wsb.pl/wroclaw/ceejme
ISSN electronic version …

Central and Eastern European Journal of Management and Economics
Vol. 1, No. 1, 47-68, Sept. 2013

Sustainability in the Supply Chain: reducing supply-chain greenhouse gas emissions in medium-sized businesses[1]

John Stepan

JPS Consulting, Kraków, Poland

Abstract: Medium Sized Businesses (MSB's) form a sizable part of the Polish and EU Business Environment with many of these companies operating in industrial / commercial sectors. Their aggregate Green-House Gas (GHG) impact is therefore significant. However, within MSB's, there is a significant resistance to GHG / Sustainability issues. This paper presents ways in which MSB's can be convinced that positive responses on GHG / Sustainability issues can provide sustained Business Benefits. It goes on to describe how the Academic Community can contribute to this process by assisting MSB's to operate in a more environmentally sustained manner whilst at the same time gaining the advantages of concrete Business and Financial Operation benefits.

Keywords: Medium Sized Businesses), greenhouse gas emission reduction, resistance to sustainability issues, supply-chain / business operations improvement, role of higher education establishments

1. Introduction

Within the EU and also in Poland, the size of the Medium Sized Business (MSB) Sector and its involvement in trade and non-financial activities indicates that it is a significant generator of Green-House Gas (GHG) emissions. Reviewing statistics comparing Poland to the EU average, this sector is 3,5% larger and the proportion of MSB's involved in cross-border trading is 7,4% higher than the relevant EU averages. These statistics help explain why, in investigating ways to reduce GHG Emissions, this paper focuses specifically on the MSB business sector. A

[1] This original article will be published in the Zeszyty Naukowe (scientific papers) of the Wroclaw School of Banking entitled "Challenges and conception in contemporary logistics", edited by Andrzej Bujak and Monika Paradowska, to be issued in 2014.

Correspondence Address: John Stepan, JPS Consulting, Kraków. E-mail: john.stepan@jpsconsulting.pl.

second reason is because, in the experience of the author, MSB's tend to have more crystallised Management and Operational structures compared to smaller businesses and lower availability of suitably trained (and empowered) internal expertise compared to larger companies.

This lack of internal expertise plus more crystallised Management / Operational structure becomes all the more relevant when reviewing Academic Research which high-lights a reluctance by MSB's to address Environmental Issues. This is often caused by a combination of a lack of appropriate internal resource, a lack of direct pressure from customers, the need to focus on day-to-day operational and financial issues and a lack of clarity as to the concrete financial and operational benefits of operating in a more environmentally sustainable manner.

The size of the MSB Sector combined with its general resistance to environmental issues should therefore indicate that assisting MSB's to operate in a more environmentally sustainable manner could have a significant positive impact on reducing overall GHG Emissions. Taking this as a premise, the aim of this paper is to identify ways in which MSB management could be convinced and assisted in implementing the changes necessary to reduce overall GHG impact.

The paper starts with an Introduction and goes on to develop an understanding of the size of this business sector and its eventual environmental impact by presenting standard EU Definitions of MSB's together with statistics on the size and characteristics of the MSB Business sector both in Poland and within the EU. It continues by reviewing Academic Research on MSB attitudes to GHG Emission Reduction mainly based on a paper by Young (2010) on Opportunities and Challenges related to SME implementation of Environmental Management Systems which provides a summary of available academic research.

The aim of these sections is to give an understanding of the scope for GHG emission reduction within the MSB sector along with some understanding of challenges thus emphasising the importance of finding effective solutions assisting MSB management to "move forward" on this subject.

The next sections of the paper show an analysis of the GHG emissions of various transport modes and an analysis of significant Supply-Chain Issues from the perspective of an MSB. The reason is to find commonalities between GHG emission reduction and improvements in MSB Supply-Chain Operations to identify those areas where MSB's can reduce GHG Emissions and at the same time improve their business from a financial or operations perspective. The reasoning is that linking GHG emission reduction with improving Supply-Chain Operations should provide a strong Value Proposition for MSB management to convince them to implement changes which enable operating in a more environmentally sustainable manner as well as more effective functioning from a business perspective.

