Harper Adams University

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Contents

Summary

This report looked at a company project within Househam sprayers, with a view to improve communication between departments and to improve the build of machines at its manufacturing assembly sites.

The company project looked at the improvement of the production bill of materials (BOMs), by improving the communication of errors found during the build of machines. Implementing a feedback system between the assembly line and design office has done this; different ideas for the system were evaluated and discussed, with a final plan of improvement devised. It was decided to be done by using forms that assembly line fitters fill out when finding an issue with the BOMs used during building a machine- the system was also tested to see if it worked, with success.

In addition to the project, this report contained feedback on the sustainability of the company, looking at the sustainability of Househam sprayers, economically, environmentally and socially/communally. Both the positive and negative facets were evaluated against each other. In addition, the influence the company project to improve communication had upon the sustainability of Househam sprayers was discussed, finding overall it would prosper the company's sustainability.

1.0. Introduction

This report will outline a detailed plan for the development and enrichment of interdepartmental communication, within Household Sprayers as a company.

Interdepartmental interactions occur between colleagues from different departments, such as a conversation between a design engineer and a store's manager. Effective management of interdepartmental communication can solve many common problems within an engineering business, such as Household sprayers (Thompson, 2016).

In detail this report will look at the communication between design, supply chain, and assembly departments within Household sprayers and how improving this can improve the accuracy of production bill of materials (BOMs).

In the process of production, a BOM is referred to parts make up of the building of a machine- like a recipe, or ingredients list for baking a cake. In other words, a bill of materials is simply what parts are required to produce a final product (Simplestudies.com, 2016).

The improvement of production bill of materials (BOMs) will improve the precision of many processes that occur within the Household Sprayers business – giving better business prosperity (Pardaan, 2016).

This report will look at introducing an improvement system, so that the accuracy of production BOMs can be ascertained. The report will also look at the sustainability of Household sprayers economically, environmentally, and socially as a whole, but focusing on the benefits that the enrichment of interdepartmental communication will have upon these sustainability factors.

2.0. Company Project

2.1. Current situation

At Household, there is currently a large, unknown quantity of production BOMs in circulation on the design system, which are being used to make machines.

Currently there is no set system of communication of errors found within production BOMs when they are used by the supply chain departments (stores and purchasing), such as a picking list to make up purchasing lists, and assembly kits for the assembly department.

The errors on the BOMs include missing parts, or the wrong number of parts. The parts not being included on the BOM mean that stores underestimate the usage of that certain part, leading to them prematurely running out. With large, lead-time from suppliers, purchasing cannot replenish the stock fast enough, thus the part becomes totally out of stock. When this happens, it slows production of a machine down as this part cannot be fitted, or another similar part is substituted in (Pardaan, 2016).

Substituting of other parts is not ideal as it makes every machine individual and not built to the same specification. This causes problems when servicing in the field, as a part could be different to the one that is specified on the build BOM for that machine.

Production BOMS being inaccurate makes problems for ALL departments (Simplestudies.com, 2016).

2.2. Why change is needed

Change is needed within Household Sprayers, because lead times on production of machines are causing problems with the customer. This is because machines are being rushed at the end of production to get them out on time for the due delivery date. This can be avoided by making the production of each machine more smooth, and with less wasted time – a fundamental way of doing this is to make sure all the parts needed and required for machines are in stock and ready to fit when needed.

The world is changing as customer's requirements are changing. Often, they want a product immediately, and do not want to have to wait for it. Certain sales can be lost, due to lead times on orders for machines, whereas another producer of sprayers (Bateman for example) may be able to produce a machine in a lower time scale. This is not good for Household's prosperity in the agricultural machinery market.

Change is needed as regards the quality of interdepartmental communication, to help improve the accuracy of the production BOMs. This is because there are machines being built to production BOMs that are incorrect – and the easiest way to rectify this for fitters from the new build assembly department, is to feed back to the design engineers in the design department. At the moment, there is no sort of formal system to do this, and any feedback or suggestions for change are lost on the way up the management line.

Shortages of parts in stores, that have been consumed and used before prediction by BOMs, can lead to extended build times of machines. Give the BOMs the correct information about the type of parts and quantity used, and the purchasing department can make better buying choices. Negotiation with multiple vendors of parts can ensure getting the most competitive prices for parts in bulk numbers, rather than having to purchase small numbers of certain parts when they have run out from stores before prediction.

If stores are given an accurate production BOM, then assembly would be given the right parts, in correct quantities. This means assembly can assemble the machines with no time wasted on waiting for parts to come into stock and be available, and no time wasted with fitters from the assembly line going to stores, to collect parts missed off the production BOM. The time fitters use to get parts from stores is wasted time, and adds to the cost of production of machines, lessening profit from the sale.

