



## ESSAY

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# Measuring up to sustainability

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**As a concept sustainability has captured our imaginations and aspirations. As a tangible and identifiable goal it eludes us. Having developed indicators to measure and monitor economic, social and environmental conditions, we want now to measure sustainability. Our emphasis on the physical, the objective, and the rational, however, sees only the external manifestations of sustainability. The internal manifestations of sustainability, the non-material, the subjective, and the experiential, are put to one side, since they are messy, interpretive and time-consuming—the world of hermeneutics. Sustainability, however, is more than a ‘thing’ to be measured, since it is about ecological integrity, quality of life and transformation or transcendence. Rather than ask how we can measure sustainability, it may be more appropriate to ask how we measure up to sustainability. © 1998 Elsevier Science Ltd. All rights reserved**

Over the past two decades interest has grown in developing indicators to measure sustainability. Sustainability is presently seen as a delicate balance between the economic, environmental and social health of a community, nation and of course the Earth. Measures of sustainability at present tend to be an amalgam of economic, environmental and social indicators. Economic indicators have been used to measure the state of the economy for much of this century. Social indicators are largely a post-WWII phenomenon and environmental indicators are more recent still. Interest in developing these indicators largely began when their respective theatres became stressed and where the purpose was to monitor performance and to indicate if any ameliorating action was required. Whereas economists

have no difficulty deriving objective and quantitative indicators (their relevance is another matter), sociologists had and still have great difficulty in deriving indicators, because of intangible quality of life issues. Environmental scientists have less difficulty when limiting themselves to abundance of single species rather than biodiversity and ecological integrity.

Sustainability, however, is more than just the interconnectedness of the economy, society and the environment. Important though these are, they are largely only the external manifestations of sustainability. The internal, fundamental, and existential dimensions are neglected. Sustainability, therefore, may be something more grand and noble, a dynamic, a state of collective grace, a facet of Gaia, even of Spirit. Rather than ask how we can measure sustainability, it may be more appropriate to ask how we measure up to sustainability.

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## The concept of sustainability

Sustainability, at least as a concept, has permeated most spheres of life, not solely because it is a political requirement but because it clearly resonates with something deep within us, even though we have a poor understanding of what it is. The concept first emerged in the early 1970s but it exploded onto the global arena in 1987 with the Brundtland Report,<sup>1</sup> in which sustainable development is defined as *development that meets the needs of the present without compromising the ability of future generations to meet their own needs*.

This very noble definition, however, defies objective interpretation or operational implementation. Most of us would see our own personal needs within the context of our circumstances rather than as absolutes. Our perceptions of the needs of future generations, therefore, beggar the imagination. 'How much is enough?' is a question we have to explore together but can only answer individually. Yet we rarely ask this key question of ourselves individually, let alone collectively.

Once the ecological integrity of the Earth is ensured and our basic needs are satisfied, how much is enough? The question should be posed mostly in the developed countries where, amidst the affluence, there is still inequity. Increasing and deliberate inequity at that, for it is a necessary feature of a growth economy and the driver of material self-advancement. Desirable though high standards of living may be, there are finite global limits. Since our concern for the environment decreases as we become more affluent,<sup>2</sup> we should not expect our quest for sustainability to increase as we become more affluent. Indeed, the few examples of sustainability that we have are where there is no affluence, the states of Kerala and Cuba, and in Amish and Mennonite communities. Here there is greater equity, justice and social cohesion. The challenge for the affluent developed world is to strive for equity and justice, whilst at the same time creating the conditions for appropriate qualitative development.

There are other definitions of sustainability which sidestep human needs, preferring to talk about ecological integrity, diversity and limits. These too defy objective interpretation. These deficiencies in the definitions, if that is what they are, cause much frustration to the rational mind, particularly for those trying to measure sustainability.<sup>3</sup> Meanwhile our reductionist mentality has tended to

link it in a servile capacity to quantitative and productive activity, such as sustainable agriculture, forestry, land management, fisheries, etc. In consequence sustainable growth and sustainable development have been captured by the dominant paradigm where, for example:

sustainable development is brandished as a new standard by those who do not really wish to change the current pattern of development<sup>4</sup>

and

sustainable development alone does not lead to sustainability. Indeed, it may in fact support the longevity of the unsustainable path.<sup>5</sup>

But the concept is still with us and getting stronger.

