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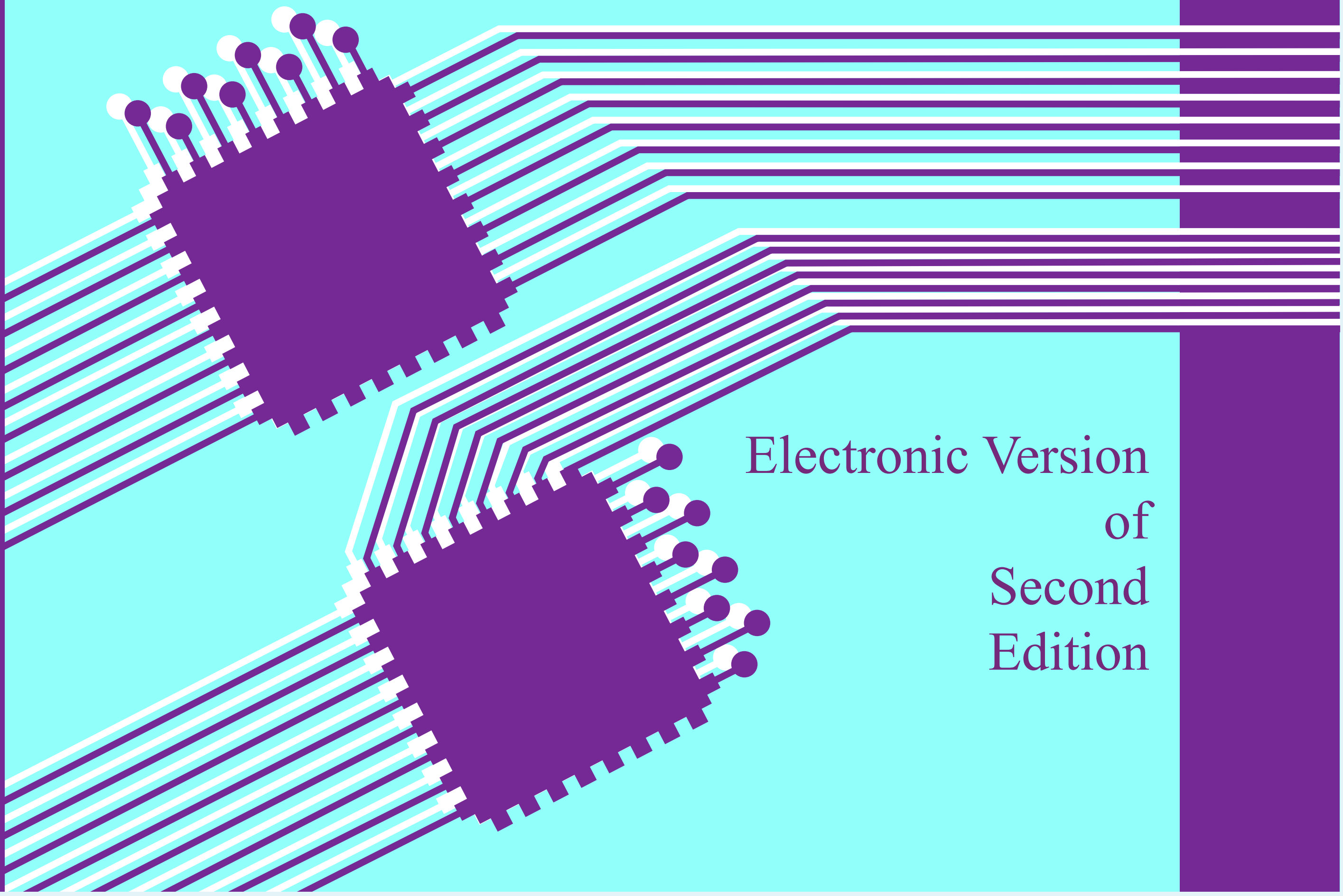
The Economics of Automatic Testing

Chapter 10
Field service economics

Brendan Davis



Electronic Version
of
Second
Edition

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"The Economics of Automatic Testing"

Published by
Brendan Davis, Cahir, County Tipperary, Ireland.

Conversion to electronic formats by…

Suirvale Design & Print, Cahir, County Tipperary, Ireland

of administrative work, such as paperwork processing, inventory control, location, withdrawal, packing, shipping, stock-taking, etc. All this work is proportional to the volume of inventory stocked and shipped around. Shipping costs are relatively high since air freight or air parcel post is often used. Emergency shipments cost even more. For international shipments, export documents and import documents will be required.

