

**38th WEDC International Conference, Loughborough University, UK, 2015**

**WATER, SANITATION AND HYGIENE SERVICES BEYOND 2015:  
IMPROVING ACCESS AND SUSTAINABILITY**

**Analysing and supporting spare parts and maintenance  
supply chains for handpumps in rural DR Congo**

*S. Jones (DRC), C. Barasa (DRC) & B. Rhodes (USA)*

**BRIEFING PAPER 2217**

---

*This paper presents findings from a study of spare parts and maintenance supply chains for handpumps in rural areas of the Democratic Republic of the Congo (DRC) in 2014 by the consultants Absolute Options for Concern Worldwide, and the steps taken by Concern towards implementing some of the key recommendations as part of the DRC WASH Consortium. The analysis and findings are relevant for other actors working on rural water supply. Key emerging issues are the role of international NGOs and donors in supporting supply chain development through more local procurement; the feasible level of professionalization of rural water management; and how INGOs can play a facilitation role in linking local actors to discuss and address these challenges.*

---

**Context and objectives**

In the 2009 Rural Water Supply Network survey of handpump utilization and functionality across Sub-Saharan Africa, the Democratic Republic of the Congo (DRC) had the highest rate of non-functioning pumps, with 67% of handpumps reported as non-operational (RWSN, 2009). Several factors contribute to the poor performance of community-managed handpump systems, including poor quality of handpump hardware, inadequate engineering of wells, inability of rural water management committees to operate, maintain, and repair handpumps, and poor quality and availability of spare parts (Carter et al., 2010). Understanding the causes of handpump system poor performance and how water management committees and NGOs plan, prepare, and manage for maintenance and spare parts replacement, is essential to achieve improved sustainability.

In this context, Concern Worldwide, as lead agency of the DRC WASH Consortium (five international NGOs implementing a four-year rural WASH programme in DRC funded by UKAid), commissioned Absolute Options (AO) to conduct a Handpump Spare Parts and Maintenance Supply Chain study. The objectives of the study were to assess sustainability factors for handpumps, conduct a supply and value chain analysis, and to recommend alternative business models with the potential to improve sustainability. This paper presents the key lessons from the research (undertaken in mid-2014) and the initiatives that Concern Worldwide is developing in response to the findings (in 2014 and 2015).

**Research questions**

The key research questions guiding this study were:

- What spare parts providers and/or maintenance providers currently operate in country?
- What is the financial and managerial capacity of water management committees (WMCs) to engage in a private sector spare parts/maintenance supply chain?
- What are the main barriers to a well-functioning maintenance and spare parts supply chain?
- What is the level of community motivation to participate in a private-sector maintenance regime, including willingness to pay?
- What measures are necessary to attract private sector actors and institutional investors?
- How should current WASH programmes adapt based upon findings and conclusions from the study?

Although the focus is on the availability, cost, quality, and access to spare parts, the study also offers important findings regarding water management committee capacity, market distortions, and the financial performance of alternative supply mechanisms.

### Methodology

The study used a combination of qualitative and quantitative approaches. Primary research included semi-structured interviews with key informants, focus group discussions with water management committees (WMCs) and water users, and quantitative household income surveys. Secondary research was conducted to identify potential water system business models and case studies, and draw upon industry expertise on water service delivery. AO consultants visited six of nine health zones where the DRC WASH Consortium was active in 2014 and conducted interviews and market surveys in Lubumbashi, Kalemie, Bukavu, Goma, Kinshasa, and Impfondo (Republic of Congo). The AO team visited 29 villages, conducted 33 WMC focus groups, 10 water user focus groups, 54 household surveys, and 38 key informant interviews. Key informant interviews included 28 recent, active, or potential spare parts suppliers, five health zone chiefs, and representatives of KfW, UNICEF, the World Bank (WSP), Vergnet Hydro, and Trust Merchant Bank.

### Results and discussion of the supply chain analysis

While stakeholders confirmed that the inability of water management committees to collect sufficient user fees and a dearth of trained mechanics/technicians are important challenges to sustainability, stakeholders ranked access to spare parts as the most important handpump sustainability challenge in the DRC. A recent UNICEF study on the spare parts supply chain in Eastern DRC (Koestler et al., 2014) similarly concluded that no supply chain exists in three of five regions studied, with the other two regions only being served by cross-border suppliers in Uganda. Interviews with water management committees (WMCs) also indicated that NGO knowledge of suppliers was not being effectively communicated to WMC partners.