We have a better understanding of what is unsustainable rather than what is sustainable. Unsustainability is commonly seen as environmental (in its broad sense) degradation, from the stresses of human population, affluence and technology on ecological and global limits. Since these stresses are all of our own construction, their control is, theoretically at least, within our capabilities. Human nature being what it is, we may push the global physical and biological capacities to their very limits, which will be survival rather than sustainability. Survival is merely not dying, whereas we probably think of sustainability in terms of justice, interdependence, sufficiency, choice and above all (if we were to think deeply about it) the meaning of life.

Sustainability, therefore, is also about the non-material side of life—the intuitive, the emotional, the creative and the spiritual, for which we need to engage all our ways of learning (being and insight as well as doing and knowing). Perhaps there are indeed some fundamental and universal truths if meaning and spirituality are components of sustainability. Morals and values, however, are not necessarily absolutes, and can be very difficult to define. Values, for instance, are qualities we absorb from our experiences. If our experiences confirm the implicit values, we are more likely to adopt those values. When our experiences continually contradict the implicit values we are more likely to modify our personal values to the projected values, i.e. we do as we are done by rather than as we are told. New ways of thinking need to emerge. Even Einstein recognised that *we cannot solve the problems that we have created with the same thinking that created them*. The

very etymology of sustainability contains both its appeal and its paradox—to *hold together with tension*.

The beauty in our inability to define sustainability means that we cannot prescribe it. The future may then unfold according to our visions and abilities provided we recognise the global limits. Sachs<sup>6</sup> presents three perspectives of sustainable development: the *contest* perspective that implies growth is possible infinitely in time; the *astronaut's* perspective that recognises that development is precarious in time; and the *home* perspective that accepts the finiteness of development. These could be considered, respectively, as the perspectives of the dominant paradigm, the precautionary principle, and the conservationist. There are, and will be, many other perspectives.

For a generation now we have wrestled with the concept. We may have as much difficulty with sustainability as we did with the concept of evolution 150 years ago. Wilber<sup>7</sup> suggests that the whole of history, and thereby evolution and the future, is a collective transcendence or transformation. We have been ignoring subjective and non-physical dimensions of the collective self as well as the individual self. In so doing we have both created the ecological crisis and prevented ourselves from transcending it. Thus, any debate about sustainability is essentially a debate about ultimate meaning—the what, who, why and how am I. But we are extremely reluctant to engage in that debate on a collective basis, not even locally let alone nationally or globally, partly because it's messy, interpretive and time-consuming—the world of hermeneutics. There is, therefore, a crisis of perception. On this side of the crisis there is mainly banality, whereas on the other side we see only uncertainty and fear.<sup>8</sup>

### The social discourse on sustainability

There is little dispute that our present path is unsustainable. The challenge of sustainability is neither wholly technical nor rational. It is one of change in attitude and behaviour. Sustainability must therefore include the social discourse where the fundamental issues are explored collaboratively within the groups or community concerned. We do not do that very well, partly because of increasing populations, complexity, distractions and mobility, but more because of certain characteristics of the dominant paradigm that are seen as desirable.

Where the discourse does occur it tends to be structured and rational where aggressive debate is esteemed and other ways of knowing and experiential knowledge, particularly of indigenous peoples, and feelings are disregarded. However, the process of discourse is as important as the analysis of discourse where knowing and acting could be seen as points on a journey, rather than as an end, as a start or a new beginning.<sup>9</sup> In sociological terms sustainability is an *absent referent* or the *absence of a presence*. Veiderman<sup>10</sup> may have come closest to a definition with *sustainability is a vision of the future that provides us with a road map and helps us focus our attention on a set of values and ethical and moral principles by which to guide our actions*.

People, however, will not readily enter into abstract discourse, particularly where they suspect they will have to get by with less or that their standard of living will decline—at least not until the need for discourse becomes inevitable and perhaps too late. Agenda 21 requires developed countries to reduce their use of natural resources and production of wastes whilst simultaneously improving human amenities and the environment. That statement does not necessarily imply a reduction in the standard of living (defined for the moment as material consumption). Through greater efficiencies it could mean maintaining the standard whilst simultaneously improving the quality of life. In that event we would be more willing to enter into further discourse to see if further improvements in the quality of life can be achieved, even at the expense of the standard of living if necessary. Just as human needs are not absolutes, neither is the standard of living nor the quality of life. The mystics may well indeed be the enlightened ones. Involuntary simplicity on the other hand is a form of poverty. Simultaneously within this social discourse the visions for the future can emerge.