Having identified these areas, again drawing on work described by Young, the paper presents research on the difficulties faced by MSB's in implementing GHG Emission Reduction Programmes. The purpose of this section is to help identify the ways in which MSB's could be assisted in implementing programmes which reduce GHG emissions which at the same time have the potential to deliver concrete business benefits. The proposal outlined in this paper is that these difficulties could be overcome with the support of Universities and Higher Education Establishments. The reason is that, in the opinion of the author, through their history, tradition, reputation, infrastructure, available resource and general cultural acceptance, Universities and Higher Education Establishments are very well placed to assist MSB's.

The conclusion summarises the paper underlining the potential in assisting MSB's implement GHG emission reduction programmes, whilst at the same time, showing ways in which they can concretely improve their operational and financial performance.

2. Definition, size and impact on GHG of the EU MSB Sector

According to the European Commission Recommendation Defining Small & Medium Sized Enterprises (SME's) (2003), Enterprises are "any entity engaged in an economic activity, irrespective of its legal form". The document goes onto define MSB's as Enterprises with:

- Headcount: Number of Annual Work Units between 50 - 250
- EITHER Annual Turnover: between €10 - 50 MLN.
- OR Annual Balance Sheet Total: between €10 - 43 MLN.

The Turnover / Annual Balance Sheet total are defined EITHER / OR to allow for enterprises with higher Annual Turnover but lower overall wealth e.g. in Trading or Distribution Sectors.

Using this definition, Table 1 shows SME Business sector statistics in Poland and the EU.

Table 1. Basic Statistics by Company Size (Estimates for 2011)

SME's in Poland and EU - basic figures									
Business Group	**Number of Enterprises**			**Employment**			**Value added**		
	Poland		***EU27***	**Poland**		***EU27***	**Poland**		***EU27***
	Number	**Share**	***Share***	**Number**	**Share**	***Share***	**Billion €**	**Share**	***Share***
Micro	1 339 817	95,7%	*92,2%*	3 060 776	37,4%	*29,6%*	27	16,6%	*21,2%*
Small	41 961	3,0%	*6,5%*	973 749	11,9%	*20,6%*	21	13,0%	*18,5%*
Medium-Sized Businesses (MSB's)	14 930	1,1%	*1,1%*	1 547 126	18,9%	*17,2%*	35	21,9%	*18,4%*
SME Totals	**1 396 708**	**99,8%**	***99,8%***	**5 581 651**	**68,2%**	***67,4%***	**83**	**51,5%**	***58,1%***
Large	3 175	0,2%	*0,2%*	2 607 341	31,8%	*32,6%*	79	48,5%	*41,9%*
Totals - All Businesses	**1 399 883**	**100,0%**	***100,0%***	**8 188 992**	**100,0%**	***100,0%***	**162**	**100,0%**	***100,0 %***

Source: European Commission, 2013.

Reviewing Table 1 above, it is evident that SME’s as a business sector are a significant part of the EU company landscape. Not only do they employ just under 70% of persons employed by Businesses, but they also generate between 50 and 60% of the Value Added. Within this, MSB’s employ around 20% of the persons employed and, in Poland and have a 22% contribution to Value Added. For the EU as a whole, the percentages for Employment and Value Added are slightly lower than for Poland.

The above figures reinforce a point made by Young (2010) in his paper described earlier on Opportunities and Challenges in SME implementation of Environmental Management Systems. On page 2 he states:

> “While a typical SME is likely to have a relatively small impact on the environment (compared to a large multi-national company, for example) the size of the sector suggests that their aggregate impact is significant”.

Although this GHG emissions impact has not been fully quantified by research, Young’s (2010) analysis of available research mentioned earlier in this paper, described estimates by Hillary (1995, quoted in Hillary, 2003) that SME’s could contribute up to 70% of all pollution caused by industry. He also described research by Stokes and Rutherford (2000) and Marshal (2008) (which he quoted from Seidel) that estimated U.K. SME’s were responsible for 60% of commercially generated waste and 60% of CO_2 emissions. On page 2 of his paper Young (2010) described the increasing role of SME's in global production and concluded together with other authors:

> "the increased presence of small companies in global supply chains is likely to have a negative effect on the pervasiveness of sustainability requirements in the value chain."