Landing costs in foreign countries

Import duties are closely related to transportation costs but are high enough to be treated separately. They can add substantially to the cost of centralized service in some areas of the world. Some South American countries have import duties as high as 70 to 100 per cent on spare parts, and a repaired board is charged duty on its value, not the cost of the repair. Placing the board testers in foreign countries can often produce the fastest payback.

These then are some of the major cost areas associated with field service when board-swapping is the primary strategy. With other strategies, there will be other cost areas as well as some of these. With an 'on-site' strategy the inventory costs, while still there, should be lower. Personnel costs will, however, be much higher since the call rate is likely to be lower when a more detailed and lengthy service call is required.

The following example is intended to show a method for calculating the savings possible when switching from a board-swapping strategy with a central repair of boards to a decentralized board test operation using a number of small testers.

Example

The XYZ Electronics Company is introducing a new product in nine months' time. The product is expected to sell well but it will place a heavy burden on the field-service organization due to its complexity and the quantities XYZ plans to install. XYZ is a relatively small company with high-technology products. It currently operates a board-swapping repair policy with all boards going back from the field to the factory for repair. Production pressures are such that field returns are a low-priority job for the production test department. As a result its pipeline delays are fairly long. It has six field sales and service offices domestically and four international sales and service subsidiaries.

XYZ has been investigating the possibility of using some low-cost digital functional board testers at its 10 service offices as an alternative to centralized repair. This cost analysis for field service of this new product with and without the ATE follows. This analysis is based solely on using the ATE for this new product-it will, however, be possible to transfer some of its older products to the new testers also.

Since repair costs are not entirely a corporate saving, only inventory-related costs are considered in the analysis. About 40 per cent of XYZ's installations are expected to be in the international territory, and the average manufacturing cost for a board is $300.

Cost of implementing the ATE program. Eleven testers will be needed-one for each office and one for the factory to update programs to compensate for engineering changes to the boards. Ten test programs will be needed for the digital boards in the product. All the above calculations of MTBF, inventories, etc., are based upon these 10 boards. The programs will be converted from the production test programs developed for the production ATE. Interface adaptors will be required to interface between the boards and the tester. The following is an estimate of the costs involved…

Cost analysis with present centralised board repair (note that some figures are rounded)

		Year 1	Year 2	Year 3	Year 4
A	Units shipments (forecast)	300	600	800	900
B	Installed base	300	900	1700	2600
C	Expected MTBF (months)	4	5	6	6
D	Failures per year (B x 12/C)	900	2160	3400	5200
E	Proportion of good boards returned	0.4	0.4	0.4	0.4
F	Total boards returned (D/(1-E))	1500	3600	5670	8670
G	Domestic returns (0.6F)	900	2160	3400	5200
H	International returns (0.4F)	600	1440	2270	3470
I	Domestic pipeline (months)	5	5	5	5
J	International pipeline (months)	7	7	7	7
K	Domestic pipeline inventory (G x I/12) boards	375	900	1417	2167
L	International pipeline inventory (H x J/12) bds.	350	840	1322	2022
M	Domestic buffer stock (three months) (0.6D x 3/12) boards	135	324	510	780
N	International buffer stock (three months) (0.4D x 3/12)	90	216	340	520
O	Incremental domestic inventory (boards)	510	714	703	1020
P	Incremental international inventory (boards) (additions per year)	440	616	606	880
Q	Total inventory (bds.)	950	2280	3589	5489
R	Total incremental inventory (boards)	950	1330	1309	1900
S	Cost of inventory added each year ($)	285k	400k	393k	570k
T	Carrying cost of total inventory (25%)	71k	171k	269k	412k
U	Import duties etc. on intl. inventory (20%)[1]	62k	123k	173k	261k
V	Total inventory related costs	418k	649k	835k	1243k

[1] Import duties, etc., based on returns (H) + incremental inventory shipped internationally. This incremental inventory is required to support the growing installed bas of products—it is the total number of boards supplied by manufacturing to field service each year.

11 testers plus quantities of spares $400k

10 programs and interfaces $100k

Training costs (mostly travel) $40k

Total project cost $540k

The cumulative savings over the four years are shown on the graph in Fig. 10.2. By inspection of the graph or by interpolation of the savings, the payback is achieved in 1.35 years.

