7 Technology and Project Management

7.1 Introduction

The introduction of a new technology into a product is often viewed as entailing risks that may outweigh the benefits and bringing new uncertainties to the business. These barriers to technology led innovation could also be viewed as applying to the introduction of SIDCOM technologies. However, the example of the SIDCOM user experiments conducted with 13 companies, mostly small companies, indicates that these barriers are often perceptions and not fundamental barriers to the adoption of the technology. The main results impacting on the technology and project management aspects of SIDCOM technology projects are discussed in this section of the report.

7.2 General Results

A total of 13 user companies successfully completed user experiments within the SIDCOM project. The results of these user experiments highlighted the following important points:

1. The average planned activity level by the user companies to produce a fully operational prototype was 207.5 person days. The actual number of person days required 221.75 person days. This represents an average deviation of +6.9%. Working in new technology areas generally gives a high degree of uncertainty and error in the accuracy of project planning estimates. The average deviation is relatively small and in comparison to many reported projects minimal. This indicates the project planning risk involved in adopting these technologies is relatively low in comparison to many other technology implementation projects.
2. The range of the actual person days varied from 93% (lowest) to 126% (highest). If these 'outrider' results are removed the average deviation for the remaining 11 user experiments was only +5.3%.
3. The planned budget for the user experiments was on average 91.45 K Euro (excluding overheads). The actual average expenditure was 81.6 K Euro, or on average 89% of that planned.
4. The average planned subcontractor costs was 38.35 K Euro and the actual average expenditure was 29.4 K Euro (representing approximately 77% of the expenditure originally anticipated). The level of subcontractor support (in budgetary terms) between the user companies varied significantly, ranging from typically 15% to 100% of that anticipated. The variation between user companies was generally related to company design experience and not to realisation technologies, and no statistically significant results could be derived for technology categories (e.g. 125 K Hz, 13.56MHz, semi-active categories etc…). The results indicate however those companies with developed, integral microelectronics design expertise typically expended approximately 27% of their anticipated subcontractor budget. This indicates that the adoption of the technology can be achieved by companies with relatively modest electronic design capabilities without excessive subcontractor support.

7.2.1 Project Planning Example –125 K Hz RFID technology

Please refer to User Experiment conducted by Assulub SA on the SDICOM web site (www.eurosidocm.com) for full details.

The purpose of the project was to use the RFID technology to manage the lubrication schedules of critical process machinery. This required the correct automatic identification of lubrication points in a factory environment, and then the control of manual lubrication of these production units for compliance with the planned maintenance schedules.

Original Equipment, and Final Assulub Reader and Tag Units

The original and actual work plan for this user experiment is indicated in the following Gantt Chart, where the deviations are highlighted in yellow (lighter shade).

Work plan: (planned actual planned and actual)																		
Gantt Chart																		
Task	**Project Months**																	
	01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**
1 Management																		
2 Training																		
3 Specification																		
4 Mechanical Design																		
5 Hardware Design																		
6 Software Design																		
7 Software PC Design																		
8 Prototype manufacture																		
9 Evaluation																		

The deviations were minor, and were caused by a factory shutdown period (month 10) and by the fact that the sub contractor wanted to carry out task 5, 6 and 7 in a more compressed timescale than originally planned. An extended period of evaluation was also required to ensure customer acceptance of the project and to resolve software coding errors that were detected during this evaluation. These project management issues are considered generic to electronic product implementations in general and are not specific issues related to the technology.

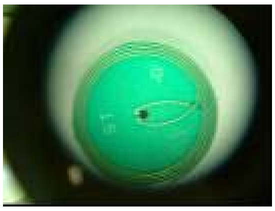
The main challenges encountered during the application experiment were:

1. The antenna and transponder design were originally considered to be a potential problem because the antenna coil was to be mounted on the steel housing of the grease coupling and that the transponder is often mounted on metal parts of the machine. These metal parts affect the RFID magnetic field. However, a prototype antenna was built and evaluated, and found out that it worked properly. It is important that the reading distance is correct so that the transponder is recognized when the grease coupling is snapped to the grease nipple and not before that. The reading distance is depending on the material the transponder is mounted on. In order to always have the same reading distance it was decided to mount a steel washer beneath the transponder.
2. There were some problems in achieving the correct magnetic field for the reed switches used in the product. The solution was to place one magnet on the north side facing the reed switch and the other magnet the south side.
3. Device specification errors in that the dimensions of the reader module was actually 40x40x10 and not 33x22x10 as stated in the data sheet. That caused some redesign; fortunately the discovered the fault before the design of the PCB had started. This stresses the importance of checking device manufacturers actual products and not to design only on outline specification drawings.
4. Subcontractor negotiations were required to resolve the fact that the subcontractor wanted to be paid money to correct errors in the software and hardware, despite the fact that a very well specified functional specification existed. This was resolved suitably.

7.2.2 Project Planning Example –13.56 M Hz RFID technology

Please refer to User Experiment conducted by KTI S.r.l. on the SDICOM web site (www.eurosidocm.com) for full details.

The purpose of the project was to use RFID technology to automate the laundry processes applied to various garments using a tag sewn on to the items of laundry.



The new LAUNDRY-TAG
Picture taken at stereoscopic microscope

The product resulting from this project is a complete RFID system made up of a passive read/write anti contention transponder (compliant with standard IEC/ISO 15693) working at 13.56 MHz and its reader/writer unit and the antenna. The final prototype is a transponder in disc package, diameter 20mm, internal thickness 0.46 mm and external thickness 2 mm.

The developed reader/writer unit allows to read all the transponders on each single garment contained in the bags, when the garments are delivered to the laundry, and to write information on it during the cycle.

This project was conducted over a period of 12 months. The workplan is shown on the next page. The main project deviations were related to:

- The laundry tag assembly and preliminary evaluation required more time than originally budgeted.
- The implementation and testing of the anti-collision protocol required more time than estimated.
- More extensive evaluations and final testing were conducted than originally planned.

However, even allowing for these variations the work was conducted within the original timescales.

The Company was originally worried about the investment required to develop the prototypes within the short time of the program and by the additional investments required for the industrialisation phase. Support from the TCE helped to overcome all those barriers; this help consisted of the following activities:

• Preliminary meetings to clarify a lot of concerns answering most of the doubts that the company had at the beginning.

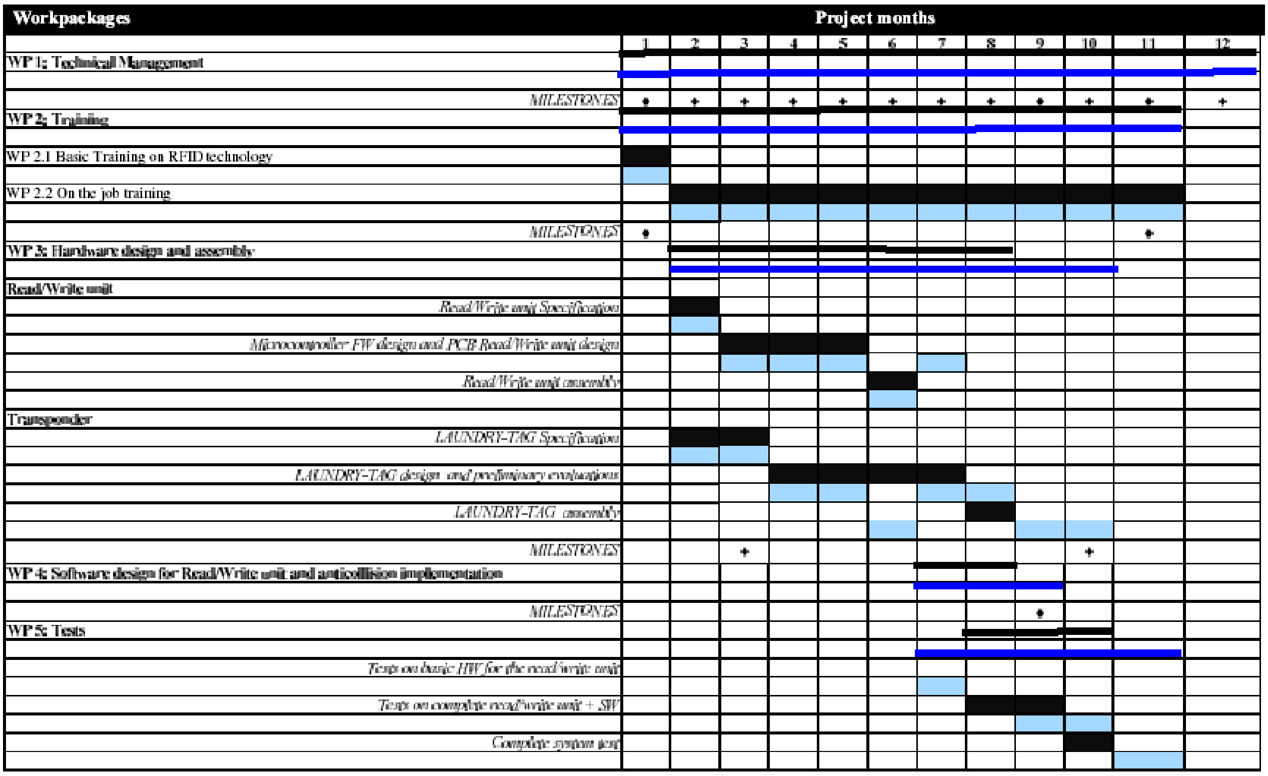
• A precise and detailed survey of the market situation, which identified the weaknesses of the existing products and highlighted the characteristics and specific requirement for a new innovative product.