The result of the market-canvassing exercise in major DRC population centres and secondary market centres was the identification of twelve active spare parts suppliers, seven intermittent suppliers, four past suppliers willing to stock again, and three suppliers with interest to enter the handpump supply parts business. Handpump and spare part manufacturers who supply DRC are mainly located in India, France, Kenya, Tanzania, Mozambique, and Swaziland, but most INGOs purchase both handpumps and spare parts directly from manufacturers in India. WMCs are almost exclusively supplied by INGOs either through initial spare part stocks that are typically depleted within two years, or through post-construction spare parts provision.

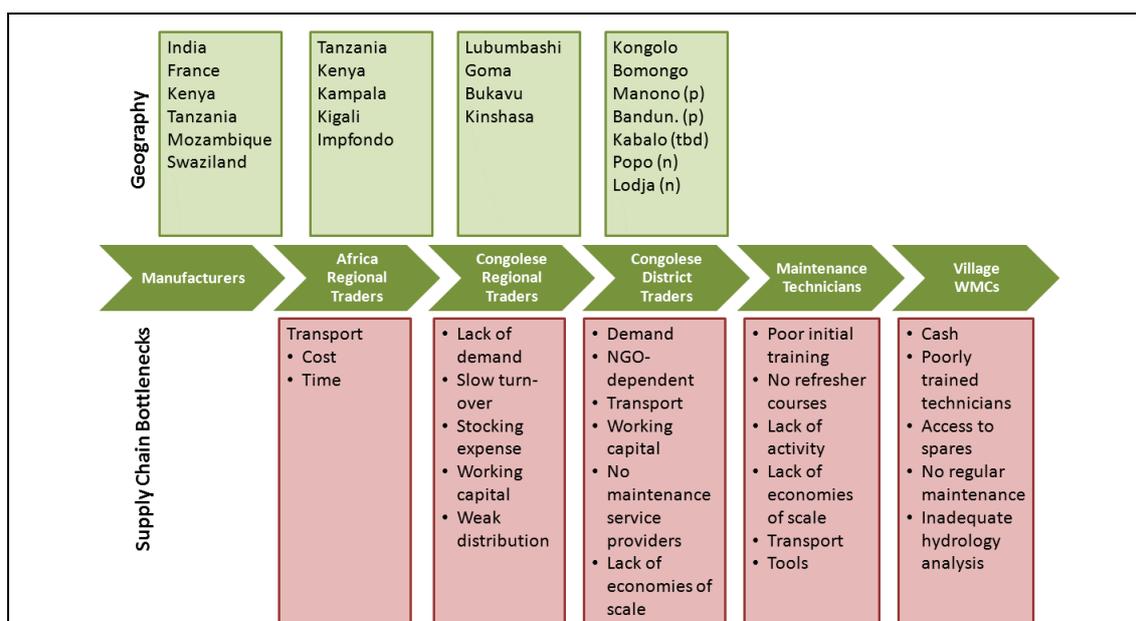
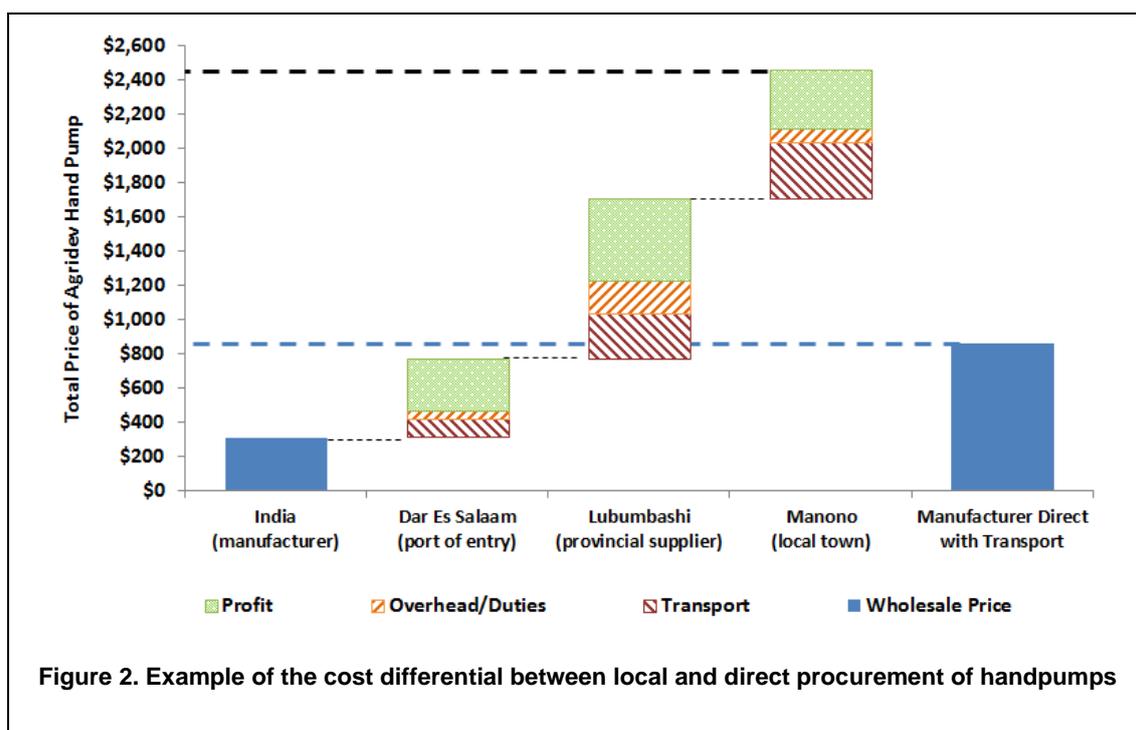