Note. This is a very simplistic look at the payback. A more accurate method that takes in the effects of depreciation and taxation is explained in Chapter 11.

So XYZ Electronics can justify the program on the strength of a single new product.

Transferring boards from existing products to be tested on the new testers will provide an even faster payback and higher ROI.

Cost analysis with ATE at each field offfice.

		Year 1	Year 2	Year 3	Year 4
D	Failures per year	900	2160	3400	5200
G	Domestic returns (boards)	900	2160	3400	5200
H	International returns	600	1440	2270	3470
I2	Domestic pipeline (months)	1	1	1	1
J2	International pipeline (months)	1	1	1	1
K2	Domestic pipeline inventory (boards)	75	180	283	433
L2	International pipeline inventory (boards)	50	120	190	290
M2	Domestic buffer stock (one month) (0.6D x 1/12) (boards)	45	108	170	260
N2	International buffer stock (one month) (0.4D x 1/12)	30	72	113	173
O2	Incremental domestic inventory (boards)	120	168	165	240
P2	Incremental international inventory (boards)	80	112	111	160
Q2	Total inventory (boards)	200	480	756	1156
R2	Total incremental inventory (boards)	200	280	276	400
S2	Cost of inventory added each year ($)	60k	84k	83k	120k
T2	Carrying cost of total inventory (25 %)	15k	36k	57k	87k
U2	Import duties etc., on international inventory 20%	5k	7k	7k	10k
V2	Total inventory related costs ($)	80k	127k	147k	217k
W	Total inventory related savings (V – V2) ($)	338k	567k	688k	1026k

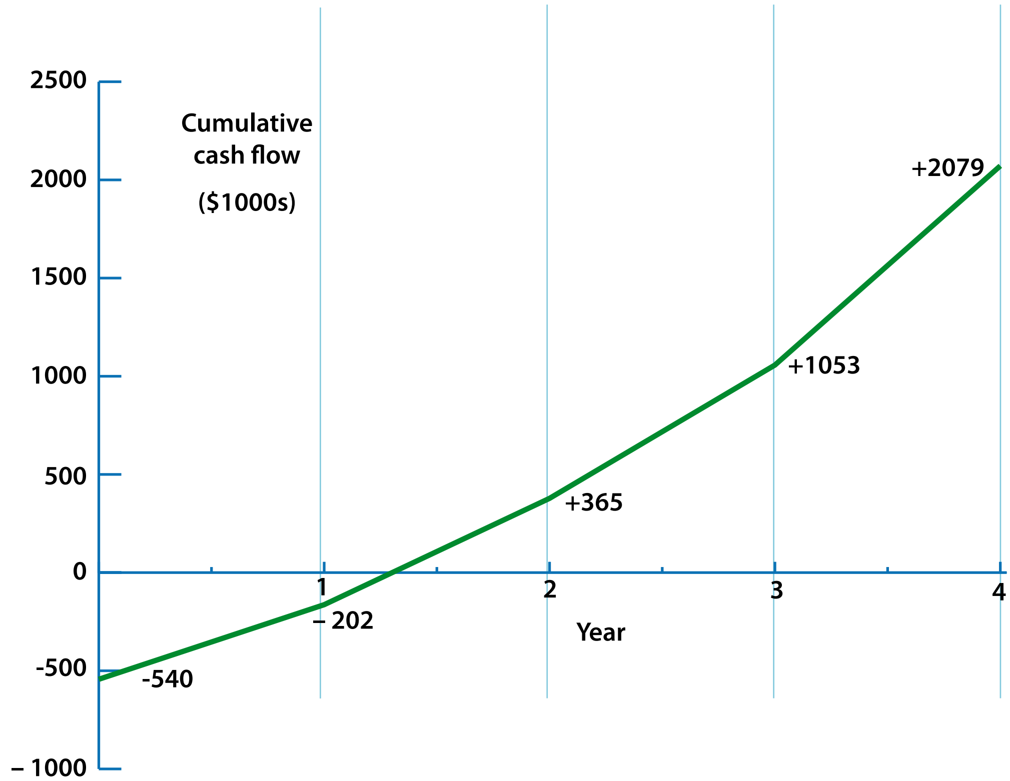

Figure 10.2 Cumulative cash flow for the example