area-wide impacts of alternative brownfield developments on a site could be summarized in a single measure, it would be very easy to determine which option provided the best expected outcome for the community. Historically, public policy has relied on cost-benefit analysis (CBA) to provide such a summary measure. But CBA has been critiqued for its over-simplifications, even by those who tend to focus assessment on economic impacts (Sugden & Williams 1978; Revesz & Livermore 2008).

The essential assumption behind reliance on a single metric or indicator is that the complexity of the world can be reduced to a series of measurable tradeoffs between different impacts. That is, in the cost-

benefit analysis case, that loss of jobs in manufacturing can be offset by new jobs in retail trade or information technology, and also that any job loss can be offset by higher property values and that those gains could be balanced against longer travel times to work, to shop, or to play. Those tradeoffs could all be measured in monetary terms, provided there is some consensus on the value of travel time.

Calculating the offsets involves simplifying reality: ignoring the distribution of the costs (losses) and benefits (gains) across the affected population, and in possibly equating the value of time expended to get to work to that needed to get to play or shop. Such simplification is inevitable in any model of the complexity of socio-economic systems, and it comes at a price.

Without additional data, a cost-benefit model cannot distinguish between a policy that imposes costs on those least capable of paying them and provides benefits to the best endowed in an economy from one that redistributes from the haves to the have-nots. In order to make that distinction, the model needs to be made more complex by dividing the affected population into two or more groups, so that the impacts on different populations can be weighed differently in arriving at a single metric.

The simplifications needed to arrive at a single indicator than considers distributional impacts that are measurable in monetary terms are straightforward compared with those necessary to address social and environmental changes. Recognition of the inadequacy of the single monetary measure was, in fact, the rationale for the whole social indicators movement (U.S. Department of Health, Education & Welfare 1969; Rossi 1972; Andrews 1974; Cobb & Rixford 1998; Gahin & Paterson 2001; Land & Ferriss 2007).

How does one trade off improved housing quality to improved sense of security? The former may be measured in space per person or amenities per dwelling unit and the latter by crime rates or arrests. The measures themselves are really oversimplifications of the conditions being considered – and there is no consistent nationwide basis for arguing which measure is the best measure of the condition. (An amenity such as air-conditioning may be important in one climate but not in another, for example. Reported crime rates or arrests may vary due to the competence of policing or to community cooperation with authorities, and thus not bear the same relationship to concern about crime in different neighborhoods.) Whichever measures may be used for housing and fear of crime; it is obvious that they are not comparable to each other – there is no common scale on which they can be measured. It is not surprising, then, that the early efforts at indicator development in the 1960s and 1970s came up with catalogues of measurements. There was no basis for choice, especially since those initial attempts were addressed at refining measures of well-being such as the Gross Domestic Product, and variation in attitudes and conditions across a nation was just too great.

Those efforts, which yielded hundreds of possible measures, still failed to consider environmental issues, which add another dimension of complexity. “Environment” as a term, even when social context as environment is excluded from the discussion, has been used to refer to such diverse matters as the aesthetics of landscape, density of human settlement, air, soil and water quality as it affects human health and the functioning of ecosystems. If a catalogue of environment indicators were developed along the lines of the early social indicators catalogues, the potential measures might be even greater in number. Since, however, we tend to ignore so many environmental issues until they reach crises stage, actually measuring the potentially measurable would be more expensive for environmental than social impacts because no prior effort has been committed. Perhaps even more significantly, since the environmental impacts would be experienced across a variety of different populations whose “health”

or on-going functioning is tracked along different scales, the prospect of combining measures into a single metric seems even more difficult.

Reducing the complexity of diverse economic, social and environmental impacts of policies or practices to a single metric presumes that all the observable changes can be measured along a common scale. CBA employs money as that common yardstick, requiring that relative prices be put on phenomena as diverse as lives saved or destroyed (human, animal or vegetable), landscapes preserved or damaged, and social orders altered, whether toward or away from greater participation, equity and empowerment. Reducing the world's complexity to a single dimension – whether or not it is a monetary one – may appear to be grotesque oversimplification and a formula for faulty decision-making. Some conditions and changes just are not commensurable – subject to a common measure with – others.