Costing of machines' production will be inaccurate currently as inaccurate BOMs will mean the pricing calculated from them is also incorrect. At the moment, if a total part, or a quantity is missing or wrong, the total price to build the machine will be also. Making the accuracy of the BOM 100% will make pricing correct.

Currently, the accounts department is flooded with minor invoices from companies, due to small orders of parts when they have prematurely run out from stores, due to inaccurate BOMs. This means that the prediction of usage of that part has been underestimated. This means accounts are being put under supplementary, unneeded pressure with extra invoices and paper work. Improving accuracy would mean less minor invoices, and thus less strain on accounts.

2.3. How to improve interdepartmental communication

2.3.1. Initial ideas

Errors would have to be found as production BOMs were used to manufacture and build machines. This means fitters would find errors as they accumulated parts given to them by the stores department in build kits, parts given in error - whether the type, lack of, or quantity of parts.

Feedback sheets from fitters when they are building machines on the production line could be used, when they come across an error in a production BOM, which would mean the issue with that BOM is recorded (Reliableplant.com, 2016).

Feedback sheets however could be filled in by personnel from the stores department, as they are also in contact with the production BOMs, but also will hear of the errors as fitters from the production line come to them to replace or change a part that has or has not been given in error due to a BOM which is incorrect. However, this may be flawed, as they would be filling in paper work with a conversation they have heard from someone else. It would be far more efficient for the person who discovers the problem to fill the paper work out i.e. the assembly line fitter.

Returning any paper work would be done by having a file holder on the wall of the assembly line build workshop where filled in forms would be put and collected on a weekly basis, by one design engineer who would have allocated time each week to assess all the suggestions and update the system as appropriate.

Another way to communicate errors would be for a fitter to go straight into the engineering office, and ask a design engineer to modify the BOM on the Household database. However, this suggestion would incur the problem of the design engineer being busy at the time, not being able to modify the database at that current moment, and not recording what has been said by the assembly fitter. This may result in the problematic BOM not being corrected, and the process of making the production BOMs correct voided.

Any initiation of a new improvement system for production BOMs would be done when order numbers are low, such as the yearly lows in sales during certain months within the U.K., according to given data for agricultural sales figures from the Agricultural Engineers Association.

2.3.2. Chosen system

The system chosen involves a feedback form system, which will be filled out by the assembly line fitters. See an example of the suggested form in the appendices, figure 1.

These forms will be collected from a set place in the workshop once a week, by a design engineer that has enough product knowledge to assess if the suggestion by the fitter needs to be done- and the production BOM updated and amended. This system should be implemented during a quiet time of production. This would be during November to February time, according to sales figures given by the Agricultural Engineers Association (AEA, 2016).

2.4. Analysis of proposal system to be put in place

2.4.1. Worked example of the system

One production BOM was used to build a machine, specifically a spray boom on a Household Spirit, as seen in figure 2 in the appendices. This production BOM was scrutinised, to attain its accuracy- this was done by asking a fitter on the production line what parts they are short of in the build kits, made up by the production BOMs. It was ascertained that 57 individual parts were missing, and the production BOM was updated, as in figure 3 in the appendices. The cost of these added parts was calculated using the software the BOMs and costing are created in, Microsoft Dynamics NAV- the cost being £6.84.

This cost on its own is low. However a machine can be made up of hundreds of BOMs, all with mistakes in, that have varying values- with some much greater than this given example. In addition to this are the labour costs for ordering, collecting, and waiting for correct parts (Reliableplant.com, 2016).

2.4.2. Benefits of system

Improving the accuracy of production BOMs that machines are built to can have significant benefits for company prosperity (Reliableplant.com, 2016).

Completeness of BOMs influences the end quality of the built machine. If fitters have the parts available to hand to fit in the order needed to build the machine properly, build quality is assured to be high. This is because parts are put on in the order intended, rather than out of order where parts can be forgotten to be fitted to machines during the build process. Fitters can spend less time chasing parts, and more time building the machines. This means cost of production of each unit will be reduced as the fitter is not wasting time securing parts they should already have, or taking parts back that they do not need. Thus units are produced more quickly and accurately. This also makes sales of each unit easier for the sales department, as they can promise earlier delivery dates, which can be a sale maker.