Veiderman<sup>10</sup> suggests three principles to underlie the discourse on sustainability:

1. the humility principle, which recognises the limitations of human knowledge;
2. the precautionary principle, which advocates caution when in doubt; and
3. the reversibility principle, which requires us not to make any irreversible changes.

## Indicators in general

Monitoring and indicators have always been essential components of closed physical systems. They are integral to the scientific method. In this context each indicator should have a threshold and a target to guide political and social action. Their usefulness for closed socio/biophysical systems (e.g. human well-being, confined ecosystems) and particularly for open physical systems (e.g. corporations, national economies, regional sustainability) is still really unknown, in that accommodation of the full impact of the externalities may not be possible. Ultimately, however, the Earth is a closed system, except for the energy flux. In that sense accurate measures are theoretically possible at the global scale, but it is local measures that are potentially more meaningful and actionable. The impact of some issues, however, may only be evident globally, e.g. global warming and ozone depletion, whereas the solutions may be local.

Henderson<sup>11</sup> has written extensively on indicators, notably the chapter in *Paradigms in Progress* (Chapter 6). The proliferation itself of indicators is indicative of the confusion and uncertainty of what is to be measured, and perhaps the absence of debate and understanding.

### *Economic indicators*

There is much dissatisfaction with economic indicators, even among economists. Most would claim that they are not indicators of anything other than the economy. Some do not believe they are even meaningful measures of economic sustainability.<sup>12</sup>

The adherents for the most common indicator, the gross national product (GNP), now replaced by the gross domestic product (GDP), are getting fewer, but it is still widely used. Daly and Cobb<sup>13</sup> have developed the Index of Sustainable Economic Welfare (ISEW), which has recently been further refined as the 'genuine progress indicator' (GPI) by Cobb *et al.*<sup>14</sup> Consumption is still the base of the index, but instead of adding negative or deleterious consumption (e.g. defence, environmental protection) it subtracts them and adds previously unmeasured positive beneficial consumption (e.g. voluntary work, caregiving, housework). Whereas the GDP in the United States has continued to increase since 1950, the GPI shows a steady decline which mirrors

people's experiences and perceptions of their well-being.

The GPI is a more realistic alternative to the GDP. The proponents of GPI presumably believe it is more likely to receive establishment endorsement by starting from the received wisdom. It is worth pointing out, however, that 50% of Americans consider themselves to be overweight, that 40% consider they consume alcohol in excess of 'moderation', that 70% of smokers would like to stop, and so on with gambling and credit card use. In other words, most of us are knowing victims of the consumer society and would like to change. Therefore, it is difficult to conceive how any index which has consumption as its base can be a measure of sustainability.

Furthermore, the GDP and the GPI are single indices. Both are aggregations of specific economic indicators. Whereas economic indicators may be equally responsive, in respect to time, to actions of adjustment, or can be meaningfully weighted in their aggregation, this is not true of social, environmental and sustainability indicators. Economic indicators are therefore not particularly useful as measures of sustainability, but economic considerations need to be factored in.

However, the very foundation of modern economic theory is suspect. Firstly, because it determines rather than reflects political and cultural development. Secondly, because it assumes scarcity of resources, most of which, until relatively recently at least, are in abundance. An economic theory that goes beyond greed and scarcity and which reflects human needs as suggested by Lietaer<sup>15</sup> is likely to yield much more useful indicators.

### *Social indicators*

There are broadly five types of social indicators: informative, predictive, problem oriented, programme evaluative, and target delineation. Many social indicators are in part economic, environmental and sustainability measures too. They can be comparative, between and within socioeconomic and ethnic groupings.

Objective conditions, such as the standard of living, are measured by analysing time-series information on observable phenomena. Subjective conditions, such as quality of life, are measures of perceptions, feelings and responses obtained through questionnaires with graded scales. It is well known that there

is little correlation in the level of well-being as measured by objective parameters on the one hand and subjective parameters on the other. There are considerable difficulties associated with the aggregation of indicators and in the design of weighting schemes. There can be aggregation of indicators of a similar nature, but in general aggregation, and certainly a single index, is uncommon.