Social (and environmental) measures that accurately reflect *all* the complexity, however, are no better. Confronted with alternatives that different on hundreds of scales, decision-makers may be immobilized due to their inability to select one option over another. Alternatively, they may find themselves making arbitrary or random policy decisions, given the need to take *some* timely action. Having too many measures is as much a formula for flawed decisions as having only one.

How, then, can the complexity of reality be modeled and simplified in a manner that acknowledges that some facets of a condition or change are, and others are not, commensurable? The answer to this question may lie in part in the fact that prices (relative values used in tradeoff calculations) are the result of market interactions (with some government intervention). Therefore, to the extent that the phenomena and changes to be measured are not bought and sold in a marketplace, any set of prices is set according to some arbitrary standard. In other words, the CBA reduction of reality to a single metric reflects a specific set of assumptions – a model – that presumes commensurability and a particular process for setting relative values. Other models can be equally valid, and need not reduce reality to a single dimension.

The assumption of commensurability of impacts incorporates the notion that there is some scale or metric along which different phenomena can be arrayed in terms of their relative positive or negative value to a population. CBA uses money as its metric, but its logic would apply equally if the scale was something as absurd as poker chips or the economists' favorite "product," widgets, provided there was a consistent and acceptable way to measure different impacts in terms of those items and their supply was in some manner limited. (It might be noted that measurement in terms of the e-currency Bitcoin is just as arbitrary, and just as dependent on acceptability and consistency.)

If one actively denies universal commensurability, one might still accept the idea that some diverse phenomena might share one common measurable scale, another set of different conditions shares a different scale and so on. This is, in effect, the logic of factor analysis, a beloved statistical tool of sociologists. With a limited set of commonly commensurable measures, one might arrive at, say six scales along which alternative real estate development plans might be arrayed. These can then be diagrammatically displayed using a spider model (Baycan Levent & Nijkamp 2002). This visual display is then potentially usable by community members to assess development alternatives, assuming that the meeting at which the spiders are displayed and discussed attracts a relative representative group of local residents and landowners.

More generally, with the objective of weighing alternative development plans *for a community*, not for a nation, the acceptability of a metric is determined by the community's acceptance of the scale and that population's acceptance of the consistency of the valuation of impacts. It may well be the case that a metric acceptable to one community is not acceptable to others, even within the same city or region. Different communities may experience precisely the same economic, environmental and social impacts but value them very differently. The subjective perceptions, not just nominally objective conditions, or residents need to be included in derivation of any indicators (Andrews 1981). It is those individual local valuations that play the role in community impact measurement that money plays in traditional cost-benefit analysis.

Given this insight – and the capacity to determine the valuations of different development impacts by individual communities – the problematic finding from the historical experience with social indicators that universal measures are unattainable can be overcome (Sheldon & Freeman 1970; Duncan 1984; Andrews 1989; Cobb 2000). The problem as identified in the social indicators literature is that the diversity internal to a society or economy is such that a measure appropriate to the national scale, one that reflects a sort of universal valuation of a particular condition, good, service, or issue, is – almost by definition – not applicable to measuring well-being in any one particular local (or even larger sub-national) context (Innes & Booher 2000; Gahin & Paterson 2001). However, that inability to find universal measures may be due more to different communities' individual valuations of a common set of impacts that are viewed nationally as important than it is due to the inability to identify those commonalities across different local settings.

It follows that there is no logical barrier to the identification of a set of common measures of social, economic and environmental impacts for developments that would be applicable in any neighborhood. Determination of how those measures relate to the actual experience of change in any one community will, however, depend on the valuation (perhaps a measure of relative positive or negative importance) of each impact by the occupants of the area. That determination, however, will not merely value different impacts for comparison of development alternatives, but will also permit the derivation of a single summary indicator of the effects on a community of a new development such as regeneration of one or more brownfields. In order to arrive at such a summary indicator, however, two distinct sets of data need to be collected in each community to provide it with a local benefits calculation:

1. A set of impact measures, reflecting the changes the development will generate in environmental, social and economic conditions. While some of these impacts may not occur for specific types of developments or in particular communities, so the impact would be measured as zero, the objective would be to derive common measures – and even a common data collection protocol.
2. A set of community valuations of importance or relevance of the different impacts that might occur. In some instances, impacts, however large, may be unimportant or insignificant relative to others to a community, so they may be assigned a zero value; other impacts may be very highly valued. The different valuations may be derived in a variety of manners – and even differently in each community, but all have to be measurable on a common scale, such as importance. This approach is similar to that used in CBA, where market prices are used for those goods and services that are sold or rented, but other mechanisms are used for valuing impacts, such as on air quality, which are not directly marketed.