• A precise and detailed awareness training delivery about the available technologies, their advantages, disadvantages and cost.

• Recommendation about the importance of involving the final users (industrial laundry) in the project from its very beginning

• To minimise the barrier related to the development risks, a detailed plan defining the availability of the agreed deliverables at planned milestones, with periodic design reviews and monitoring meetings was developed.

WORKPLAN: PLANNED AND ACTUAL TIME SCHEDULES



7.2.3 Project Planning Example –Non-contact sensing

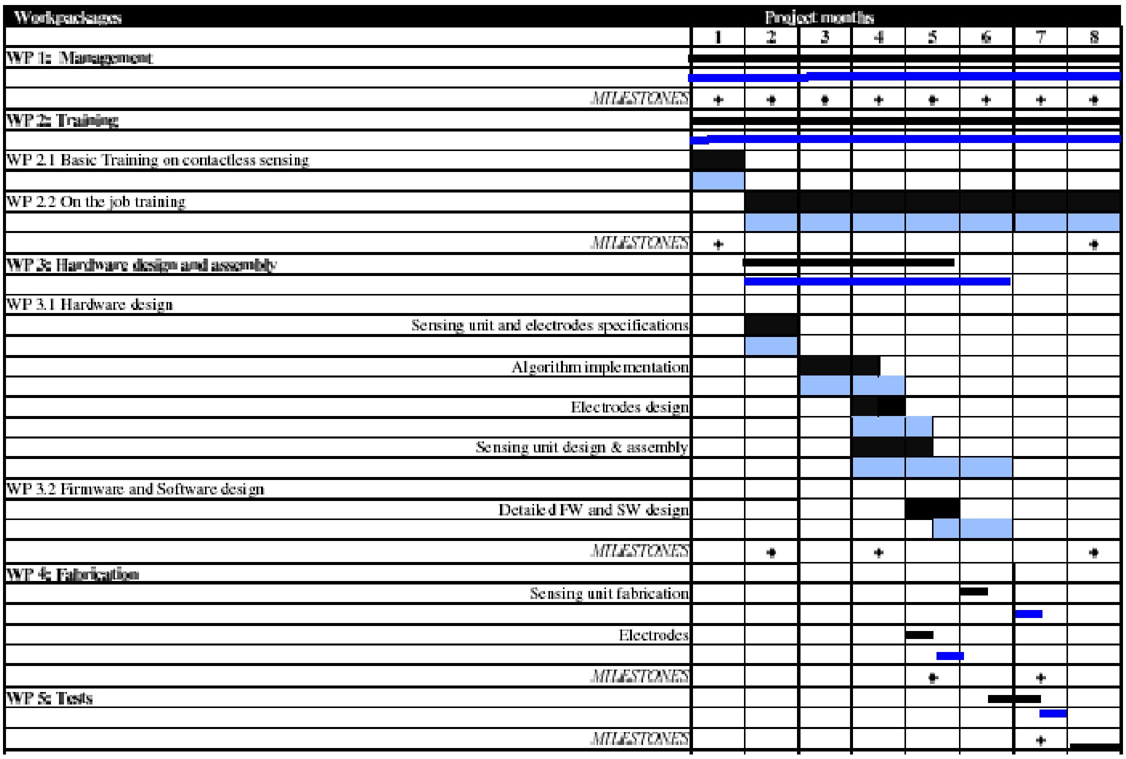
Please refer to User Experiment conducted by Bonferraro on the SDICOM web site (www.eurosidocm.com) for full details.