Table 2. Total External Trade by Company Size (2010)

SME's in Poland and EU - Total External Trade		
Business Group	**Poland Share**	***EU27 Share***
Micro	6,1%	*11,1%*
Small	10,5%	*12,3%*
Medium-Sized Businesses (MSB's)	25,6%	*18,2%*
SME Totals	**42,3%**	***41,6%***
Large	45,5%	*44,5%*
Not Categorised	12,2%	*13,9%*
Totals - All Businesses	**100,0%**	***100,0%***

Source: Eurostat, 2011.

This conclusion is reinforced when looking at Table 2 showing the External Trade Contribution of SME's in Poland and within the EU. External Trade Data was taken to reflect the demand for transport being one of the EU's most significant GHG Generators[2].

Per Table 2 above, SME's account for 42% of External Trade whilst MSB's account for 60% of this figure in the case of Poland and for 44% in the case of the EU taken as a whole.

In themselves, these numbers indicate significant transport volumes, however to them should be added transport volumes due to SME activities within countries. Unfortunately, data on intra-country SME transport was not directly identified so Table 3 below was developed showing Total Value Added per Business Group for Non-financial Businesses. Although Table 3 has

[2] In a Paper published in September 2009 Sessa and Enei present trends in EU Transport until 2050 showing Transport emissions as the only GHG emissions which continue rising throughout this period. This is from a base which according to a Paper by van Renssen (2012) is already 24% of total EU GHG emissions. Transport constitutes the second largest source of GHG emissions within the EU.

similarities to the Value added columns of Table 1, it was developed from a different EU Data Source to gain understanding of actual or potential Transport demand both in Poland and within the EU. Value added data was used to avoid "double-counting" which would have occurred if Turnover figures had been used. Likewise, data on Non-financial businesses was chosen as only these business sectors will be significant Transport users.

Table 3. Value Added Non-financial Businesses by Company Size

SME's in Poland and EU - Value added Non-financial Businesses				
Business Group	**Poland Value (Mln.€)**	***EU27 Value (Mln.€)***	**Poland Share**	***EU27 Share***
Micro	26 430	*1 261 663*	15,9%	*21,8%*
Small	21 868	*920 550*	13,2%	*15,9%*
Medium-Sized Businesses (MSB's)	35 727	*1 079 876*	21,5%	*18,7%*
SME Totals	**84 025**	***3 262 089***	**50,6%**	***56,4%***
Large	82 113	*2 518 044*	49,4%	*43,6%*
Totals - All Businesses	**166 138**	***5 780 133***	**100,0%**	***100,0%***

Source: Eurostat, 2013.

Per Table 3 above, SME Value added is between 50 and 56% of total Value added and, within Poland, MSB's are by one third the highest generator of Value added. Within the EU, SME's are the highest generators of Value added whilst MSB's, still create 33% of SME Value added.

There are two conclusions from Tables 2 and 3, firstly that the Transport Requirements of SME's account for a significant volume of Transport GHG emissions and second, significant volumes are generated by MSB's operating within the EU.

As described earlier in this paper, transport is the only emissions source within the EU from which GHG emissions are expected to continue increasing to 2050.This reinforces the statement in the Introduction to this Paper that assisting MSB's reduce Transport emissions has the potential for significant contribution to reducing overall GHG emissions. This is not only with regard to today's volumes but also for the foreseeable future.

3. SME's (MSB) attitudes to GHG emission reduction

Reviewing Academic Research on SME / MSB attitudes to Environmental Issues, several authors comment how sceptical SME's are on them. In the paper by Young (2010: 3) discussed earlier, these is a comment how Hilary concluded SME's were:

> "…very sceptical of the benefits to be gained from making environmental improvements. In many cases, especially for the smaller organisations, low awareness and the absence of pressure from customers (the most important driver for environmental improvements and EMS adoption)….. insufficient other drivers mean that few efforts are made to address environmental issues".