The summary indicator would be derived by multiplying the recorded magnitude of each impact by its community valuation and then adding up all those products.

This logical process may be summarized in mathematical terms so as to demonstrate measurability and conformance to the logics of cost-benefit analysis-based program evaluations.

$$CB_t = \sum_{n=1}^{N} I_{n,t} * V_{n,c,t}$$

Where: CB_t is the community benefit from a variety of impacts of change as experienced at point in time t, recognizing that the benefit calculation may vary over time,

$I_{n,t}$ is the n^{th} impact of change experienced or anticipated by the community in time t, one of N different impacts measured, and

$V_{n,c,t}$ is the valuation placed on the n^{th} impact by community c in time t, reflecting the conditions and attitudes of the specific community at a particular point in its history.

This formulation permits an assignment of a single common valuation for the area-wide effects of a brownfield redevelopment, thus allowing a community to consider different brownfield projects, combining a variety of approaches to mitigation with diverse reuse alternatives. It also recognizes that an identical further redevelopment in the neighborhood may be weighed differently since the valuations of individual impacts will be made at a different point in time (presumably after the first development has been completed or its impacts are already anticipated), and thus in a different context.

-To Optimize or Not – That is the Question

Having a single indicator can greatly simplify decision-making, but it is inherently distorting. Reality is multi-dimensional, if only at the level of the three dimensions of social, economic and environmental change, let alone the real complexity of the world. Collapsing diverse changes into a single metric is a process by which, for example, unappealing new buildings or lost opportunities to enjoy scenery get traded off for more jobs for local residents or a larger supply of affordable housing. The level of the tradeoff is the relative "price" of each possible impact and, to the extent that the price is locally determined, it may reflect local preferences, writ large. No single individual in a group such as local residents may, however, accept that tradeoff level, so the indicator may well be considered inappropriate by many in the local community.

The issue of appropriateness or legitimacy of the summary indicator is one of a number of reasons why community decision-makers should resist the economists' tendency to optimize, that is, to pursue the best possible value of the indicator. An exclusive focus on maximizing community benefits as measured by the calculator may lead to decisions that overlook extreme tradeoffs, such as loss of life or increased exposure to toxins for some community members for improvements in overall economic or housing conditions, or even social status and external perception of the neighborhood. The tendency to ignore elements of the complexity abandoned to arrive at a single metric is strengthened when decisions are more tightly focused on the value of that one indicator (Etzioni & Lehman 1967). As a result, efforts to maximize benefits based on such a summary measure can lead to policies that would be unacceptable if

examined using a broader set of individual indicators (Meyer 1976; Campen 1986; Baycan Levent & Nijkamp 2005).

The pursuit of optimization also includes the risk of sacrificing variety and diversity, at least over time. If a brownfield redevelopment relying on Risk Based Corrective Action (RBCA) to build new retail premises proves to have a higher valuation on the summary measure than an alternative involving a higher level cleanup to construct low income housing, the retail premises should be pursued. It does not follow automatically that a nearby project in the neighborhood should result in the same decision, even if no new data have been collected on which to base an impact calculation. Retail needs may be on the way to being satisfied while no attention may have been given to housing needs. However, the focus on the summary indicator to the exclusion of everything else may limit the diversity of projects approved. Similarly, the blind pursuit of optimization of the impact indicator may sacrifice the positive uniqueness of a community, whether cultural or architectural, to attainment of some nonlocal objectives that have become societal norms (Etzioni & Lehman 1967; Meyer, 1976; Holling & Meffe 1996; Revesz & Livermore, 2008). British efforts to derive indicators expressly ignore the approach of "maximizing," choosing instead "improving" or "achieving" as the operational terms for actions or objectives (Pearce 2005).

Documenting Community Perceptions and Feelings – Developing Weights for the Measures

Whatever measures may be collected for the environmental, social and economic conditions of neighborhoods and how they might change as the result of different brownfield developments, there remains the question of whether or not those changes are of importance to the people in the area. A measure of importance is needed simply to reduce the number of condition measures tracked so as to provide actionable data, not an overwhelming mass of information, only a small subset of which is relevant for decision making (Angrist 1976; Carley 1981; Brugmann 1997).