Best lead times on the production of a machine can be attained, as fitters are not having to waste time going to stores to get parts missed from BOMs and build kits. In addition, they are not having to wait for parts to be made by the fabrication shop, or to come in from delivery from external suppliers when stocks in stores have run out due to prediction of stock levels being out- caused by items being missed from BOMs or incorrect quantities being noted upon them. Also, this will reduce strain on the purchasing department, as they will have to make less small orders to suppliers when a minor amount of parts have prematurely run out of stock before prediction of use said so. Furthermore, this will then help accounts as they will have fewer invoices to deal with, as purchasing will place fewer orders. In addition, purchasing will have more freed up time, to liaise with suppliers for better deals on purchased parts- thus reducing again the cost of production of machines.

By fitters feeding back if they are using parts or not in certain BOMs, it will stop obsolete parts from being produced by the in-house fabrication shop, and stop obsolete parts being ordered from outside suppliers- again, saving cost to the company, making production of machines more cost efficient.

By refining the BOMs to have 100 per cent accuracy, the estimation of cost of production will be more accurate, thus profit per unit sold can be assessed more precisely (Simplestudies.com, 2016).

2.4.3. Disadvantages of system

There are also disadvantages to this proposed system, which are mostly based on employee effort and ethos towards the company's prosperity.

More paper work would be created due to this proposed system of a feedback form. However, with this said, if paperwork is collected weekly and time allocated to the system being followed through, and feedback being fed into the system which controls the production BOMs generation, this would be minor and easily overcome. There would be an accumulated process of improvement and accuracy feeding in to the system. Initial discussions on this suggested improvement project have been well received.

If the fitters who are building the machines do not take pride in their own work, and also do not care for the quality of the machine they produce, then the paper feedback forms will simply not be filled out by themselves when they come across a problem with the BOMs or kits. However, if a reward system was put in for completion of the forms to a high standard, such as company team building outings then this problem could be eradicated.

2.4.4. Predicted overall effect of the system

Advantages of the system outweigh disadvantages, so that the overall effect would be a better quality machine produced, in less of a lead time from the initial order, in a more cost effective and lean manufacturing process.

This would lead to better company profits on each unit sold, and units being sold having a better working life in the field- thus prospering Household's build quality to the customers. This would lead to more sales (Simplestudies.com, 2016).

In addition, Household employees would have a better working ethos, if during their working hours they came across less problems with the building of machines due to the BOMs gradually becoming more and more accurate.

In conclusion, the overall effect of the system being implemented within the build process would lead to bigger profits, and better employee prosperity and satisfaction.

3.0. Sustainablity at Household Sprayers

3.1. Positive Facets of Sustainability

3.1.1. Economically

The heating tunnel from the workshops uses waste oil from Household machines, saving the company costs. This activity is fully in line with the company's outlook and fulfils an environmental and community purpose too as so many of Household's beliefs do. This reduces production costs and improves efficiency, as in-house waste products are recycled. The oil is carefully collected in tubs, not allowed to leech into bare earth where environmental pollution would occur. This outlook is seen further in the bulk requesting of parts at the end of each day to the other manufacturing site within Lincolnshire avoiding multiple trips the next day.

Many more economic benefits are gained alongside environmental and social ones too, as below.

3.1.2. Environmentally

Water is sourced naturally at the Leadenham site and all machines are only tested with this natural water – no chemicals. This is a prudent use of natural resources. This makes sound economic sense as costs are reduced and impact on the local community where cleaner air is desirable. In line with this, the wash bay at Woodall Spa has a catch in the drain, which stops non-biodegradables going into the drainage system. The testing field is adjacent to the factory, thus less fuel is required reducing pollution, protecting the environment and its biodiversity as well as the community's interests. Similarly, vehicles for repair from customers are transported to the servicing department under their own steam wherever possible to avoid heavy reliance on heavy transportation to convey them. Again, this has a positive impact for the environment as well as for those living there that considers this company policy attractive. Costs are reduced for the company ensuring economic viability too. On a daily basis, employees' trips between sites for meetings and company activities are also shared demonstrating the company ethos, which pervades the general outlook.

When machines are repaired or new ones completed for delivery, the same ethos applies with a view to sustainability for the environment in tandem with the same economic and community advantages too by operating bulk delivery wherever possible. Company time is saved, fuel costs are reduced and the environment gains, recognising the needs of everyone. Scrap metal is recycled as is cardboard to reduce impact on the environment too. This is the outlook of the company and is an innate part of its ethos. An external company, to ensure maximum environmental sustainability is supported, sorts the general rubbish. The community locally benefits positively too by less, needless waste going into landfill.