In his analysis, Young (2010) identified a number of business drivers in academic literature which have relevance for SMEs. These include:

- Increased market share/ New markets (Fleischer, 2009; White and Stewart, 2008)
- Improved profits/Financial performance (Fleischer, 2009; White and Stewart, 2008)
- Cost reductions/Efficiency (McKeiver and Gadenne, 2005)
- Competitive advantage (Condon, 2004; McKeiver and Gadenne, 2005)
- Employee attraction / Retention (Fleischer, 2009; Jenkins, 2004; Roberts et al. 2006; White and Stewart, 2008)
- Reputation building (Fleischer, 2009; McKeiver and Gadenne, 2005)
- Legislative compliance (White and Stewart, 2008)
- Supply-chain pressures - e.g. maintaining access to existing markets / Customer retention (Roberts et al. 2006)
- Reputation protection (Jenkins, 2004; White and Stewart, 2008)

These business drivers have an impact on the SME business model either as a single issue or on an aggregate level and on page 3, Young continues by describing the key driver in the SME business model. This is the need to avoid financial and operational risks which may affect company survival. It results in a concentration on daily activities, short-term problem solving / issue handling and a concentration on "balancing the daily business". In this situation, quoting Biondi and Iraldo, Young concluded (Seidel et al., 2009):

> "A demonstrated relationship [between] financial performance and environmental / social considerations is very important for SME adoption of CSR initiatives"

A possible approach is the use of legislation or compulsory reporting and in this context, on page 5, Young described how a number of academic writers suggested:

> “SMEs often state that they will not invest in such improvements unless they are forced to do so by law”.

Moreover, even when legislation is applied, Young concluded that a significant issue presented in academic literature continued to be awareness of the concrete impact of legislation on SME’s / MSB’s Operating Models.

One can only conclude that if SME’s / MSB’s are to be convinced to implement GHG emission reduction programmes, the most effective would be to present tangible financial or business operation benefits which an MSB could achieve while also reducing Supply-Chain GHG emissions.

4. The environmental perspective: transport options and GHG emissions

To understand the options which, from a GHG emissions perspective, could best be presented to MSB’s, an analysis of various transport modes was carried out using data from the UK Government DECC Guidelines (Department of Energy and Climate Change (DECC), Department for Environment, Food and Rural Affairs (DEFRA), 2012). The parameters used were base done fully laden 40’ Container load equivalent:

- Load: 25 tons (Gross Container Weight: 29 tons - 4 ton Container plus 25 ton Load / Load weight used where Trucks is not designed to take full Container load).
- Daily distance covered: 600 Km/day (standard used by Road Freight Hauliers).
- Trucking Distance: 2 full days / 1.200 km.
- Empty Return not considered (to ensure valid data comparison).
- 8% “Distance Adder” for Rail Transport to allow for longer routes[3].
- Short Sea / Inland Waterway included for comparative purposes only (solution isdependent on geographical location because of network limitations in most of EU).

Table 4 was prepared using the above parameters.

[3] 8% Adder is per data presented by Prof Alan McKinnon in a report to the European Automobile Manufacturers Association in September 2010 (McKinnon, 2010).

Reviewing Table 4, the Transport Modes with the lowest GHG emissions are Rail or Water. This also applies when Total GHG emissions are considered and a “Distance Adder” is added to Rail compensating for (normally) longer transport routes. Comparing Rail with Inland Waterways one needs to bear in mind that for technical reasons (draft issues / length restrictions), Barges can take up to 200 TEU and in this category (Water Transport up to 999 TEU) GHG emissions impact is higher than Rail. Table 4 does show advantages in Water Transport using larger Container Vessels. However, operationally, transport from port to inland destination, serves as a severe limitation. Summing up therefore, Table 4 confirms the commonly held opinion that, within a given geographical region for Inland Transport, Rail, is the Transport Mode with least GHG emissions impact. Thus to achieve “lowest possible” Inland Transport GHG emissions, ways should be found to encourage MSB’s to benefit from Rail Transport.