The technical objective of this user experiment was to add a low cost sensor solution to a domestic dishwasher that allowed the level of water softening resins in the machine. Many water supplies contain hardness minerals, like calcium and magnesium. When present in water they can form a scale and create problems in washing machines, heaters, dishwashers, coffee makers, humidifiers and plumbing systems. To stop the harmful effects of these hardness minerals a water softener system is presently embedded in every dishwasher manufactured by the company.

The use of contactless sensing to introduce a closed loop system for the control of resins regeneration, delivered several benefits including amongst others:

- Automatic control of salt quantity needed for the regeneration process and to allow an automatic regulation of the system in dependence of the hardness of water supplied, thus avoiding the manual set up by the final user.
- A minimization of the environmental impact of the use of the dishwasher by reducing power consumption, reducing the waste of cleaning products and subsequent pollution levels.

The project was completed within 8 months as indicated in the following Gantt chart.



The work plane was carried out in schedule with the total project duration, with only minor deviations in terms of the timing of the individual activities. The most significant deviation was under the task of sensing unit design and assembly, whose delay was partially related to the extension, in time and effort, for the activities of algorithm implementation and electrodes design.

The project entered new technology areas for the company, and required new algorithms to be developed. The work included:

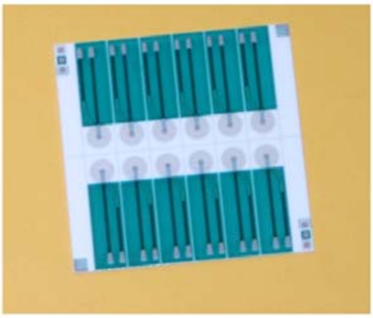
- Modelling the water effect with a low pass filter and cancelling this effect through an appropriate choice of the duration of the pulses of the burst used to acquire the signal
- Rules for design of the electrodes. Verification of influence of different electrodes (coaxial metal foils internal and external to the resins tank).
- Reliability issue (repeatability of measures), including some evaluations in condition of resin polarization
- Setting of evaluation workbench and realisation of suitable evaluation sensing electronics. The equipment used was a complete set of the softener, with ionic exchange elements and all external pipes and electro valves. Parts were made accessible for the right placement of electrodes. Preliminary evaluations done to verify how the technology actually performs in measuring resins efficiency degeneration against volume of water processed were critical to t he success of the project. This sensing technique has never been applied before, either by the user nor by other white goods manufacturers. An unique relation between the slope of sensed signals and the degree of water hardness was verified and an adequate algorithm was drawn.

The development of such a technology implementation project plan is considered essential for the successful outcome of sensing technology projects.

7.2.4 Project Planning Example –Active RFID technology

Please refer to User Experiment conducted by Trace Gmbh on the SDICOM web site (www.eurosidocm.com) for full details.

The objective of the user experiment was to develop a simple, small and reliable sensor solution connected to a RF transmitter that allowed critical process parameters such as oxygen, pH, or glucose levels to be monitored in small fermentation systems. This is required to meet the needs of the biotechnological industry for fermentations of micro bacteria and tissues for the production of specific drugs such as insulin. The sterile environment in the fermentation vessel is unaffected by the RF sensors as they are without any mechanical connection to the environment outside the vessel.



