

## EU-PLF

# Deliverable 2.2

## Systems operational at 15 farms

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Dissemination level		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	X
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	



# Smart Farming for Europe

Value creation through *P*recision *L*ivestock *F*arming



## 1. Introduction

To demonstrate the potential of PLF systems on farm, a number of PLF-technologies were implemented on in total 10 fattening pig farms, 5 broiler farms and 1 calf farm. The farms were selected by the technology providers (Fancom, Soundtalks, PLF-Agritech and Royal Veterinary College). Selections were made based on a number of selection criteria, listed in section 3 (list of selected farms). Four of the pig farms are located in Hungary (2) and Spain (2) were also part of the joined Collaborative project FP7-KBBE-2012-6: ALL-SMART-PIGS, entitled Practical implementation of precision livestock technologies and services at European pig farms using the living lab methodology

In each farm, dependent on the species, a number of selected key indicators, representing at least one of the domains welfare and health, environmental load and productivity are monitored by the implemented systems. The systems that are used are eYeNamic (FANCOM, broilers,pigs), Sound Monitor (SOUNDTALKS, pigs, broilers, calves), dust and ammonia monitor (RVC, PLF-Agritech, broilers), pig weight, feed supply, dust and ammonia sensor (PLF-Agritech, Pigs).

With the installed PLF technologies, data is collected automatically at specific time intervals. Software is developed to store and visualise the data on-farm or remotely at any location with an available Internet connection.

## 2. Overview of the implemented systems

A detailed overview of the implemented systems was described in Deliverable 2.1: Definition of implementable systems. A summary of the new installed systems is given below:

### eYeNamic

eYeNamic is a system used both in pig and poultry farms. It is a camera system that performs measurements of the activity and the distribution of the animals. Top view cameras generate a visualization of the floor area. The image analysis software translates acquired images into indexes of distribution and activity. These indexes are a measure of animal position and movement and thus of animal behaviour. eYeNamic was installed in all 5 broiler farms (4 cameras per farm) and all 10 pig farms (4 cameras divided over 4 compartments).

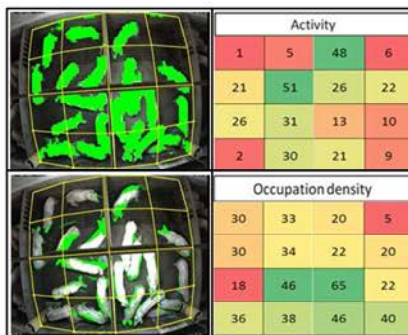


Figure 1: eYeNamic for pigs



Figure 2: eYeNamic for poultry

### Sound Monitor

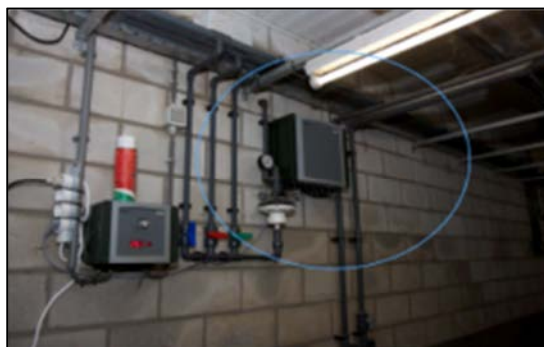
SoundTalks has developed a monitor to record sounds in livestock buildings. A dedicated algorithm detects the number of coughs that occur in a pig house. The Pig Cough Monitor was installed in each of the 4 compartments on each of the 10 pig farms.

The hardware of the Pig Cough Monitor was also installed in the 5 poultry houses and in the Irish Teagasc institute where groups of young calves are housed. The idea was to widen the application of cough monitoring in fattening pigs, towards the automated monitoring of stress in poultry houses and the monitoring of respiratory infections in young calves.

The microphones and the SoundTalks computer are protected against the harsh environment of commercial livestock houses.



*Figure 3: Pig Cough Monitor Hardware*



*Figure 4: Pig Cough Monitor mounted on wall*

## Dust and Ammonia monitoring

Particle size distributions are measured with a combination of two Aerodynamic Particle Sizers (APS, see Figure 5: TSI APS 3321 Figure 5 and Figure 6) PM1, PM2.5, respirable (~PM5), PM10 and total suspended particles with TSI DustTrak DRX.



