What is the cost of not going metric?

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This is a very complex question as it is really about a number of smaller questions that add up to the overall final costs of not using the metric system by itself. Because of this, I have answered this question using a Question and Answer technique. There are three questions and three answers here, but I have also used sub-questions and sub-answers.

Question:

How much does it cost the USA to be non-metric or to use dual measurements — metric and U.S. Customary?

Answer:

Despite the positive experiences of every country in the world that has already upgraded to the metric system, this question has not been well researched. To help us to develop our thoughts about the costs of non-metrication, I will include some similar questions before I answer them. As I don't think that any of these are inherently more important than any other, I have listed them in alphabetical order.

- How many businesses have lost orders or contracts because they could not do the job in metric?
- How many businesses have not even been approached for quotations or estimates because international businesses automatically assume that businesses in the USA cannot do metric work?
- How many have had to pay a premium for metric parts because they only bought enough for a specific job?
- How many have made costly mistakes in converting a metric job to old pre-metric measures?
- How many people have had to be terminated because they refused to work in metric? How much does it cost to find and employ their replacements?
- How much are we, in the USA, prepared to pay to be different to everywhere else in the world?
- How much does it cost to have someone buying one fastener when they need the other and having to make a second trip to the store to rectify the problem?
- How much does it cost to retrain school leavers in old measures when they have been taught the metric system at school?
- How much extra does it cost for duplicating products in both metric and U.S. Customary?
- How much extra does it cost for keeping both the metric and the U.S. Customary inventories separate?
- How much extra does it cost to have stores that have to carry both metric and U.S. Customary?
- How much extra production costs are involved with making products like fasteners in both metric and U.S. Customary?
- How much has not going metric really cost us?
- I would like to know is how much it has cost us for not being metric.

I collected these questions over several years. Some of these were sent to me personally as editor of the 'Metrication matters' newsletter, (See http://metricationmatters.com/newsletter) and many others I collected from metric email lists especially the USMA email discussion list (See: http://lamar.colostate.edu/~hillger/listserv.htm).

Question:

Has anyone done any research or written about the costs of not going metric?

Answer:

As far as I can find out, this is an extremely poorly researched question. I will answer this in three parts. I will refer you to articles by Jos. V. Collins (in 1915), Richard P. Phelps (in 1992), and some thoughts of my own (in 2006):

Sub-answer 1

Jos. V. Collins did some work on this question in 1915. He concluded in an article called, 'A metrical tragedy', that a 'Total annual loss of $315 000 000' could be attributed per year to non-metrication in the USA at that time. (Note: if you allow for inflation between 1915 and now, then Collin's figure for annual losses becomes $6 100 000 000 per year in 2005)

Notes: For these calculations I used the CIA Fact Book:

http://www.cia.gov/cia/publications/factbook/geos/us.html#Econ as the source for Gross Domestic Product, the inflation calculator at http://www.bls.gov/ and I referred to the Jos. V. Collins article at:

http://etext.lib.virginia.edu/etcbin/toccer-new2?id=Cat1Sci.sgm&images=images/modeng&data=/texts/english/modeng/parsed&tag=public&part=24&division=div2

Sub-answer 2

This question could also be considered as, 'How much money is wasted in teaching old pre-metric measures in schools in the USA?'

In an article, 'The Case for U.S. Metric Conversion Now' (1992, December 9) Richard P. Phelps stated that:

> *'It (USA education system) teaches two systems of measurement in the schools and, the confusion from learning two systems aside, there is a cost to the time spent in teaching two systems. A full year of mathematics instruction is lost to the duplication of effort.'*

You can view Richard P. Phelps' article after you register on the Education Weekly database at: http://www.edweek.org/ew/articles/1992/12/09/14phelps.h12.html

In 2004, according to the U.S. Department of Education, the Total Expenditures for Education in the USA for elementary and secondary education was $511 200 000 000 (511.2 billion dollars) and this included all expenditures, federal, state, local, and other.

(See: http://www.census.gov/compendia/statab/education/all_levels_of_education/)

Assuming that arithmetic and mathematics classes compose about 1/5 of a school curriculum, then mathematics costs 102.24 billion dollars each year. And if Phelp's conclusion is correct, that *'A full year of mathematics instruction is lost to the duplication of effort*', and (allowing for drop-outs) we assume that the average school life of a student is 12 years, then each year in the USA 8.52 billion dollars is wasted in teaching old pre-metric measures in schools.

Sub-answer 3

From my own experience metrication does not cost anything; it saves money.