A measure of *relative importance* for each condition measure retained is necessary to permit the derivation of a single valued summary indicator of community site redevelopment impact. Unlike the condition measures, the importance measures would not be expected to change quickly in response to the redevelopment of one or more brownfields. All will have to be hyper-local, so the methods by which they may be collected is a primary concern for development of the summary indicator. While the ideal would be *an importance measure* that is easily quantified as continuous, that may not be possible in many instances. Some set of scalar values (rating a condition as low, middle, or high, for example) may be the most attainable hyper-local data. These measures would be judgement calls by the people collecting the information and thus might be dismissed as biased. In this instance, however, that bias is just what is needed since the data collectors will be community residents and it is their opinions that are needed for determination of the aggregate local impact of different brownfield redevelopments (Bunge 1975).

- The interest current residents have in remaining in the neighborhood reflects the extent to which any findings of the summary indicator reflect the attitudes and interests of the people likely to be affected by the redevelopment. Local membership institutions (CBOs, churches, and the like) can provide useful proxy data. Membership turnover rates and address changes indicating moves out of the area may be used to construct a measure of neighborhood commitment. This data will all be historical, but may show a trend before a redevelopment that indicates how much any reclamation and reuse project is to current residents as compared to others that might be attracted to the area.

- Neighborhood residents' concern for their safety from others may be measured by observation of behaviors, from walking at night to spending on locks and other security devices. Detailed data on behaviors would require extensive surveying and/or residents' behavior logs, and not expected to be available. Physical safety concerns about street crossings or the risks of environmental releases are even harder to determine – unless there already exist some efforts by local people or organizations to change those conditions, in which case those activities themselves may be used as a measure of concern.
- Some opinions about neighborhood conditions, housing cost and availability, recreational access, and retail services may be collected directly by the 10-20 people enlisted as data gatherers. Again, these data normally would be seen as biased if the people providing information simply recorded their opinions and those of a small number of others. However, some minimal guidance to data collectors on "surveying" may suffice to get closer to true community attitudes and perceptions: suggesting varying (and recording) time of day of "surveys," gender and age of respondents, and location at which survey was conducted.
- Those opinions may be used to rank the conditions that local people most want to see changed – and may also be needed to determine *direction* of change desired (that is, whether people want more or less of a particular observable condition). But direct ranking questions may also be asked, using a similar "survey" method. Ranking might take the form of literally taking an array of identified conditions and putting them in order by their importance, with no 'ties' permitted. But that procedure is likely to lead to arbitrary settings, differentiating ranks between conditions that are equally important simply because a rank has to be assigned. An alternative would be to rate each condition on its importance (as high, medium, or low, for example), but then respondents would have to be limited on the number of top rankings permitted so not all conditions would be described as dire.
- The local data collectors can also amass a great deal of information that non-locals may not be able to acquire, or which would be costly to gather. Neighborhood labor force participation rates, a reflection of job opportunities, may be reflected in the number of people hanging out on streets – or in bars – in the middle of the day; such hyper-local data may not be attainable in any other manner. Building conditions and activity, reflecting local efforts to maintain or upgrade housing or retail, may be better measured by observation of construction activity than by collection of building permits from local authorities (especially since much interior repair and rehab work may be done without permits). Vacant storefronts and retail establishment turnover, measures of low retail competitiveness, similarly may not be as readily tracked by nonlocal databases as by locals observing their neighborhood. Photographs, which could be gathered on handheld devices, may also be useful in deriving community priorities, albeit they may require more post-collection data analysis.

Aggregating into Ranking Criteria and Indicators of Change Over Time

This discussion of attitude measures has been addressed to the potential for using local data collectors to acquire the hyper-local data that would be needed to weight the individual conditions measures (which also may be collected by local residents) and derive a single summary indicator. It has not linked one or more particular attitude or importance measure to a particular condition measure, as would be needed to derive the weighted sum of conditions that could permit comparison of development alternatives.