Sensor Assemblies and Flow Sensor Unit

The actual and original planned work plans are shown in the following Gantt chart.

Planned
Actual

Project Time Plan																
#	Task	Project Months														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Training	■														
		■	■													
2	Technical Management	■	■	■	■	■	■	■	■	■	■	■	■			
		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
3	Specification	■	■	■												
		■	■	■	■											
4	Design				■	■	■	■	■							
						■	■	■	■	■	■	■	■	■		
5	Evaluation										■	■				
														■	■	■

The main reason for the deviation in the time plan was the need for detailed evaluation of alternative sensor solutions, and the technical development of the preferred sensor solution (including packaging solutions). This indicates as in Bonferraro's user experiment the need for detailed sensor test bench and evaluation programs within the overall technical project plan. The implementation of the RFID interface was conducted as originally planned.

7.3 Training and Equipment Expenditure

Training: A review of the SIDOCM user experiments conducted on www.eurosidcom.com indicates that many companies only achieved training in its new technology area using dedicated subcontractor or TCE support. This indicates a shortage of specialised bespoke RFID training courses. Generally technical support was only available from the selected device manufacturer, and where companies were small this support was limited as the suppliers preferred to support companies with the potential for larger scale production orders for these components. Such factors should be factored into the project planning for projects in this technology area.

Equipment Expenditure The average planned costs for development equipment for the 13 user experiments was 900 Euro. Although estimates were low, the actual equipment cost was on average only 150 Euro. The result does indicate the modest capital investment costs required to adopt the SIDCOM non-contact technologies. Indeed 10 of the 13 user companies did not purchase new equipment, and were able to deliver operational prototypes using existing CAD and other development tool sets. This indicates that one potential barrier to adoption (investment cost barriers) does not exist for the SIDCOM technologies.

7.4 Economic Impacts

The aggregated economic projections achieved by the user companies was:

Average payback period: 21.75 months

Average reported ROI (return on investment) over 3 years: 240%

These aggregated figures include the companies own industrialisation costs involved in taking the basic prototype to market. The average reported industrialisation cost was 71.5 K Euro. This value varies significantly from user company to user company, largely as a result of the target market (e.g. medical markets as in Getmed’s case with long and arduous approvals processes) or where investments in manufacturing equipment (as in PAV card) was required.

However, on an aggregated level as the average user experiment cost was 81.6 K Euro, the return on investment on the user experiment budget only would be expected to be of the order of 450%.

Whilst these quantified economic results were projected by the user companies, a series of other economic benefits which would impact positively on the user companies’ performance were reported. These benefits included development of new services or markets. The number of user companies reporting these benefits is indicated in the following terms where the number is expressed as a percentage of the 13 user companies involved in the sample.

Reported Economic Benefit	% Reported
Increased Sales	100.0%
Increased Market Share	85%
New Markets Reached	46%
New Services Delivered	46%
Improved Export Potential	69%
Reduced Product Costs	23%

Reported Economic Benefits of the Adoption of SIDCOM Technologies

One of the most noteworthy aspects of the benefits reported is the impact on the innovation impact of the adoption of the SIDCOM technologies. This is evident in the delivery of new services or entry into new markets, where a total of 69% companies engaged in the SIDCOM project reported one of these developments. Finally, a major impact in terms of improved export potential is reported (69% of all companies reporting improvements).

The addition of new technology to a product to add new services would normally be expected to add new costs to the product. Generally, this was true for the SIDCOM project as the new added value was delivered at a generally low incremental increase in cost. However, this is not inevitable. 23% of the user companies reported a decrease in product cost. The general conclusion is that SIDCOM technologies may deliver significant end customer benefits (leading to increased sales and new market opportunities) that outweigh any marginal increase in the product costs.

7.5 Conclusion

The SIDCOM user experiments indicate the implementation of these technologies can be achieved successfully without significant risk, project planning difficulties or excessive financial investments. The adoption of the technologies can also deliver significant innovation and economic returns for companies adopting these technologies.