Figure 1. Summary of spare parts supply chain bottlenecks in the DRC

The spare parts market in the DRC therefore suffers from a “NGO-induced demand-side market failure”. The natural development of a private sector spare parts supply chain has been constrained due to the heavy reliance of WMCs on NGO-procured and supplied spare parts, and the direct purchase of handpumps and spare parts from manufacturers outside of the DRC or even Africa. Low turn-over of spare parts makes it difficult for suppliers to stock spare parts, as most are reluctant to tie-up working capital. Figure 1 summarises the key bottlenecks in the underdeveloped spare parts supply chain in the DRC.

**Cost-benefit of local procurement**

Direct procurement of handpumps and spare parts by INGOs from outside DRC is in part driven by the high cost of local procurement under the current market structure. Figure 2 details cost components of retail prices at points along the handpump supply chain from India to the example of Manono town in Katanga province (Concern Worldwide’s operating base in the region). Costs are broken down into: cost of goods sold (manufacturer price plus intermediate supplier costs), transportation, overhead and duties, and profit. If an INGO operating in Manono were to procure an Afridev handpump from a local trader, it would pay approximately \$2,450 given the current market structure and volume levels. This compares to a total cost of \$859 (including interior transport and humanitarian duty exemption) if the INGO were to purchase handpumps directly from the manufacturer in India (figure based on an actual August 2013 quote for five pumps. The per unit cost would likely drop further for direct procurement if the INGO were to place larger orders. Despite the economic development benefits of local procurement, the INGO would have a difficult time justifying the higher cost of local procurement to its donor.



**Figure 2. Example of the cost differential between local and direct procurement of handpumps**

The high cost of local procurement is driven by two primary factors: 1) the low-volume of handpump purchases and 2) lack of direct linkages between local suppliers and manufacturers. Several suppliers stated that they include significant profit margins (between 28% and 100%) in their retail prices to compensate for low-turnover and stocking risk. The lack of direct procurement relationships between Congolese suppliers and pump and parts manufacturers is inefficient as profit margin and transportation costs for traders in Dar Es Salaam, for example, and neighbouring trade hubs are included in final retail prices in the DRC. Researchers were able to calculate intermediate costs and profit margins through direct interviews of suppliers in India, Dar Es Salaam, and Lubumbashi, and used a triangulation approach to confirm data with numerous local suppliers (no one supplier was willing to provide all cost and margin data, but each interview focused on at least one data point that were aggregated into a full cost and margin calculation).

However, if purchase volumes were increased and direct trade linkages established, the cost of a locally procured handpump would drop from \$2,400 to \$997 per unit, or only \$138 more than purchasing direct from manufacturers in India. Key recommendations to support a stronger supply chain of handpumps and spare parts are: 1) facilitate direct linkages between provincial suppliers and manufacturers; 2) facilitate reasonable terms from manufacturers (based upon prevailing INGO terms); 3) advocate for tax exempt status for spare parts stocked on a speculative basis; 4) increase spare parts purchase volumes to obtain lower prices and most importantly, 5); procure spare parts from provincial and local suppliers.