*Figure 5: TSI APS 3321*



*Figure 6: TSI DustTrack DRX*

For measurements at the fan outlets, short sample air inlets are mounted into the air flow, with diameters chosen to provide approximately isokinetic sampling conditions. The flow from the inlet is then directed into the APS systems. However, as the fan speed is often variable, some non-isokinetic sampling is to be expected. Furthermore, spatial variation in PM<sub>10</sub> throughout the buildings is assessed on selected days using particle size selective aerosol monitors (Environmental Devices Corporation, HAZ-DUST EPAM 5000, Figure 7).

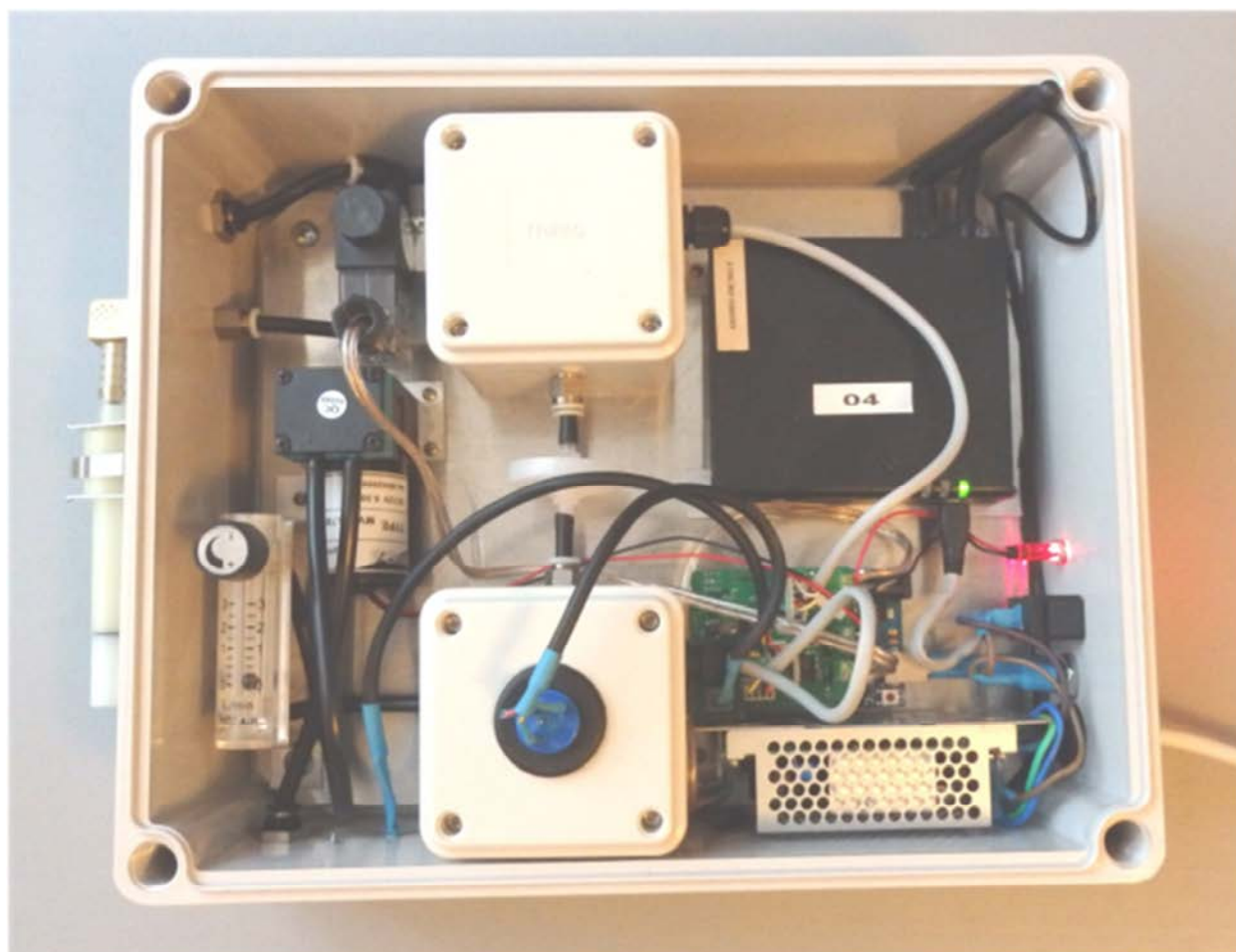


*Figure 7: Haz-Dust EPAM 5000*

## Enviro-Detect

Enviro-Detect is created to facilitate routine assessment of environmental conditions on commercial livestock farms and thus improve environmental conditions of stock, farm workers and reduce pollutant emissions. The unit contains cost-effective components for measuring air temperature, relative humidity, the concentrations of ammonia, carbon dioxide and air-borne particles. The software component of Enviro-Detect™ will calculate the