Henderson<sup>16</sup> reviews the debate about indicators of progress suggesting the need to clarify the confusion of means (i.e. the obsession with economic growth) and ends (human development).

### *Environmental/ecological indicators*

Environmental indicators tend to relate to the environmental sphere closest to human activity and can include economic, social and sustainability parameters too. They measure the quality of the living and working environment, usually for the three spheres of air, land and water, and may include measures of our productive use of resources, e.g. agri-environmental indicators. Ecological indicators relate more to ecosystems, where in some cases the human impact is not so evident. Indicators pertinent to the integrity of ecosystems and biodiversity are prominent. The OECD produced a pressure/state/response model which many countries have used in the preparation of their State of the Environment Reports, whilst focusing on their particular environmental/ecological issues.

Most of the indicators have, or will have, thresholds and targets. There is little desire or attempt, at present, to aggregate indicators or derive a single index.

### *Ecological footprint*

The ecological footprint is a useful measure for urban societies and industrialised countries, as they have become distanced from and are less aware of their dependence on the products of the land. It is a method for estimating the area of productive land required to produce the materials and energy required to support and to absorb the wastes generated by the present way of life. The average North American needs around 4 hectares to support his or her lifestyle. Vancouver depends on an area 24 times its size, and the Netherlands (as a small densely populated country) 14 times. If the rest

of the world were to support such lifestyles we would need a planet with five times more productive land than it actually has.<sup>17</sup>

The footprint is an input/output measure of consumption, technological activity, and trade flows of all biophysical material needed by and produced by that city or nation expressed in terms of productive land area but using monetary conversions. It is a single index. Small cities or countries highly dependent on external flows (i.e. exports), and with little influence over international currency fluctuations, such as New Zealand, would have footprints highly susceptible to factors beyond their control. Footprints put relative numbers on what we already know or suspect, that cities and small densely populated countries are unsustainable. The footprint may be useful for internal and temporal reference, but there could be a tendency to compare performance against other cities or countries and perhaps provide an excuse not to take appropriate action. Ecological footprints are therefore not particularly useful measures of sustainability.

### *Sustainability indicators*

Measures of sustainability at present tend to be an amalgam of economic, environmental and social indicators. The first two are amenable, but with difficulty, to quantitative measurement as they can be expressed in biophysical terms. There is a tendency to express social indicators in such terms too, but with less success. There is therefore a tendency to see sustainability only in biophysical terms.

Examples of sustainability indicators for a city and which reflect their origin in other indicators are:

1. income per capita ratio for upper and lower deciles;
2. solid waste generated/water consumption/energy consumption per capita;
3. proportion of workforce in the employ of the top 10 employers;
4. number of good air quality days/year;
5. diversity and population of specified urban fauna (particularly birds);
6. distance travelled on public relative to private transport per capita;
7. residential densities relative to public space in inner cities;
8. relative hospital admission rates for selected childhood diseases; and



9. proportion of low birth weights among infants by income groupings.

Boswell<sup>18</sup> advocates a theoretical basis for indicators of sustainable development based on our knowledge of sociology and ecology. He likens our stage of development to that of a climax community within an ecosystem succession. He then presents system attributes (energy use, community structure, life history, nutrient cycling, selection pressure and equilibrium) in terms of goals for sustainable communities. These number 23 necessary but not sufficient conditions. Boswell evaluates these goals against the indicators selected by Sustainable Seattle<sup>19</sup> and the ranking that Hart<sup>20</sup> has given over 500 indicators. Although an approach based on human ecology is clearly appropriate, Boswell does concede that the communities themselves should determine the strategy and the indicators.

Whereas these are facets of sustainability, we must look beyond conventional measures to include a sense of quality of life, well-being, belonging, relatedness, and harmony. We may have to be prepared to accept semiquantitative and even qualitative indicators.

Environmental and social indicators are rarely expressed as a single index. Nevertheless, there is some interest in developing a single index of sustainability based on a weighting of a selection of economic, environmental and social indicators. Such an index cannot possibly cater for response times that range from a few years (e.g. medical intervention) to generations (e.g. global warming).