Eco-boost vans (Vauxhall) are used exclusively by engineers to travel all over the country reducing the negative, environmental impact locally and nationally. They use less fuel to reduce the Company's carbon footprint and are, of course, economic to run.

All big machines manufactured are fitted with Michelin Xeobib tyres- these are specifically designed to give the least ground pressure, thus ensuring that the impact of the heavy machines, do not cause high concentrations of soil compaction (Michelin, 2016).

Company policy applies to lighting too throughout the sites offices, where motion sensors are required.

Estimation of CO2 emissions by a typical company to government standard is 6390 tonnes of CO2/year (CoolClimate, 2016).

However according to AMEE, Household only produces 2,264 tonnes of CO2/year- showing they are very economical in their manufacturing operations (Amee.com, 2016).

3.1.3. Social/Community

It is company policy that many parts for repairs are created in-house in order to provide local jobs for the community and the local economy, retaining money within the locality. Of course this makes sound economic sense too, as well as lessening the environmental impact of increased transportation. Equally, customers have the benefit of a service exchange on parts, which can be reconditioned. Farmers can obtain new parts at reduced costs when trading in used parts, benefitting the community as well as being environmentally/economically sound. Parts are reconditioned and sold on. Through all of these, economically for the company, margins are reduced too.

Household prides itself on the use of local companies for support when needed to maintain jobs and retain money locally as for example: Rainthorpe haulage, local bakery for catering, RP coatings limited (powder coating), IT support, steel fabrication for more complex parts, etc. The Company has a policy of using external, service contractors in remote areas to support distant, local communities more quickly and efficiently. The company has a strict Personal Protection Equipment (PPE) policy whereby they provide staff with boots, gloves, goggles and protective clothing such as overalls, ensuring worker health and safety. All toilets have Dyson hand dryers which are more healthy and efficient time savers when employees may be using the facilities up to ten times a day (Dyson, 2016).

Local and National charities are supported through donation boxes on all counters. £1500 was raised last year. Harper Adams University is an example of the type of community supported - by the funding of sports' equipment.

The company reaches beyond the local and national to international customers providing translations of company literature such as machine manuals. They received an award for this in 2010 from the UK Trade and Investment East Midlands International Business Awards. This supports business growth and sustainability on a larger stage. This opens up an international market for Household sprayers (Lincolnshire, 2010).

3.2. Negative Facets of Sustainability

3.2.1. Economically

Currently, when a customer needs a part, a service engineer can be sent with this one part to deliver it. This is not efficient, when it costs fuel money and wages for that employee to be sent, especially when it can be done at less of a cost by sending the part by courier, on a pre 9am delivery. Doing this also reduces the value of profit on the product, as money has been over spent delivering it (TNT, 2016).

Also, frequently, service parts are not in stock, such as cab air filters. These cannot then be sent with a service engineer when they are carrying out a machine 500-hour service, and have to be sent separately when they come into stock, which is not financially efficient. This also links when the stores department do not send the correct parts with service engineers, causing engineers not to be able to carry out jobs when getting to customers' premises- such as a recent instance when a service

team were working abroad, and were not sent a vital part to repair a machine- this caused the team to do a 10 hour round trip to Oslo in Sweden to pick up a part so the job could be finished. Again, this is a show of inefficiency, and also a bad show of environmental conscience.

In the sales office, currently staff have the ethos that if they are away from their desks they do not need to answer the phone. Currently, lots of phone calls to sales personnel are missed due to them leaving their mobile phones in the office when they leave. If the personnel adapted the ethos and practice to be more efficient in answering calls, by always carrying their mobile phones with them, more sales could be attained.

Household run two lorries for transport jobs but the majority of the time there is one lorry that is not in use, and is standing on the yard. This is economically unviable to have a lorry that needs to be taxed, and MOT'd and tested very regularly sitting doing no work. When the infrequent uses are made of it, it would be cheaper to hire in extra help from an external supplier.

All these negative, unsustainable, economic factors have negative, environmental detriments too.

3.2.2. Environmentally

In addition, water at the Woodhall Spa site used for testing machines is from the refined mains source, and after use it is dumped down the drain, which is a high waste of natural resources, whilst also being economically hard hitting. A solution to this would be to have a borehole made into the natural water table, to supply all the water to the Woodhall site, which would be greatly advantageous environmentally.

3.2.3. Social/Community

Staff currently are undertrained in vital skills needed to carry out certain jobs comprehensively, such as the re-gassing of air conditioning units on machines. Staff have been trained in handling of the actual gases involved, but not in the next, important stage of re-gassing the units proficiently on machines. This lack of training is also apparent in the new build department, with new staff being taken on and given no formal training on building of machines. They are simply expected to pick it up as they go. This lack of training for staff is highly detrimental to their worker health and safety, and to the quality of machine build/service given to customers by Household staff.