Table 4. Comparative Emissions Data by Transport Mode

GHG Emissions - Comparative Data by Transport Mode									
Transport Mode	**Vehicle Type / Traction Mode**	**Road Vehicle Category (tons)**	**Payload Cap-acity (tons)**	**Transport Mode Total GHG / Km. (kg) ****	**Weight of Load (tons)**	**Distance (km) *****	**Total Distance Travelled (km)**	**Total GHG Emission (kg)**	***GHG Emission Compared to Rail (%)***
Truck	Rigid	>3.5-7.5t	4	0,78033	25	1200	8400	6555	***480%***
Truck	Rigid	>7.5-17t	10	1,02153	25	1200	3600	3678	***269%***
Truck	Rigid	>17t	15	1,37474	25	1200	2400	3299	***242%***
Truck	Articulated	>33t	29	1,42496	29	1200	1200	1710	***125%***
Rail	Diesel / Electric		29	1,05386	29	1296	1296	1366	***100%***
Inland Water / Short-Sea Container	0-999 TEU		29	1,26034	29	1200	1200	1512	***111%***
Short-Sea Container	1000-1999 TEU		29	1,11476	29	1200	1200	1338	***98%***
Short-Sea Container	2000-2999 TEU		29	0,69455	29	1200	1200	833	***61%***

NOTES:
* Payload Capacity is either Gross Container Weight or Average Truck Capacity depending on which figure is relevant
** Transport Mode Total GHG / Km. Includes all GHG Emissions be they directly caused by the Transport Mode or indirectly eg. due to (for instance) Fuel Storage Requirements or Electricity Generation and Distribution for Electrically driven Transport or Locomotives
*** Rail includes "Distance Adder" (8%) . Inland Water / Short Sea Container has no "Distance Adder" as results shown only for comparative purposes because of Inland Water Network Limitations in most of the EU

Source: Department of Energy and Climate Change (DECC), Department for Environment, Food and Rural Affairs (DEFRA), 2012.

However, it is obvious that a general statement of this nature cannot apply "across the board". Among other reasons, not all MSB's have a Business Model that facilitates shipping and operating with 40' or 20' containers whilst ensuring acceptable Customer Service Levels. Some MSB's need more frequent transport, some have smaller loads to specific destinations, some have distance requirements or limitations which cannot be handled efficiently using Rail Transport. In all these cases MSB's will be obliged to find solutions which are more flexible and based on significantly smaller payloads which "by definition" entail the use of smaller or incompletely loaded vehicles.

Table 5 was therefore developed using quantative data from the UK Government DECC Guidelines[2] to understand the possible impact of loading on GHG emissions.

Two observations can be made based on Table 5. First, the last column of Table 5 confirms something that was already apparent from Table 4, that higher load capacity Trucks have lower GHG emissions impact per Ton/Km. Second, that the more Payload carried by a Truck in a specific Vehicle Category, the lower the GHG emissions per Ton/Km. Reviewing the penultimate column in Table 5, showing the impact of Payload within specific Vehicle Categories, in most cases GHG emissions per Ton/Km. are 100% lower when fully loaded compared to the average U.K. load. The target, for MSB's which, for Business Operational Reasons, are obliged to use Truck Transport must therefore be to maximise Truck Payload (almost) irrespective of what specific Vehicle Category fits the needs of their business.

Concluding this section of the paper, one can write that, from a GHG emissions perspective, the optimum directions for MSB's would be to use Rail Container Transport and to attempt to maximise the carrying capacity of any vehicle that is used. This second aspect becomes even more important if, for Business Operational reasons, Rail Container Transport is not a viable option. The question must therefore be raised;- if Rail Container Transport and Full Loads are the most environmentally sustainable options, how can MSB's be encouraged to apply them?

To help answer this question, it may be worth devoting some time to understand MSB business and operational perspectives on Supply-Chain Issues.