expected concentrations and emission rates of the different airborne pollutants (by using prediction models developed during previous studies) and will compare these values with measured concentrations/emission rates. Enviro-Detect greatly simplifies data management and minimises the cost of environmental monitoring. This enables producers to measure environmental quality routinely on farms, reducing worker Occupational Health & Safety risks, improving environmental outcomes, and potentially improving production efficiency.

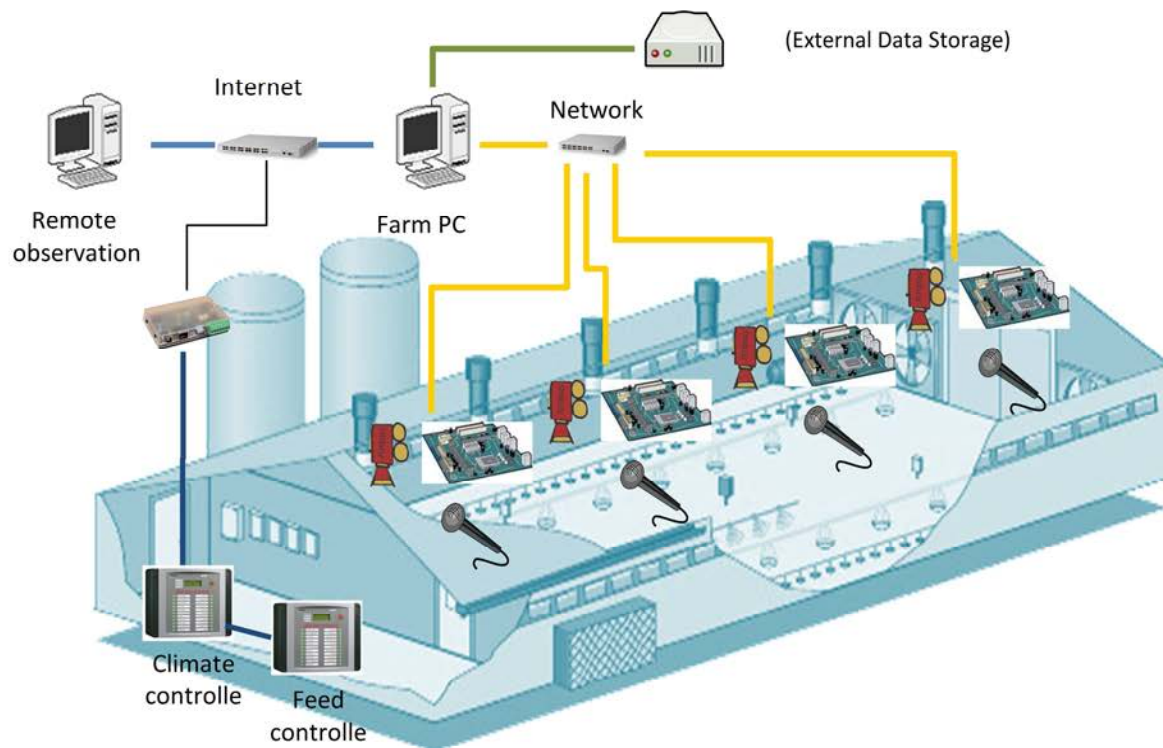




*Figure 8: Pig Environment Monitor Hardware (Enviro-Detect™)*

## Data collection system

The data from the Fancom and Soundtalks systems are collected by means of local network on a farm PC, which also provides the visualisation of the data to the farmer. Back-ups of the data are stored on external Hard Disks. These disks are sent to the technology providers at the end of each fattening period. The farm PC is accessible over internet for remote observation. Every day, Fancom and Soundtalks check the status of the data collection over the internet connection.