Furthermore, when internal jobs are advertised, and interviews are held, favouritism is applied towards candidates by those manning the interview process, giving possible interviewees unfair chances of attaining a new position in the company - this leads to unacceptable friction and dissatisfaction on a social level within Household.

When the service department raises service orders, the items needed for the job are currently entered manually. These manual inputs do not contain parts numbers or the correct descriptions- thus leading to confusion when service engineers try to get parts needed from the stores department. What normally ensues is a back and forth question time with departments trying to assess which part is being specified on the service order. A way to overcome this problem would be to have service orders generated by selecting part numbers on the internal parts database. Generating a list this way would denote the correct part numbers and description. This would make the whole process much more easier for staff, whilst also being more economical as less time would be wasted by employees.

3.3. Company Project effect on Sustainability

Economically the company will make more money, as there will be less wasted time by fitters during the build of machines- thus machines can be made more efficiently, and add value to the product.

Environmentally, less waste will be produced with obsolete parts not being fabricated from raw steel profiles, and thrown away.

Socially, staff will feel better in the work place, as they are working to positively help their day to day jobs, cutting down the amount of errors in production BOMs, so an improved process will evolve where they get on with their roles within the company without having to solve issues that should not arise due to incorrect BOMs.

4.0. Conclusion

It has been found that incorrect production BOMs are causing machines to be built in longer lead times, and at extra expense than is necessary. A system has been created to improve the accuracy of production BOMs, by using a feedback system from the assembly line fitters- when they find an issue with a BOM. A design engineer will then process the feedback forms, and update the production BOMs where it is needed. It has been proven that the system works, with a trial run on a single production BOM- which had parts both missing, and had been under evaluated in its costing on Microsoft Dynamics NAV.

In addition, the sustainability of the company has been evaluated and discussed in detail, showing mostly that the company runs sustainably, but with a few changes in operations a lot more sustainability could be attained. The negatives have been discussed, with possible, obvious actions to solve issues given. Also, the impact the improvement to production BOM feedback from the assembly line has been evaluated, and thus shows the project would better the company's sustainability- this its self reinforces the importance of the project being put into place within the company's machine build process.

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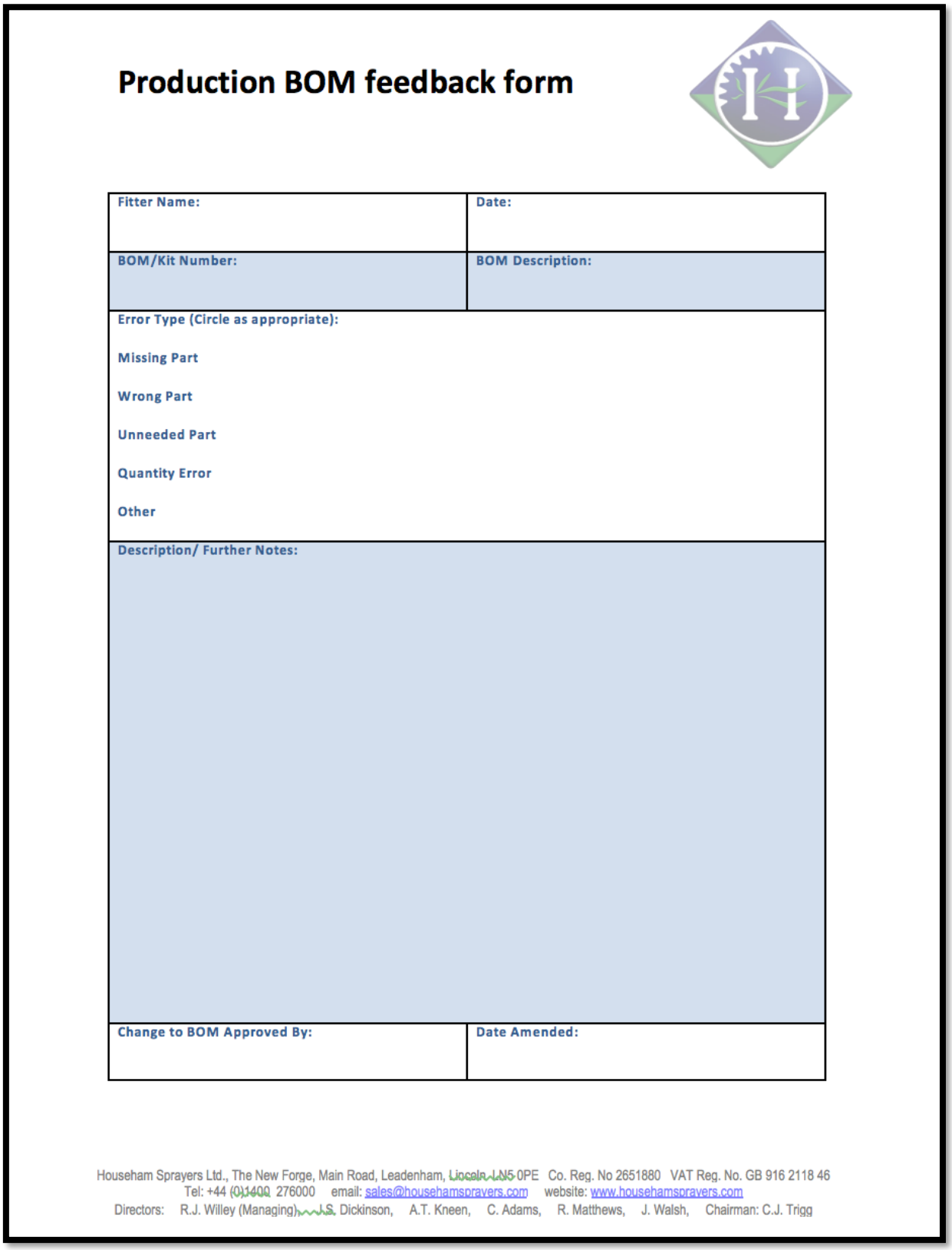
6.0. Appendices