Table 5. Comparative Emissions Data by Loading

GHG Emissions - Comparative Data by Truck Loading

Transport Mode	Vehicle Type	Vehicle Category (tons)	Maximum Payload (tons) *	% Weight Laden	Actual Payload (tons)	Total GHG / Km. (kg) ***	GHG Emission / Ton Km. (kg)	*GHG Emission - % Variation Compared to 100% Load*	*GHG Emission - % Variation Compared to Artic. Truck*
Truck	Rigid	>3.5-7.5t	4	0,0%	-	0,66585	0,66585	***341,32%***	*1355,10%*
				50,0%	2,00	0,72309	0,36155	***185,33%***	*735,80%*
				100,0%	4,00	0,78033	0,19508	***100,00%***	***397,02%***
			Avg. Load** =	46,0%	1,84	0,71852	0,39050	***200,17%***	*794,72%*
Truck	Rigid	>7.5-17t	10	0,0%	-	0,79660	0,79660	***779,81%***	*1621,20%*
				50,0%	5,00	0,90907	0,18181	***177,98%***	*370,02%*
				100,0%	10,00	1,02153	0,10215	***100,00%***	***207,90%***
			Avg. Load** =	39,0%	3,90	0,88433	0,22675	***221,97%***	*461,47%*
Truck	Rigid	>17t	15	0,0%	-	0,95914	0,95914	***1046,53%***	*1951,99%*
				50,0%	7,50	1,16694	0,15559	***169,77%***	*316,65%*
				100,0%	15,00	1,37474	0,09165	***100,00%***	***186,52%***
			Avg. Load** =	54,0%	8,10	1,18413	0,14619	***159,51%***	*297,52%*
Truck	Articulated	>33t	29	0,0%	-	0,86018	0,86018	***1750,59%***	*1750,59%*
				50,0%	14,50	1,14257	0,07880	***160,37%***	*160,37%*
				100,0%	29,00	1,42496	0,04914	***100,00%***	***100,00%***
			Avg. Load** =	44,0%	12,76	1,21034	0,09485	***193,04%***	*193,04%*

NOTES:
* Maximum Payload is either Gross Container Weight or Truck Capacity depending on which figure is relevant
** Avg. Load = Average U.K Payload for a Specific U.K. Vehicle Category
*** Transport Mode Total GHG / Km. Includes all GHG Emissions be they directly caused by the Transport Mode or indirectly eg. due to (for instance) Fuel Storage Requirements or Electricity Generation and Distribution

Source: Department of Energy and Climate Change (DECC), Department for Environment, Food and Rural Affairs (DEFRA), 2012.

5. The MSB business operations perspective: supply-chain business operation issues

From a specific MSB's Perspective, Supply-Chain affects MSB Business Operations by impacting:

- Cost
- Quality
- Supplier / Customer Service Levels

Supply-Chain Cost impact is because of the obvious impact on the Marginal Service Level which directly impacts on the Business Operation because of (for instance) total throughput time, pick-up and delivery time, order to delivery accuracy (both from a Customer and from an internal operations perspective), potential for theft, etc. The impact of the Supply-Chain on Quality is potentially very big through (for instance) damage in transit, exposure to weather (causing product or packaging deterioration), perishability and shelf-life impact, poor handling (damaging product or packaging) all of which can have a direct effect on MSB Customers or on an MSB's internal operation.

These aspects have to be very seriously considered in selecting or optimising a specific Supply-Chain for a specific MSB. What adds a degree of urgency is the fact that MSB's are not normally in a position where they feel they can "dictate to" a market. For this reason, MSB Management and Operations staff often feel very constrained firstly, with regard to making a correct choice as to a particular Model and secondly, if Quality and Service Level parameters are met in an acceptable manner, to introducing any changes. What is very interesting in this context is that once a certain Supply-Chain Model has been setup and is running, Cost, one of the two most important drivers behind any MSB Business, takes "second place" to Quality or Service Level because these are drivers which the MSB feels can pose a greater short-term risk to its operation.

In this context, Table 6 shows some of the areas MSB's would be looking at to reduce Supply-Chain Cost, improve Service Levels or reduce Supply-Chain Quality Risk. It was developed based on the authors own experience working over many years both as a customer and as a logistic service provider for national and international companies within Poland and the rest of the EU.