After the initial, relatively small, expense for planning and training the rest of the metrication program is about counting the savings and the profits. Here are four items about costs that you might find useful.

1. My experience with metrication in the building industry in Australia suggests that a well-planned and well-executed metrication program will increase gross profit by between 10 % and 15 % leading to a net profit increase between 15 % and 20 %.
2. In General Motors when they began their metrication program (in the 1970s) they created a group to monitor the costs so that they could claim them back later from the government. Then, when they discovered how much metrication was saving General Motors, they quietly disbanded the metric costs accounting group.
3. The Confederation of British Industry was established in 1965 to act as a pressure group promoting the interests of the UK's larger businesses. When the Confederation of British Industry (CBI) surveyed its members about metrication in 1980 — after 15 years of British metrication — they found that

   > *'... the extra cost of continuing to work in dual systems of measuring was around £5 000 million every year'.*

   For companies on which the survey was based, increased production costs were equal to 9% of the companies' gross profit and 14% of their net profit when compared to fully metric CBI companies.

   To put this into perspective: in 1980 £5 000 million was roughly half the cost of the entire UK National Health Service; in today's currency, 5 000 M£ is equivalent to about 12 000 M£; and the net saving from 1980 to 2006 is about 110 000 M£ – plus compounding interest.
4. With reference to the USA, if you take the cost estimates from items 1 and 3 and make a bold, but not wild, assumption that it costs about 9 % of gross turnover to use dual measurements (metric and U.S. Customary) then based on a 2005 estimated Gross Domestic Product for the USA of $12.735 trillion dollars it costs the USA about 1.15 trillion dollars per year to use dual measures; this is a bit more than $3850 per person per year.

Remember, also, that metrication is a one-off expense, but not going metric is an on going expense that goes on year after year.

Question:

One of the arguments advanced against mandatory conversion is that it would be too costly for American industry. What's your response to that?

Answer:

Any discussion of metrication costs should begin with the observation that companies and industries that have made successful metrication transitions typically increase their gross profits by about 9 % and their net profits by about 14 % and (in Australia) after 35 years of quietly enjoying these profits they have forgotten all about any initial metrication costs.

I have been fortunate to have closely observed successful, smooth, rapid, and cheap metrication transitions. I have also closely observed unsuccessful (so far), rough, extremely slow, and horribly expensive attempts at metric conversion.

Essentially the cost of any metric transition program depends on the method you choose to use to make your change from pre-metric measures to metric units. From my observations there seem to be four approaches that people take to metrication.

Four approaches to metrication

Recently, I examined a 'Sizing Chart' for men's clothing. It stated that it consisted of two parts: one where 'Measurements are in inches' and another where 'Measurements are in centimetres'. It looked like a bit of a measurement muddle to me until a quick examination revealed that all of the measurements were really inch measurements converted to over precise centimetre values (to two decimal places!) for the 'Sizing Chart'.

While I was thinking about this strange way of running a business it occurred to me that there have been four main approaches to metrication. I suspect, and I know from Australian experience that this clothing company is using one of these four approaches to metrication. In my classification this men's clothing company is using 'Approach 3', below.

Approach 1

Keep all design and manufacture in old measures and communicate with the public in old measures.

This is the approach actively promoted by groups such as the British Weights and Measures Association and used by the Wild West Hall of Fame in the USA.

I used to know a small company in Geelong that made rainwater tanks using this technique – they are no longer in business; and another Australian company that made industrial sheds – they are no longer in business either. I now don't know of any other companies that have consistently tried this approach and are still in business in Australia. I suppose that this approach is based on mottoes such as: 'Do nothing' or 'Ignore it, and it will go away'.

I also think that this approach is impossible to achieve in the year 2006; go to http://www.metricationmatters.com/articles.html and download the article, 'Don't use metric' to see some of the difficulties.

This is ultimately the most expensive approach, as all efforts eventually produce zero results.

Approach 2

Do all design, processing, and manufacture in metric units and then communicate with the public in old pre-metric units. For example, most worldwide automotive companies design, build, and market in metric measuring units only.

However, the automotive industry in the USA designs body parts in millimetres and engine parts in micrometres, builds to this precision and then sells to the public with a 'mph' speedometer, 'ml' odometer, 'in.' tyres with 'psi' pressures. Although a car might have its 10 000 parts measured some 100 000 times using only metric units, the four labels, 'mph', 'ml', 'in.', and 'psi' are all that is needed to convince many drivers in the USA that they are driving an English units car and that all is for the best in this English units world.