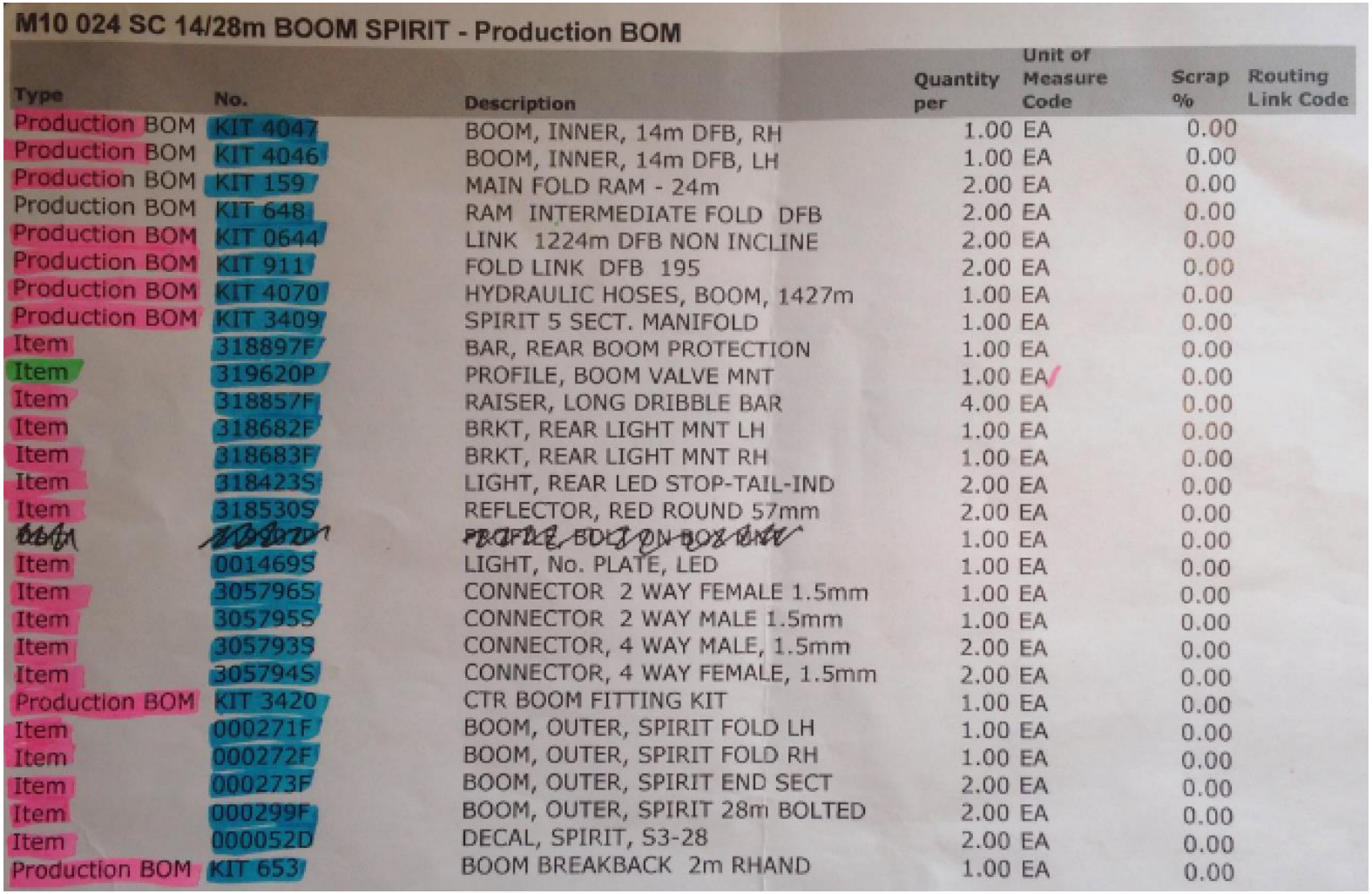
Production BOM feedback form

Fitter Name:	**Date:**
BOM/Kit Number:	**BOM Description:**
Error Type (Circle as appropriate): **Missing Part** **Wrong Part** **Unneeded Part** **Quantity Error** **Other**	
Description/ Further Notes:	
Change to BOM Approved By:	**Date Amended:**

Household Sprayers Ltd., The New Forge, Main Road, Leadenham, Lincoln LN5 0PE Co. Reg. No 2651880 VAT Reg. No. GB 916 2118 46
Tel: +44 (0)1400 276000 email: sales@householdsprayers.com website: www.householdsprayers.com
Directors: R.J. Willey (Managing), J.S. Dickinson, A.T. Kneen, C. Adams, R. Matthews, J. Walsh, Chairman: C.J. Trigg

(Source: Authors Own)

Figure 1 Example of feedback sheet from fitters to report issues with production BOM or kit



M10 024 SC 14/28m BOOM SPIRIT - Production BOM

Type	No.	Description	Quantity per	Unit of Measure Code	Scrap %	Routing Link Code
Production BOM	KIT 4047	BOOM, INNER, 14m DFB, RH	1.00	EA	0.00	
Production BOM	KIT 4046	BOOM, INNER, 14m DFB, LH	1.00	EA	0.00	
Production BOM	KIT 159	MAIN FOLD RAM - 24m	2.00	EA	0.00	
Production BOM	KIT 648	RAM INTERMEDIATE FOLD DFB	2.00	EA	0.00	
Production BOM	KIT 0644	LINK 1224m DFB NON INCLINE	2.00	EA	0.00	