Table 6. Transportation Supply-Chain Improvement Areas

Supply-Chain Improvement Areas				
Improvement Area	**Improvement Methods**	**Cost Impact**	**Quality Impact**	**Service Level Impact**
Investment Cost	Outsourcing / Use of Third Parties	Reduced Cost of Asset Base / Reduced Maintenance and Replacement Costs / Improved Flexibility responding to Changes in Demand	Opportunity to use Specialists in given fields / Potential for Innovative & "Best in Class" Solutions	Faster Delivery Times / Better Service Levels then with Own Resource / Shipment "Track & Trace" Capability / Potential for "Best in Class" Solutions
Handling & Loading	Load in Final Delivery Containers	Reduced Handling Cost due to Unloading / Reloading	Use of containers designed to handle specific products / Less risk of Handling Damange to Packaging or Contents / Lower risk of Exposure Damage	Faster Deliveries / Reduced "Through-Put" Times / Less "Opportunities for theft" because of less frequent Loading & Unloading
Transport Loads	Full Load Principle - fully load available Transport Capacity (Weight or Volume) / Avoid "Empty Return"	Reduced Fuel Costs / Reduced Maintenance Costs		
Consolidated Transport	"Shared Shipments" with products of several different companies shipped in one load	Reduced Cost "per unit shipped" / Allow Participation in Better Pricing & Discount Structures / Better application of "Full Load" Principle	Possible to ship in more robust Containers / Less risk of Handling or Exposure Damage	Faster Deliveries / Reduced "Through-Put" Times / Encourages use of more Secure Containers (less "Opportunities for theft")
Load Consolidation "Milk-Runs"	One Customer "picking-up" from several Suppliers in a specific area or one Supplier shipping in one transport to several Customers in a specific area	Reduced Cost "per unit shipped" / Better application of "Full Load" Principle	Better control over specific Customer / Supplier Deliveries	Faster Info. on Quantity Issues (thus better issue preparation & recovery planning) / Use of "Empty Return" Loop for Returnable Packaging Transport

Source: Author’s own experience working with companies in Supply-Chain Optimisation.

Reviewing Table 6 it becomes apparent how important it is to combine various improvement areas. Each of these areas, on their own, are either difficult for an MSB to implement or, based just on the MSB’s own volumes, provide solutions which are often compromised (e.g. waiting with shipments until a full load is ready can compromise Customer Delivery Requirements).

Handling and Loading in Final Containers may seem a very promising solution in terms of Quality or Service level but can give rise to the "Empty Return" problem of having to ensure empty packaging return shipments.

Other solutions "look good on paper" but problems arise with implementation (e.g. availability of containers for Final Delivery Loading) or can result in increased costs (e.g. to cover the need for specialised Tracking & Tracing Capabilities allowing tracking of specific loads in a Consolidated Transport).

There may also be legal liability, conflict of interest or insurance issues making it impossible to implement specific solutions (eg. for MSB's located on one Industry Park or geographical area it may be tantalising to Consolidate underutilised Transport to Customers at another Industry Park / geographical area; however, for legal liability or insurance cover reasons, it may well be impossible for them to do this using transport belonging to any one of the companies).

Another example is that quite often a specific MSB will not have the transport requirements to ensure full load shipments.

Thus, an MSB considering implementing improvements in its Transportation Supply-Chain, needs to look at the totality of its requirements to try to find ways in which it can benefit from synergies by applying several improvement areas since it is clear from Table 6 that combining improvement areas, "the whole" becomes very much more than the "sum of the parts". Thus, it becomes very apparent how much benefit could be provided by combining volumes to meet appropriate Quality and Service Level Requirements.

Clearly, for very many MSB's, generating the necessary volumes is not a realistic option and so one method for achieving these synergies is by outsourcing or use of appropriate Third Parties. This often serves as a foundation to implementing Supply-Chain Improvements allowing the MSB to concentrate unhindered on developing its core business areas whilst providing a partner who should have much deeper capability for implementing synergies across improvement areas. The reason for this is because applying these synergies should be the core business improvement area of the selected outsource partner or Third Party. What this does however mean, is that from a practical perspective, a clear selection process is needed beforehand which ensures that outsource partners or Third Parties are chosen with the best possible “fit” to a specific MSB’s needs and, in addition, have the potential to support future requirements even in cases where “for today” the MSB is not able to define these future requirements.