Since we are not likely to have continuous measures for all conditions and attitudes, the simple process of multiplying importance times conditions and then summing the products, the process envisioned in the mathematical expression already presented, may be impossible to implement. That process assumed that all findings, on conditions and their importance to locals, could be expressed on a continuous scale. The reality is that many findings may not be expressed in that manner.
Crime rates may be expressed in a continuous number of reported crimes per 100 residents, for example, but it is unlikely that a similarly continuous measure for concern about crime can be derived; the concern or importance measure will probably be expressed a "low," "medium," or "high" – or at best on a one to seven or one to nine scale. In the case of housing, to pick another example, a condition measure such as square feet of residential space per person may provide continuity of values, but it would fail to reflect housing quality, and a rating scheme of "substandard," "poor," "average," "excellent" may be preferable as a condition measure.

The sum of products of such categorical measures will not produce a consistent or defensible summary indicator. A community may have a condition that it ranks as "excellent" and also gives it an importance rank of "high," indicating that the neighborhood is not satisfied with the current condition and wants further improvement (and/or fears damage to the condition in the event of development). How should that condition be valued in a summary indicator relative to one in the same neighborhood that is rated as "poor" and has an equivalent high importance rank? That is, how do we model the community ratings when it comes to excellent attributes people want to *protect* relative to poor conditions that the neighborhood wants to *improve*?

There is no one clearly superior answer to this question. The process of aggregating a variety of different community conditions and their importance rankings into a smaller number of indicators to guide action or assess impacts of change is thus more art than the science implied by the equation we derived. It is shaped by the types of data on both conditions and perceptions that can be collected at the hyper-local level. That fact, in turn, means that, in practice, the ability to aggregate measures into a reduced number of indicators will depend on what the data collectors at the local level will be capable of assembling in the way of observational and quasi-survey information.

This is why testing the special data collection apps with guidance given to local data collectors is an important part of this project. The development of the apps and the processes of assessing the success of their implementation are topics beyond the scope of this review of lessons from past efforts to develop indicators that have broader scope than cost-benefit analyses. So we turn now to discussion of how the indicators could be used, once developed. The experience with the social indicators movement offers some important insights.

Designing Appropriate Indicators

Blood alcohol levels found when people are arrested for drunk driving provide a good measure of the degree to which those individuals drank too much. The numbers arrested are a measure of the extent to which people do or do not concern themselves with drunk driving. Both may be decent measures of the specific behavior for which they are used – but neither provides any measure of the levels of alcohol consumption or inebriation in a community. Drunk driving arrests are down in recent decades, presumably due to the efforts of Mothers Against Drunk Driving and their allies, but there is not necessarily any reduction in drinking activity.

This example should make clear that not all measures can serve all purposes, and that most measures are very narrow in their value as indicators of change or policy impact. The very narrowness or limited applicability of many measures may help to reduce the number of items to be arrayed in arriving at indicators. It also underscores that the indicators to be developed need to be relevant to the processes or decisions that are expected to generate the changes that they are intended to track.
This last point cannot be stressed enough: a useful indicator does not merely measure a condition or change, but provides information that is relevant to (that is, understandable and usable in) decisions that will be made that could affect the condition in question. A Phase I site assessment on a site, for example, does not result in a specific probability of contamination (a good measure to have, if it were available), but an indicator of whether or not additional investigation is needed to assess the brownfield property. The fact that the indicator is a crude two-level finding of Yes or No, rather than a statistically derived probability measure is irrelevant; it is useful for the decision to be made. The data collection and analysis effort that would be needed to come up with a probability of contamination would be a waste of resources. Even more significantly, that effort might actually weaken the decision process since the meaning of the probability level may not be well understood and the need for further site investigation would become more debatable.

On the other hand, a decision on approving a risk-based corrective action needs to be informed by good data on the risks involved – that is, data on the probability of damage to human health and the environment if contamination is left on site, and information on how land use and engineering controls would be expected to change the measured risk likelihoods. A yes/no tool for a RBCA mitigation decision is inadequate since the controls and their impacts need to be known for the response design.

Indicators, therefore, must be appropriate for use in areas such as:

- health planning (Chen, et al. 1975; Andrews 1981; Rogerson 1995; Waddell 1995; Besleme & Mullin 1997; Cole, et al 1999; Messer, et al. 2014),
- addressing community sustainability (Alberti 1996; AtKisson 1996; Haughton 1997; Brugmann 1997; Guy & Kibert 1998; Nijkamp & Pepping 1998; Haughton 1999; Innes & Booher 2000; Hoffman 2000; Roseland 2000; Valentin 2000; Alker & McDonald 2003; Gahin et al. 2003; Fraser et al. 2006; Mascarenhas, et al 2010; Davidson 2011),
- measuring civic engagement (Selman & Parker 1997),
- assessing a community's quality of life (Besleme, et al. 1999; Wismer 1999; Berman & Phillips 2000; Michalos 2004; Kapuria 2014),
- calculating a community's vulnerability to natural hazards (King & MacGregor 2000) and
- determining a community's housing needs (Winston 2008),
- assessing residential, commercial, retail, and industrial land-use conditions,
- assessing a community's risk of exposure to hazardous materials or toxics, (air, land, water, built environment).