### Criteria for the selection of sustainability indicators

The monitoring of sustainability is a long term exercise. As much as we would like the criteria for selection and the indicators themselves to be appropriate over a long time frame we are on a steep, and perhaps long, learning curve. We will need to be flexible, for our ideas and preferences will change with time. The criteria and preferred indicators could be different for the groups who will choose and use them. Expert systems may be appropriate.

Professionals may prefer quantitative, and if necessary, complex criteria that are amenable to rigorous statistical analysis. Some may wish to reduce a large group of indicators to a single index of sustainability. Communities on the other hand may prefer, or be prepared

to accept, qualitative criteria and few indicators in the interests of simplicity and direct relevance. If we exclude qualitative criteria because they are not readily amenable to objective analysis we are likely to exclude some essential features of sustainability.

There are many sets of criteria (e.g. Liverman,<sup>21</sup> Sustainable Seattle). They range from the simple (the efficiency, equity, integrity, manageability of Opschoor and Reijnders<sup>22</sup>) to the complex. Hart believes that the best measures may not have been developed yet but suggests the following criteria:

1. multidimensional, linking two or more categories (e.g. economy and environment);
2. forward looking (range 20–50 + years);
3. emphasis on local wealth, local resources, local needs;
4. emphasis on appropriate levels and types of consumption;
5. measures that are easy to understand and display changes;
6. reliable, accurate, frequently reported data that are readily available; and
7. reflects local sustainability that enhances global sustainability.

Many of these criteria are short on human or social criteria, such as quality of life, sense of safety and security, sense of relationship to others and our connectedness with the Earth. A criterion that doesn't appear to be mentioned is one that reflects the degree of choice an individual has in an action. Most of us are locked into systems of our own collective construction within the dominant paradigm, many of them unsustainable, where the choice to be different can be socially, economically and practically difficult. Examples include the use of solar radiation and rainfall upon one's own house, and the choice not to own a car. Much more sustainable actions could result where the individual can make choices free of systemic pressure and economic distortions.

### Risk analysis and comparative risk assessment

As in all theatres of qualitative and insufficient or imprecise quantitative information and uncertainty, where much is at stake and there may be several options for action, risk analysis can help in selecting the preferred, the least cost, and/or the least risk option. The poorer the information and the greater the uncertainty, the more risk analysis may need to be

used. At a time when we are confronted with a whole barrage of different issues and problems with insufficient resources, a prior analytical stage has emerged—that of comparative risk assessment. This technique ranks the issues/problems according to the urgency, cost and likelihood of success. The proceedings of a conference to debate, and no doubt advance, the technique presents just as convincing arguments against comparative risk assessment as it does for.<sup>23</sup>

Too often we argue we have insufficient information, or inappropriate information, upon which to take sound objective action, particularly action affecting sustainability. Yet in our hearts we know there are systemic functional deficiencies, both within ourselves and in our organisations. Rather than make a personal, corporate or political decision we call for more information, for more research. We prevaricate. Too often that information or research adds to the uncertainty or controversy. Valuable time is lost and yet more unnecessary work is embarked upon. We know the direction our action should take even though we do not know precisely what it should be. We lack the collective will to do so because we do not collectively address and own the problem. Much publicly funded research and development is a surrogate for social action. Many of the problems and solutions are neither technical nor entirely rational. A new mythology needs to emerge and that may be sustainability.<sup>24</sup> They are soluble only through social action, where the populace as well as the technical experts become informed on the issues and make informed recommendations to the decision makers.

### Limitations of measures of sustainability

Even though we cannot define sustainability objectively and unambiguously, we should not abandon or defer attempts to measure it. Even if we come to recognise that there are other equally valid ways of learning, we have to start where we are, which is within a highly reductionist, rational, material, and acquisitive world.

We can define limiting aspects of sustainability (e.g. the sustainable productive capacity of a specific area of land, or the carrying capacity of the world) and trends in the direction of sustainability (e.g. greater use of public transport, more equitable distribution of

income) and choose indicators that are appropriate and meaningful. The former would be thresholds below which we enter an unsustainable state. The latter would be directions in which we need to move. Many in fact are really indicators of unsustainability. Many debates and studies about the measurement of sustainability do not define, or even derive a common understanding, about what is to be measured. The context of sustainability cannot be separated from its measurement.