### **Water management committees and demand analysis**

Water management committees and their members represent the demand side of the supply chain equation. Without sufficient, sustained demand, supply chains will not develop or will atrophy into non-existence. As such, an important component of this study is to assess the capacity of water management committees to sustainably manage water systems, including the collection of user fees to pay for repairs and spare parts. Although WMC capacity is certainly improving through WASH Consortium activities, the base level of WMC capacity is extremely low. WMCs still require significant training in key areas such as organizational management, financial management, transparency, and the ability to maintain and repair handpump water points. Even those WMCs who have had several iterations of NGO training (such as the Lwakato WMC in Manono territory, some of whose had members had been trained by two different NGOs before being reconstituted by Concern Worldwide) still lack clear roles and responsibilities of committee members, management and operations plans, and business plans that could help project expected maintenance and repair expenditures and user fees.

An important recommendation is to reconsider the sequencing of WMC and community training activities to begin developing basic management skills *prior* to the installation of improved water points. Important components of pre-installation training should include the development of user fee rates and collection strategies and community sensitization regarding the need to pay for water services, earlier on in the 12-step community mobilization process used by the WASH Consortium. Following the study, this change was made to the Consortium's approach and integrated into programme guidance in January 2015.

A critical component of WMC sustainability is the ability and willingness to pay adequate user fees to cover at the very least routine maintenance and repair costs. The very low income levels of rural villages and a lack of a culture of paying for water present obstacles. However, financial analyses and individual household economic surveys of current and potential project areas suggest that the majority of water user households have the financial wherewithal to pay sustainable fees (AO consultants conducted over 50 individual household economic surveys to determine feasible water fees using UNDP's water affordability index). A second question, perhaps more relevant question, is whether users are *willing* to pay fees and how this willingness can be increased. The DRC WASH Consortium is conducting further operational research in 2015 to address user preferences between the use of improved water points and alternatives (such as unimproved sources with household water treatment), as well as the social marketing skills required by water management committees to promote payment.

### **Alternative spare parts and maintenance business models**

Another component of this study was to investigate the feasibility of alternative business models for spare parts supply and maintenance and repair services. AO identified seven potential business models including: 1) an integrated supply/service model; 2) independent for-profit maintenance service providers; 3) consignment-based authorized dealers; 4) the current model of WMC spare parts procurement and repair; 5) public-private model utilizing health centre networks; 6) the establishment of physical subsidiaries of current suppliers and 7); the facilitation of creative finance mechanisms.

As part of this analysis, AO also conducted a minimum density analysis to determine maintenance service provider break-even points and financial feasibility. Based upon this analysis, there is not yet a sufficient density of handpumps in most areas within a 100km-200km radius for independent maintenance service providers to be profitable (based on discussions and analysis with World Up, the only for-profit handpump maintenance service provider identified during the study). AO estimates that a minimum of 375 pumps within a 100km radius is required to support one independent, for-profit, maintenance service provider. This option will be monitored as the volume of water points in any area increases, as for example in the area of Katanga where Concern Worldwide works, discussed below. Concern Worldwide is first trying to support improvements to the current model of WMCs by beginning to make the role of technicians increasingly professionalized and trying to set up better links with dealers as suggested under the third potential model.

While the DRC WASH Consortium already partners closely with local health services (the Rural Water Directorate does not have a presence at local levels), reliance solely on this option for stocking spare parts was considered risky by INGO staff members. However, elements of this model are being considered as part of the possible next steps.

### **Actions taken by Concern Worldwide so far**

The rest of this paper summarises the steps Concern Worldwide has taken so far since the research. Concern has operated in Katanga province in south-eastern DRC since 2008, implementing over 80 water points as part of its WASH programme including capacity building for volunteer water management committees to manage and operate the facilities. The total number of water facilities in Manono territory, where Concern now focuses its work, was estimated as 276 at end of 2014 (including those developed by other actors). The number of non-functional facilities was estimated at 40%, and only 60% of those which are functional are thought to be operating at full capacity. The 2013-2017 programme (funded by UKAid and IrishAid) aims to construct 130 water facilities (about 90% of which are boreholes and dug wells with hand pump installations, 7% are spring protections and 3% are piped schemes) and will bring the number of water points in the territory to at least 400.