We might even say that any measure may become an indicator when it is directly used for, and likely to influence, policy and practice decisions. In the community context, that may be decisions by neighborhood people and their organizations themselves, or they may be policies and practices of other parties (individuals, private entities, government agencies) that the local people want to influence. Some uses by neighborhoods of indicator findings include:

- *Defining what neighborhoods want.* No community is monolithic; there are always diverse opinions about priorities. Unemployed people want jobs, but they may be competing for attention with overcrowded people wanting more affordable housing. Even if the same people are both unemployed and in substandard housing, indicators can help them to consider which actions will improve their quality of life the most. Community condition change indicators will also need to aggregate the concerns of the individuals within the neighborhood in some manner (Waddell 1995; Sawicki & Flynn 1996; Cobb & Rixford 1998; Cole, et al 1999; Wismer 1999; Salvaris 2000; Valentin & Spangenberg 2000; Sawicki 2002).

The indicators can serve the neighborhood decision process in two manners. First, by laying out alternatives for entities intending to act. Second by informing people in the community about conditions and their neighbors' perceptions and concerns, whether or not action is imminent (Land 1983).

- *Getting funding/support for neighborhood objectives*. There may be little need for community change indicators to help a neighborhood decide on objectives – they may already have done so. Even if such indicators are needed, however, there is still a need for indicators to which potential external allies will respond if the local area is to get broader support to accomplish what its citizens want. The specific indicators required may be dictated by Requests for Proposals (RFPs) from governments or others providing funding, but the effort associated with deriving new indicators for each application for support may be overwhelming. It is more likely that the RFPs request some evidence about impacts of interest to grantors but leave the details of indicator development to applicants. There is thus a need for indicators that are acceptable to the community and seen as relevant to funders (Alberti 1996; Cobb & Rixford 1998; Cole, et al 1999; Salvaris 2000; Dluhy & Swartz 2006; Holden 2007; Mascarenhas, et al. 2010).

Indicators are derived from RFPs reflect the priorities of the decision-makers issuing the call for proporsals, and the fact that they are part of the declared decision process assures their relevance. These are two of the characteristics that all indicators should exhibit, in addition to their scientific validity and implementability (Alberti 1996; Holden 2007).

- *Shaping local private sector investments.* Some measures of community conditions and potential change may be relevant to private sector calculations of returns on investments. Neighborhoods may be able to influence investor decisions by the provision of indicators of the effects of alternative development efforts. Such indicators have been used to negotiate "community benefit agreements" with major developers by illustrating unmet needs, demonstrating how they may be met, and providing strong indicators of the amount of community resistance that might arise if the needs are not addressed (Gross, LeRoy & Janis-Aparicio 2005; Taskforce on Public Benefits Agreement 2010).

Since private and public rates of return tend to differ, even on purely monetary scales, design of indicators to which private parties will respond is particularly difficult. One critical element is that the indicators need to address causes, not merely conditions, so that alternative actions and their different impacts are linked, permitting a sort of "what if" analysis by decision-makers (Cobb & Rixford 1998). Each of these uses involves a different type or types of decision-makers, operating with a specific set of criteria for evaluation of alternatives. The indicators to be developed in each case will have to be consistent with the pre-existing criteria of the decision-makers, incorporating their implicit models of reality and action as the new data extend the array of variables considered to include more of the factors that are important to the community itself.