We should acknowledge at the outset the limitations of quantitative measures and that any measures are merely *the map not the territory* (Bateson)—merely *the finger pointing at the moon* (a Zen saying). But we must be on our guard to keep well clear of thresholds. Surplus 'capacity' may be a spur to further inane growth and consumption. International trading in sustainability units could mean we all arrive at global survival (not sustainability) together. Biophysical measures are really measures of how close we are to the carrying capacity of the Earth. Thus, biophysical measures are only indirect, partial and limiting measures of sustainability.

Even though sustainability is about the quality and other intangible non-physical aspects of life, that does not mean we may not be able to derive measures for them. Just as biological indicators (e.g. trout) are now used to measure the quality of industrial effluents, in addition to conventional chemico-physical indicators, we should be able to derive parameters that measure how well we and the Earth are as we swim around within the maelstrom of life.

### Initiatives to measure sustainability

Sustainability indicators are being developed and applied at the grassroots level—the communities themselves, e.g. Jacksonville, Pasadena, Seattle in the USA, and at the institutional level in Europe, and North America. These indicators tended initially to be a potpourri of the three types above and there are still resemblances. As communities learn from the experience of others more appropriate and community-specific indicators should emerge.

The most promising of overseas initiatives to monitor sustainability are those that the public have initiated, and who largely retain 'ownership' and control, e.g. Sustainable Seattle—despite the fact that only eight of the 40 indicators have shown some improvement.

Technically they may be flawed, but the success lies not in the indicators themselves but in the process and the participation, for it is here that the real debate and the sharing occurs and the mutual voluntary adjustments can be made. There is a limit, however, to the extent to which individual voluntary adjustments, or pressure for collective adjustment, can be made when our attitudes and behaviour may have been shaped more by the nature of our society (our systems of governance and organisation) than from free choice. In other words, if systemic change (e.g. to our economic system) is needed, it may be easier and quicker if it is effected by those with the power and influence.

The discourse of sustainability is part of the process of working towards sustainability. We will find we will know we are becoming more sustainable without having to measure it. Part of that discourse will be measures of sustainability, both the relatively easy that measure proximity to thresholds and directions, and the qualitative. But they will be consequential, for the hard graft of achieving sustainability will have begun. Therein lies the success of initiatives like those in Seattle.

The commencement of that discourse is the challenge. It is already in progress within NGOs and environmental and social change groups, but they may not see their particular window of interest as progress towards sustainability.<sup>25</sup> The discourse needs to be extended to the community at large, to local communities, to open debate of the big issues ahead of us, and to a more effective and participatory democracy. Local communities need to renegotiate the meaning of community in the modern world and find avenues for expression. Citizens' juries and consensus conferencing are great vehicles for exploring these deep and wide issues.<sup>26</sup>

## Conclusions

1. There is growing acceptance for the concept of sustainability despite our inability to objectively define it and therefore to implement it.
2. Sustainability is more than ensuring ecological integrity and the standard of living. It is about the quality of life and thus addresses the ultimate questions about meaning in life.
3. Sustainability is as much a process of discourse and effort as it is a state.
4. Institutional initiatives and debates about measuring sustainability are reluctant to engage with the concept of sustainability. Thus, there is no common or shared understanding of what is to be measured.
5. Sustainability indicators are often an amalgam of economic, social and environmental indicators, but show signs of maturing into better measures of sustainability.
6. Such indicators, however, are limiting measures reflecting unsustainability and survival rather than sustainability. Their main value is in indicating direction of change rather than a desirable state.
7. Indicators are the map, not the territory (the finger pointing at the moon). The hard work of achieving sustainability lies elsewhere.
8. The most successful initiatives to measure sustainability are those initiated and controlled by autonomous public groups (e.g. Sustainable Seattle), where the process is more important than the indicators.
9. The greater the effective participation in democracy, in executing the role of community, in consensus conferencing, in citizens' juries, etc., the more chance we have of achieving sustainability.
10. We will need to address the fundamental existential questions and seek meaning in life if we are to achieve sustainability. As we seek to measure sustainability we should be asking ourselves how we ourselves measure up to sustainability.

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