Concern has embarked on piloting initiatives to address the issues highlighted above, in particular the issues of improving WMC governance, institutional capacity and links to supply chains, starting in September 2014. It is envisaged that the pilot will take 6-8 months for more comprehensive lessons; this paper highlights some of the initial practical measures already being taken and key challenges so far.

### **Improving the training for handpump technicians**

The conventional practice has been for NGOs to identify 2 people from the village where the water facility is installed, often with no background in mechanical work at all, and to train them for 2-3 days, after which they are deemed to have become handpump mechanics and expected to continue rendering repair services to water points. But the Absolute Options study and Concern internal evaluations of the operators showed that over 75% of them neither had the skills nor the tools to install and carry out even the most basic repairs on a handpump. To address this, Concern has expanded the training course from 3 days to 20-30 days (spread over 1-3 months) and also expanded the roles of a handpump mechanic to a “Water Supply Operator” (WSO), to take care of the whole facility including hygiene, cleanliness, fence and drainage maintenance, and tariff billing. The bulk of the training happens in the trainee’s village and starts right from well-siting, through to reservoir and apron construction and yield testing. Training on hygiene, monitoring of free residual chlorine, and hand pump installation is done by grouping trainees from 3-5 villages within reasonable geographic proximity. A trainee is engaged for maximum 6 hours per day and receives a token payment of \$3 per day of activity, to compensate for the time spent away from their other activities. For the actual hand pump installation, each trainee is paid \$30 as a fee. This is a key moment as it is the first labour fee received after the training.

Each WMC (or a cluster of 2-3 WMCs) will be issued with a toolkit for maintenance of the water facility, to be available to the WSO. So far, 12 WSO have gone through this process, 2 per water point completed, and are yet to be deployed. (The plan is that each WMC shall engage 1 WSO from the two trained per water point to serve on rotation basis for a period of 3-4 months. The WSO shall be paid a monthly percentage commission agreed with the WMC and corresponding to monthly tariff collections. Projections based on water supply business plans done for individual WMCs show that a figure of \$3 per day worked is feasible, paid per WMC or cluster of WMCs in the case of smaller villages (the daily wage of an unskilled worker in the area is \$3-\$5). Once the first cohort of WSOs has been deployed, their performance and that of the water point will be monitored and recorded regularly by Concern in collaboration with local health services.

### **Bringing stakeholders together to support supply chain development**

Currently, there is no handpump spare parts stockist at the territory headquarters in Manono town, nor at any of the more remote markets across the territory. The nearest handpump and parts dealers are based at the provincial headquarters in Lubumbashi, which is at least 650km from Manono town (a 2-3 day road trip with no regular public transport). Towards this end, Concern in consultation with local and provincial government authorities and private sector operators, jointly organised a stakeholder conference in November 2014. This brought together 230 WMC representatives and government and civil society staff to discuss the establishment of a handpump spare parts and service chain in South/ East Katanga. The forum came up with

a 5 point action plan to be implemented through the collaboration of Concern, government, WMCs and civil society. An action group was selected by the gathering and will meet during the first quarter of 2015 to commence execution of the 5 point plan, namely:

- Facilitate the establishment of a handpump and spare parts and service provider/dealer at Manono and provide them with basic skills and capacity building – technical skills for them and their agents, book keeping skills, price cataloguing, marketing and publicity. Such a dealer would be an entity already engaged in a related business (such as selling motorbike parts or a hardware store, so that hand pump and spare parts is an additional income stream but not the sole business). Measures would have to be put in place to guard against monopolistic tendencies.
- Facilitate linkages between WMCs and the health area level, and health areas to a Manono dealer, and facilitate WMCs to organize into an umbrella organization/lobby group that can lobby for their interests (such as the potential issue of monopolistic pricing raised above).
- Facilitate linkages between a Manono dealer to provincial dealer(s), who themselves are already linked with international suppliers.
- Capacity building to Water Management Committees - good governance practices and structures, basic skills training in water supply management, business planning and water tariff set up and administration.
- Dissemination of the concept of “Small Doable Important Actions” that can be done by households to improve their current water sources and household hygiene without external investments by partners. This is a key part of the DRC WASH Consortium’s overall approach and aims to maximise the impacts of the WASH programme through behaviour change given the risks to sustainability of water supplies.