Production BOM	KIT 911	FOLD LINK DFB 195	2.00	EA	0.00	
Production BOM	KIT 4070	HYDRAULIC HOSES, BOOM, 1427m	1.00	EA	0.00	
Production BOM	KIT 3409	SPIRIT 5 SECT. MANIFOLD	1.00	EA	0.00	
Item	318897F	BAR, REAR BOOM PROTECTION	1.00	EA	0.00	
Item	319620P	PROFILE, BOOM VALVE MNT	1.00	EA	0.00	
Item	318857F	RAISER, LONG DRIBBLE BAR	4.00	EA	0.00	
Item	318682F	BRKT, REAR LIGHT MNT LH	1.00	EA	0.00	
Item	318683F	BRKT, REAR LIGHT MNT RH	1.00	EA	0.00	
Item	318423S	LIGHT, REAR LED STOP-TAIL-IND	2.00	EA	0.00	
Item	318530S	REFLECTOR, RED ROUND 57mm	2.00	EA	0.00	
[illegible]	[illegible]	[illegible]	1.00	EA	0.00	
Item	001469S	LIGHT, No. PLATE, LED	1.00	EA	0.00	
Item	305796S	CONNECTOR 2 WAY FEMALE 1.5mm	1.00	EA	0.00	
Item	305795S	CONNECTOR 2 WAY MALE 1.5mm	1.00	EA	0.00	
Item	305793S	CONNECTOR, 4 WAY MALE, 1.5mm	2.00	EA	0.00	
Item	305794S	CONNECTOR, 4 WAY FEMALE, 1.5mm	2.00	EA	0.00	
Production BOM	KIT 3420	CTR BOOM FITTING KIT	1.00	EA	0.00	
Item	000271F	BOOM, OUTER, SPIRIT FOLD LH	1.00	EA	0.00	
Item	000272F	BOOM, OUTER, SPIRIT FOLD RH	1.00	EA	0.00	
Item	000273F	BOOM, OUTER, SPIRIT END SECT	2.00	EA	0.00	
Item	000299F	BOOM, OUTER, SPIRIT 28m BOLTED	2.00	EA	0.00	
Item	000052D	DECAL, SPIRIT, S3-28	2.00	EA	0.00	
Production BOM	KIT 653	BOOM BREAKBACK 2m RHAND	1.00	EA	0.00	