*Figure 9: Overview of the data collection system*

### 3. List of the selected farms

All potential farms were selected and scored based a list of criteria:

- Location in at least 5 different countries, 2 pigs farms in Hungary, 2 pig farms in Spain
- Climate control system compatible to data collection: Fancom=1; Other=0,5; None=0
- Feed control system compatible to data collection: Fancom=1; Other=0,5; None=0
- Farm Manager System: Fancom=1; Other=0,5; None=0
- Al least 4 identical compartments of 100-200 pigs per compartment on same or similar pig house: Yes=1; More or less=0,5; No=0
- Reliable internet connection: >5MB=1; 1-5MB=0,5; <1MB=0
- History of severe respiratory disease problems: Yes=1; No=0
- Distance to local assessors: <200km=1; 200-500km=0,5; >500km=0
- Light level in the compartment: Good=1; Adequate=0,5; Poor=0
- Ability to connect to the reporting system in the slaughterhouses: Yes=1; Not clarified=0,5; No=0
- Willingness of the farmer to cooperate and spend time on the project: High=1; Medium=0,5; Low=0
- Willingness to provide access to external people to the farm: High=1; Medium=0,5; Low=0
- Ability to act as an ambassador for PLF technologies: High=1; Medium=0,5; Low=0
- Familiarity with the use of a PC: High=1; Medium=0,5; Low=0

In total about 20 candidate farms were investigated, and after scoring the final list was set:



Selected Pig farms:

Country	Location Farm (Town)	Farms	Number of farms	Status on 30/10/12
Hungary	Egyházaskesző Fadd	Karakai Dunahyb	2	Installed
Spain	Tona Prats de Lluçanès	Granja Mir Granja La Lluçanesa	2	Installed
Italy	Caravaggio	Merigo Farm	1	Installed
France	Plabennec Vatry	Bergot APC	2	Installed
The Netherlands	Grashoek Meijel	Teeuwen Verhoijzen	2	Installed
North Ireland	Stewartstown	McCrea	1	Installed

## Selected Poultry Farms

Country	Location Farm	Farms	Number of farms	Status on 30/10/12
The Netherlands	Kessel	Colbers	1	Installed
United Kingdom	Chesterfield	Speller	1	Installed
United Kingdom	Throchmorton	The Poultry Site	1	Installed
Italy	Verona	Laverini	1	Installed
Spain	La Grandadella	CAL XULIC, SL	1	Installed

The distribution of the selection farms on the map of Europe is shown in next figure



Figure 10: Location of the EU-PLF farms

## 4. Overview of the encountered problems during installation

<b>Problems encountered during the first year: month 1 - 12</b>				
<b>Workgroup name:</b> <i>Pigs/Poultry workgroup</i>				
<b>Problem</b>	<b>Solution</b>	<b>Chance to have the same problem again in a new set-up/installation</b>	<b>Things to take care of/to check</b>	<b>Suggestions</b>
<i>1. Pest (rats/mice)</i>	<i>Protection with hard plastic tubes, spray cables with paprika/chilli concentrate</i>	<i>Problem always actual</i>	<i>Sufficient hard plastic tubes, equipment to mount on wall</i>	<i>Place all cables/wires in hard plastic tubes, careful when applying spray as the concentrate is very strong, but food grade</i>
<i>2. Language problem</i>	<i>Interpreter</i>	<i>Problem always actual</i>	<i>Find out if which languages are known by local people</i>	<i>Use interpreter</i>
<i>3. Different (power) connectors in different countries</i>	<i>Travel plug for temporary use during installation; use of correct plugs for permanent equipment</i>	<i>Problem always actual</i>	<i>Find out which plugs are used</i>	<i>Use the correct plugs for permanent equipment</i>
<i>4. Hidden heating in ceiling (broiler house)</i>	<i>Ask farmer to put on heating, to find out where hot tubes are located</i>	<i>Probably only in broiler houses, not in pig houses</i>	<i>Make sure no equipment is placed close to the hot tubes, risk of overheating</i>	<i>Place all equipment at least a few meters away from hot water tubes</i>
<i>5. Pigs eat cables during installation</i>	<i>Move pigs away if possible; install with sufficient people when not possible, spray cables with paprika/chilli concentrate</i>	<i>Problem always actual in pig houses</i>	<i>Make sure the pigs cannot reach cables [pigs can reach &gt;&gt;1.5m when on fences!]</i>	<i>Main problem = when putting cables through wall, do with &gt;=2 installers, careful when applying spray as the concentrate is very strong, but food grade</i>
<i>6. Height worker cannot drive in broiler house when litter is</i>	<i>Only work in broiler houses when there is no litter</i>	<i>Problem always actual in broiler houses</i>	<i>Height worker with sufficient battery power</i>	<i>Do not attempt repairs in broiler houses when there is litter in the house</i>