Given the above, the following are measures that may serve as good impact indicators for community benefits:

- Access to greenspace and parks, which may affect both physical activity and air quality, contributors to improve health conditions, in addition to area property values (De Sousa 2006; Kaufman & Cloutier 2010).
- Population density, property values, and unemployment, which can be combined into a measure to assess potential contribution to economic growth of site regeneration (Chrysochoou et al. 2012).
- The "livability" and "sustainability" measures combining to constitute the LEED-ND evaluation scheme of the US Green Building Council.
- Measures of the environmental risk exposures eliminated by the redevelopment, which might include data on past uses, soil permeability, and local pollution receptors (Chrysochoou, et al. 2012).
- Measures of the extent of waste and waste processing operations in the neighborhood, as a reflection of both risk and environmental justice concerns (Dillon, 2014).
- Minority population proportions of the local residents, since that higher minority populations tends to be associated with less brownfield redevelopment, so success in regeneration has more impact in those cases (Eckerd & Keeler 2012)
- Preferences expressed in any existing surveys of community residents that address development options, whether done 'scientifically' (Greenberg & Lewis 2000) or more informally and not randomized, such as might be conducted by a CBO, or community members on their own.
- Past reliance on risk-based corrective action (RBCA) for brownfields redevelopment, as a measure of prospective risks and need for continued community engagement (Meyer, 2010).

Possible Community Indicators for Use in BCBAT

Dealing with the impacts of brownfield site mitigation and redevelopment, we might start with the data on the sites themselves, that is, data now collected by ACRES and information we might recommend be added to that database. But the impacts of any redevelopment depend on the context in which it takes place, so we really should start with locally collected data on community conditions. As we have already argued, however, both the measurable conditions and changes associated with a brownfields project may be valued differently in each community, so neighborhood perceptions also need to be included in the overall set of information to be employed. (We might designate the conditions and perceptions as "physical" and "psychological" realities as shortcut terms for the triple bottom line conditions on the ground and the socio-psychological status of the neighborhood population for simplicity in language.) All this information then needs to be integrated into a set of impact scales, combining measures into one or more summary indicators. Remembering that reliable and well-informed community or local area data cannot be obtained from nonlocal sources, we can review possible sources of needed information.

- **Neighborhood Observations.** Local residents can be recruited to collect data on a variety of conditions. These include numbers of vacant storefronts, evidence on building conditions, types of businesses and facilities in the neighborhood, residents' uses of the streetscape and/or open space or greenspace at different hours (leading to inferences on unemployment, recreation access, nighttime safety and other factors), transportation resources and utilization, and so on.
- **ACRES data.** Minor tweaks to the existing PPF can permit the collection of additional standardized data that can be used in assessing both site conditions and redevelopment prospects. In the ideal, these modifications to data collection procedures would be coordinated with design of local data collection systems.

- **Community Perceptions and Priorities.** Gathering data on people's attitudes, which is what is involved in pursuing this information, involves asking them questions. Those questions can be asked of their neighbors by the same residents who are recruited to conduct observations. While it may be argued that the questioners will not necessarily interview a random or representative sample of community members, some guidance can be offered to encourage pursuit of a variety of different respondents. Any bias that may occur is not necessarily any worse than that experienced by formal survey researchers who often receive the answers their respondents think they want, not true opinions which might be more readily shared with neighbors.
- **Comparative Neighborhood Status Data.** Neighborhood conditions alone are not adequate for assessing needs and interpreting expressed priorities. The communities in which brownfields are addressed are parts of local governments, counties, states and the nation, and some comparative data may be relevant to different types of valuations of alternative redevelopments. These data may be exceptionally important when environmental and economic justice and equity impacts of projects weight heavily in community choice criteria. These data are available at all levels of government, and should be accessible to decision-makers in individual neighborhoods through an easy-to-access portal that permits selection of relevant information from data that are updated as regularly as new statistics are generated.

Next Steps Toward the BCBAT

This literature review provides a framework upon which the development of the BCBAT models for identifying and measuring the community benefits of brownfields redevelopment projects will be built. The project will make an initial selection of measures and means of collecting the relevant data to test how to collect hyper-local data that will be integrated with other relevant measures. The project will assess the inclusion of community priorities to provide weights to benefits measured. It will test the value and efficiency of community collected hyper-local data. And finally it will demonstrate the possibility for aggregating up to municipal, state, and national levels and for cross community comparisons of community collected hyper-local data. The literature demonstrates the need for this type of analysis, as well as the benefit of developing tools to facilitate empowering neighborhoods and other sub-municipal areas to project future and actual changes relevant to their specific priorities and needs. It speaks directly to the value of creating systematic methods of data collection and analysis that open the doors to broader measures of community benefits beyond those that prioritize economic measures.

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