Road makers in the UK use this approach. Roads are designed and constructed in kilometres and millimetres and then labelled (signed) with mileposts and mph signs. Again, many members of the public believe that they are driving an English units car, on an English units road, in an English units world.

The world gold industry mines in tonnes, refines in grams, and milligrams, and then reports sales to the public in Troy ounces.

The world oil industry drills in millimetres and metres, extracts in litres and cubic metres, sells in kilograms, and then reports the selling prices to the public in theoretical barrels that never actually existed.

This dumbing down of the metric units to old measures costs money and time. People need to be employed to do the dumbing down calculations and to communicate these to the media and the public. In addition there is the additional costs due to errors made with these calculations. The outstanding example of this is NASA whose scientists, designers, and engineers all work in metric units and these are then dumbed down for the public use by the 'communications department'; when these two different approaches clash they can lead to fiascos like the Mars Climate Orbiter loss at a cost of about 125 million dollars.

This cost is ongoing for as long as the company decides to continue this dual approach. Having dual methods serves no useful purpose in either the short or the long term.

Approach 3

Design and manufacture in old measures and then use conversions (almost always soft conversions that are too precise) to communicate with the public.

This is the approach taken by the clothing company mentioned above with their clothing sizes. It is an attempt to convince the public that the company is progressively metric while not having to spend a red cent on retraining in the factory because there they are still using inches (and more rarely half-inches and quarter-inches) for all of their design and garment making.

This is also the approach taken by the menswear industry in Australia. For example, a 38 inch jacket is designed, cut, and made to inch precision, then labelled as 97 centimetres implying centimetre precision.

I think that many air-conditioners are built to designs based on whole numbers of horsepowers, therms, and BTUs (as design element goals), and then these are sold to the public in kilowatts.

The cost of doing business this way will continue for ever, as there has actually been no metric transition at all. The staff simply uses old measures then try to give the illusion that they are progressive by using metric names for sizes that are truly old measures.

Approach 4

Design and build in metric units, and communicate with the public in metric units. This is the simple and easy approach taken by Australian builders, carpenters, electricians, fitters, furniture makers, machinists, gasfitters, plumbers, welders and many others who design, build, and communicate with the public in millimetres. In some cases metrication in these Australian industries took less than a month and produced increased annual profits of 15 % or more, which they have enjoyed each year since the mid 1970s.

As well as being simple and easy, this is the cheapest approach. The total costs consist of some basic training programs, a few small tools (metric-only tapes and rulers) and a commitment to replace larger tools with metric-only tools as and when these need replacing.

Combined approaches

Although it is easy to identify the four main approaches to metrication and to identify many companies and industries that use each approach, it is sometimes more difficult to classify groups who have chosen – mostly by default – to use somewhat messy combinations of these four approaches.

Consider the cost of the confusion at Kodak where the film division used Approach 4 to complete metrication in the 1910s while the photographic paper division is still puddling along with a sort of combined Approach 1 and Approach 3 in 2006 — 96 years later — and they've still got a long way to go.

I mentioned earlier that NASA lost the Mars Climate Orbiter at a cost of about 125 million dollars because they confused old measures with metric measures. I won't comment on

NASA's measurement practices, except to suggest that various parts of that organisation are using all four of the above approaches, often in conflict with each other.

Timing

The timing to complete metrication using each of the four main approaches is interesting:

Approach 1 — never, the muddle continues.

Approach 2 — metrication is completed internally in the industry within a few years, but the public conversion is designed not to happen until metric measures have developed to a point where it is OK (morally right?) to discuss metric measures in public. This could take a couple of human generations (say) 50 years.

Approach 3 — very slow conversion will take place as a back-conversion from the company's public 'metric' position. Typically, you could expect this type of conversion to take at least 100 years.

Approach 4 — quick and easy metrication, with a time of less than a few months being possible, and less than two years being typical.

Future

I suspect that an overwhelming majority of the world's people — even in the USA — believe that in the future we will be predominately metric in the way we carry out our personal and commercial dealings. Most don't doubt that this position will definitely be reached in (say) 100 years; many think that it will take 50 years; and there are others who hope that this can be achieved in 5 years. I think that all of these will be correct for some people at some time; it will depend on how they choose to go about their metrication process.

In any case, and at whatever cost, I think that we can assume that metrication will eventually happen. As I see it, there is no doubt about whether or not metrication will happen – I regard that as a given.

Don't ever doubt that metrication is inevitable. No individual, no group, no company, no industry, and no nation that has ever used metric measures for some time (and especially SI units) ever goes back to using old pre-metric or pre-SI measures — whatever the cost.