<i>spread out</i>				
7. Very high ceilings	Height worker when possible (~broiler houses), very long ladders when not possible (~pig houses)	Problem always actual	Height worker/very long and secured ladder	Use height worker if available; when using ladders, make sure it is definitely long enough
8. Farmer reluctant to give access to (part of) the house	Make clear agreements before starting the installation	Problem always actual	Farmer should allow access to all relevant parts of the building	Make clear agreements long (>1 month) in advance, confirm the agreement just before (1 week) installation
9. Overheating of equipment	Place cooling or fans in the equipment	Problem always actual, especially in Southern countries	Equipment can withstand high temperatures	Test all equipment in harsh conditions (climate room if possible)
10. Asbestos in houses	(?). Do not drill holes in asbestos	Problem actual in older buildings, and in less developed countries	Make sure no holes are drilled in asbestos	Be careful with asbestos!
11. Water (cleaning, condense...) on equipment	Equipment that can withstand spray of water	Problem always actual	Silicone for final sealing, make sure all equipment is water proof, and no water can stand on equipment	Do thorough testing of water tightness of equipment before bringing in farms, seal with silicones.
12. HDMI versus DVI versus VGA connectors	Use screen with both HDMI/DVI and VGA input. Use adapters between HDMI/DVI or correct cables	Depends on which equipment needs to be monitored with screen	Screen with HDMI/DVI and VGA input, correct cables or adapters	Screen with HDMI/DVI and VGA input and adapters. When possible, make sure only 1 connector is used for all equipment (HDMI is preferred)
13. Very long distances between farm and hotel/stores	No solution	Problems always actual	Check beforehand where major stores/cities/hotels are located	When stores/cities/hotels are >1h drive from the farm, foresee more days to complete the installation!
14. Flies cover lenses with dirt	Fly-repellent, maintenance scheme to clean lenses, potentially use transparent film in front of the	Problems always actual in pig houses	Fly repellent	Treat lenses with fly-repellent, make scheme to clean lenses regularly

	<i>lenses</i>			
15. Short duration of battery of height worker	Rechargers on-site, recharge overnight	Problem always actual in broiler houses	Charged batteries	Try to charge battery whenever possible
16. Problems when setting-up wireless network connection	IT-personnel on-site during installation	Problem actual when animal house in other building than office	Manual for installation	Get advice from local IT specialist who knows the farm
17. Farmer wants cable to go in tube under the ground	With wire to pull cable, pull all cables through	Problem actual when animal house in other building than office	Sufficient personnel, sufficient time, sufficiently long cable to pull secondary cable through the tube	This is a very time-consuming process, and very intensive as well. Make sure enough personnel + time is foreseen.
18. No (or very bad) internet connection can be obtained with cable connection	Install 3G (or 4G) antennas	Problem actual on farms where there is no internet connection yet	Test the internet connection that is available on the farm, check if the farm-area is covered by 3G! (or 4G)	Only use 3G (or 4G) in case a solution with a cable connection is not possible
19. Unstable power at farm	Install UPS	Problem always actual	UPS	Install UPS when doubt
20. Abrupt power-off	Make sure all equipment can withstand sudden power-off, or install UPS with safe shutdown	Problem always actual	Test if equipment can withstand multiple sudden power-off situations	Make sure equipment can withstand multiple sudden power-offs (+ test that power-off during start-up of the system is also no problem)
21. Farmer wants multiple (8) very long (> 100M) cables through a very narrow tube	User wider tubes to avoid problems! In any case, use sufficient soap to facilitate the process, and make sure the cables and the tube are always in line when pulling the cables. Do not fix cables together	Problem actual in new, well organised houses	Tubes are sufficiently wide to avoid problems	Use wider tubes or more tubes
22. Switched versus regular Ethernet	Use correct wiring	Problem always actual	Check which wiring should be used	Most of the time the regular (non-switched) wiring is