(Source: Authors Own)

Figure 2 Original, incorrect production BOM for Househam Spirit Boom

M10 024 SC 14/28m BOOM SPIRIT - Production BOM

Type	No.	Description	Quantity per	Unit of Measure Code	Scrap %	Routing Link Code
Production BOM	KIT 4047	BOOM, INNER, 14m DFB, RH	1.00	EA	0.00	
Production BOM	KIT 4046	BOOM, INNER, 14m DFB, LH	1.00	EA	0.00	
Production BOM	KIT 159	MAIN FOLD RAM - 24m	2.00	EA	0.00	
Production BOM	KIT 648	RAM INTERMEDIATE FOLD DFB	2.00	EA	0.00	
Production BOM	KIT 0644	LINK 1224m DFB NON INCLINE	2.00	EA	0.00	
Production BOM	KIT 911	FOLD LINK DFB 195	2.00	EA	0.00	
Production BOM	KIT 4070	HYDRAULIC HOSES, BOOM, 1427m	1.00	EA	0.00	
Production BOM	KIT 3409	SPIRIT 5 SECT. MANIFOLD	1.00	EA	0.00	
Item	318897F	BAR, REAR BOOM PROTECTION	1.00	EA	0.00	
Item	318857F	RAISER, LONG DRIBBLE BAR	4.00	EA	0.00	
Item	318682F	BRKT, REAR LIGHT MNT LH	1.00	EA	0.00	
Item	318683F	BRKT, REAR LIGHT MNT RH	1.00	EA	0.00	
Item	318423S	LIGHT, REAR LED STOP-TAIL-IND	2.00	EA	0.00	
Item	318530S	REFLECTOR, RED ROUND 57mm	2.00	EA	0.00	
Item	001469S	LIGHT, No. PLATE, LED	1.00	EA	0.00	
Item	305796S	CONNECTOR 2 WAY FEMALE 1.5mm	1.00	EA	0.00	
Item	305795S	CONNECTOR 2 WAY MALE 1.5mm	1.00	EA	0.00	
Item	305793S	CONNECTOR, 4 WAY MALE, 1.5mm	2.00	EA	0.00	
Item	305794S	CONNECTOR, 4 WAY FEMALE, 1.5mm	2.00	EA	0.00	
Production BOM	KIT 3420	CTR BOOM FITTING KIT	1.00	EA	0.00	
Item	000271F	BOOM, OUTER, SPIRIT FOLD LH	1.00	EA	0.00	
Item	000272F	BOOM, OUTER, SPIRIT FOLD RH	1.00	EA	0.00	
Item	000273F	BOOM, OUTER, SPIRIT END SECT	2.00	EA	0.00	
Item	000299F	BOOM, OUTER, SPIRIT 28m BOLTED	2.00	EA	0.00	
Item	000052D	DECAL, SPIRIT, S3-28	2.00	EA	0.00	
Production BOM	KIT 653	BOOM BREAKBACK 2m RHAND	1.00	EA	0.00	
Production BOM	KIT 654	BOOM BREAKBACK 2m LHAND	1.00	EA	0.00	
Item	4002316050	BOLT M16 x 50 HT BZP	16.00	EA	0.00	
Item	4044516024	NUT NYLOC M16 A2 TYPE P	16.00	EA	0.00	
Item	4066516030	WASHER M16 A2 FRM A HD	32.00	EA	0.00	
Item	4001508020	SETSCREW M8 X 20 A2	6.00	EA	0.00	
Item	4067508015	WASHER M8 SPRING SINGLE COIL	6.00	EA	0.00	
Item	4044508013	NUT NYLOC M8 A2 TYPE P	12.00	EA	0.00	
Item	319907P	PROFILE, BOLT ON BOX MNT	1.00	EA	0.00	
Item	4066508016	WASHER M8 A2 FRM A HD	22.00	EA	0.00	
Item	4001508025	SETSCREW M8 X 25 A2	12.00	EA	0.00	
Item	4043508013	NUT PLAIN M8 A2	4.00	EA	0.00	

Added parts that were missing from original BOM in error

(Source: Authors Own)

Figure 3 Modified production BOM, containing correct list of parts