### **Improving water management committee structures**

Existing water management committees in the areas have been constituted on the old model where members are generally picked on the basis of hierarchy (depending on age, gender and power dynamics in the community), regardless of their other essential competencies (literacy, integrity, diversity of skills and experience, etc.). AO recommends that it would be necessary to reconstitute such committees, and going forward, to constitute committees to invigorate and diversify membership (age, education, occupation, skills and experience, sex, and power dynamics). The reconstitution will begin in the first quarter of 2015. A second weakness of the WMC model is the assumption that a committee member, with a few days of training, is prepared enough to provide his/her services in the long term. But the litany of failed WMCs over the years has proven repeatedly that such is not the case. It is proposed that roles be separated: the water committee should operate like a Board of Directors, dealing with overall oversight of the scheme, while a paid water supply operator handles the routine operation and caretaking of the facility at a fee. Payment for labour rendered motivates performance. This approach too, is planned for integration during 2015, and will entail deployment of the WSOs who have undergone the new training curriculum described above.

### **Supporting financial management**

Another recommendation was to support WMCs to develop “business plans” for the water facilities, to determine and operate water tariffs to be paid by water users, and to establish a mechanism for safe deposits and access to credit. This measure was already planned under the WASH Consortium’s programme approach, and business plan and water tariff trials have been ongoing since mid-2014. During the November stakeholder’s forum, introductory links were made between a small micro-finance agent in Manono and the WMCs. The WMCs generally agreed that it was feasible for them to establish deposit and savings accounts with the micro-finance agent, where they would deposit water tariff collections. However, the WMCs were hesitant on the matter of credit facilities, preferring instead to integrate Income Generation Activities (IGA) to supplement deficits in their business plans for running water services.

### **Emerging issues**

The following key issues have emerged for Concern Worldwide and the DRC WASH Consortium in seeking to implement the recommendations of this research:

- To what extent will there be donor buy-in on the idea of greater local procurement for the longer-term benefit of contributing to the development of sustainable rural water services, but while increasing the initial costs of water services? The WASH Consortium is developing advocacy initiatives on this issue at national level. A key issue is what level of critical mass of funders and implementers would be required to have a real influence on the development of supply chains.

- At local level, what level of professionalization of the operation of water facilities will be accepted? A number of WMCs are expressing resistance to relinquish daily operation of water facilities to water supply operators. A water facility in a remote village is a significant asset and its management bestows some status. Extensive discussions are required at village level to address this.
- How can the role of INGOs shift to facilitating local discussions to try to address these problems, rather than just as implementers of projects? Especially in the east of DRC, INGOs and their staff are more used to humanitarian work and less used to such a facilitation role. Moreover, the logistics, resources and effort of hosting large gatherings of stakeholders in remote areas is extremely significant.

---

### Acknowledgements

The authors would like to extend thanks to the whole Absolute Options team, the research participants, and the staff and partners of the member agencies of the DRC WASH Consortium: Concern Worldwide; Action Against Hunger (ACF); ACTED; Catholic Relief Services (CRS); and Solidarités International (SI).

---

### References

- Carter, R., Harvey, E., Casey, V. (2010). User financing of rural handpump water services. Presented at the IRC Symposium 2010: Pumps, Pipes and Promises, IRC International Water and Sanitation Centre, The Hague, The Netherlands.
- Koestler, A.G., Kahorha, J., Biteete, L. (2014). Supply chain analysis of handpumps and spare parts in Eastern Democratic Republic of Congo. A-Aqua and UNICEF.
- RWSN (2009). Handpump Data 2009. Selected Countries in Sub-Saharan Africa. RWSN, St Gallen, Switzerland.

---

### Contact details

Stephen Jones  
DRC WASH Consortium /  
Concern Worldwide, DRC  
Email: wash.monitoring  
@consortiumwashrdc.net  
www.consortiumwashrdc.net

Chaungo Barasa  
Concern Worldwide, DRC  
Email: chaungo.barasa  
@concern.net  
www.concern.net

Bryan Rhodes  
Absolute Options LLC, USA  
Email: bryan.rhodes  
@absoluteoptionsllc.com  
www.absoluteoptionsllc.com