connectors				OK
23. A switch was replaced, causing IP-settings to change, causing all connections with fixed IPs to fail from that point in time	<ul style="list-style-type: none"> <li>- Use DHCP instead of fixed IP-addresses</li> <li>- communication with local IT personnel</li> </ul>	Problem always actual	Check IP settings	Fixed IP-addresses have a lot of advantages, the suggestion would be to use fixed IP, but inform local IT personnel that they cannot modify IP settings without letting you know well in advance.
24. PC can not deliver sufficient power for multiple (4) external USB powered hard drives on a permanent basis	<p>Plugging the USB drives in the USB3.0 ports did solve the problem</p> <p>Use of other type (externally powered) USB drives.</p> <p>NOTE: placing a USB-hub with power did not solve this problem!</p>	Pre-installation problem	Make sure PC can deliver sufficient power ( + on which ports) for the equipment that is connected to the PC	Make a test set-up with similar conditions, let it run for at least a few days (problems did not occur straight away, but started after a few days!)
25. Difficult to adjust cameras when alone	Never do the set-up of the camera system when alone	Problem actual when installing cameras		Make sure someone can adjust the camera, while the second person can look at the camera image to give feedback
26. Power lines can be very long in broiler houses!	Make sure sufficient power extension chords are on site, to go from front to back of a broiler house	Problem always actual in broiler houses	Location of power plugs, length of broiler houses	Make sure very long power extension chords are available on site
27. Metal box with PC equipment: door should open correct side	Ask farmer where he wants to place metal box, check to which side the door should open	Problem always actual	Make sure door opens to correct side	Ask farmer to which side door should open, or make sure door can be changed on site.
28. Equipment not arrived	Always ask confirmation if equipment has arrived, before leaving towards the farm	Problem always actual	Equipment has arrived	Call e.g. 1 week before traveling to the site to ask for confirmation of equipment arrival

<p>29. Equipment did not arrive on farm on time due to miscommunication at ordering</p>	<p>Order placed</p>	<p>Low</p>	<p>Check orders have been placed and confirm delivery date</p>	<p>Follow up on delivery to farm</p>
<p>30. Damage to equipment during cleaning between batches</p>	<p>Ordered replacement units and installed asap</p>	<p>Medium</p>	<p>Instruct staff on use and care for equipment</p>	<p>Prepare instruction manual for farm staff</p>
<p>31. Dust analysers measurement chamber (optics) heavily polluted and no longer working</p>	<p>Cleaned and calibrated at manufacturer</p>	<p>High</p>	<p>Install cyclone with pm 20 cut-off to prevent large particles entering</p>	<p>Simple catch bottle might be sufficient solution</p>
<p>32. High temperature in equipment enclosure</p>	<p>Fit cooling fan</p>	<p>low</p>	<p>Extensive tests before installation at realistic conditions (dust level and temperature)</p>	<p>Reserve time prior to installation date</p>

## 5. Procedures for farmers to use the installed systems

### Cleaning of camera lenses

The procedure to clean the lens cover is as follows (for location of the lens cover see figure below)

- Clean the lenses of the eYeNamic cameras every 2 weeks with a soft cotton cloth
- Don't apply too much mechanical pressure on the camera to prevent it from moving;
- make sure that you stand on a solid platform !
- In order to protect the lens cover from being scratched and from getting dirty, only handle it using a soft, cotton cloth.
- If the dirt is more persistent, add a mild alcohol-free detergent without abrasive particles.
- Make sure to dry the lens cover using a soft, cotton cloth after cleaning



## Replacing the external hard drives

- Shutdown the pc
- Take off the external hard drives with their USB connection
- Plug in the new set of external hard drives
- Start up the pc
- Check if the external hard drives are active in Windows Explorer (see figure below)
- If the external hard disk are not active than restart the pc again, or report the problem.
- Pack the four 'old/removed' external hard disks in a box and mail the details to [Irooijackers@fancom.com](mailto:Irooijackers@fancom.com)
  - Dimensions
  - Weight
  - Pick up address
  - Phone number
  - Opening times
- In a few days DHL will come to collect the packets.
- If there are problems then mail to: [Irooijackers@fancom.com](mailto:Irooijackers@fancom.com)