6. Environmental and MSB business operations perspective commonalities

A fear sometimes raised with regard to Environmental Initiatives is the negative effect on operating cost. Discussing the subject with MSB management, a view can be heard that Environmental Initiatives have a negative cost impact (almost “by definition”), thus “if society wants these initiatives to implemented”, then “society” should pay for this. Whilst in some cases (e.g. in tougher emission requirements for trucks) it may be the case, whether this negative cost impact is the case in all circumstances is debatable, among other things, because of the complexity of the Business Environment. Applied in one business case, solutions based on specific Environmental Initiatives may result in more cost, in another, the same solutions will result in cost neutrality or (even) cost reduction by, for instance, encouraging the implementation of operational improvements (because negative cost impact can provide a trigger for companies to implement operational improvements with a much stronger “bottom-line” impact then the apparent negative cost).

Reviewing the Supply-Chain Improvement Areas listed in Table 6, they all have the potential to reduce cost. Moreover most of them also have the potential to improve Supply-Chain Service Level plus reduce the risk of Quality Incident Occurrence. They all therefore, have potential to achieve significant improvements in MSB Business Operations. Whether they have a similar potential with regard to GHG emissions is analysed in Table 7.

Reviewing Table 7, what is apparent is that the improvements in Supply-Chain Business Operations unlock significant potential for GHG emission reduction. For sure, the Operational benefits of the Supply-Chain Improvements must be quantified by a specific MSB, however from Table 7 it is clear that improvements in Supply-Chain Business Operations are not only viable from a Business Operation Perspective but they can also function as enablers providing MSB’s with strong potentials for GHG emission reduction. This conclusion is all the more surprising in that it runs counter to what seems to be a commonly held view on the subject that GHG emission reduction is a cost (and therefore a burden placed on MSB's).

Table 7. Supply-Chain Business Operation Improvement / GHG Emission Impact Comparison

Supply-Chain Business Operation Improvement / GHG Emission Impact			
Improvement Area	**Improvement Methods**	**MSB Business Operation Impact**	**Transportation Supply-Chain GHG Emission Reduction Impact**
Investment Cost	Outsourcing / Use of Third Parties	Cost / Quality / Service Level Improvement Potential	Significant GHG Impact Potential: Volume Consolidation / Providor Focus on Environmental Issues thus use of more ecologically viable Transport Solutions
Handling & Loading	Load in Final Delivery Containers	Cost / Quality / Service Level Improvement Potential (but need to avoid "Empty Return" Problem)	Reduced GHG because of Potential to use Containers Rail Transport (but solution needed for "Empty Return" Problem)
Transport Loads	Full Load Principle - fully load available Transport Capacity (Weight or Volume)	Cost Improvement Potential	Reduced GHG per Unit of Transported Product because of "Full Loads"
Consolidated Transport	"Shared Shipments" with products of several different companies shipped in one load	Cost / Quality / Service Level Improvement Potential	Greater Potential for "Full Loads" thus potential for Reduced GHG per Unit of Transported Product
Load Consolidation "Milk-Runs"	One Customer "picking-up" from several Suppliers in a specific area or one Supplier shipping in one transport to several Customers in a specific area	Cost / Quality / Service Level Improvement Potential	Greater Potential for "Full Loads" thus potential for Reduced GHG per Unit of Transported Product

Source: Author's own experience working with companies in Supply-Chain Optimisation.

The only issue shown (handling "Empty Container Return") can be eradicated by selecting an Outsource Partner / Third Party Provider with a sufficiently large customer base (in both directions) to ensure the partner has a realistic capability of managing Container Flow in-line with the MSB's requirements.

In this situation, the major issue for an MSB then becomes not so much "is it worth it" to implement Supply-Chain GHG emission reduction programmes or "who will pay for them" but, driven by the Business Operations improvements, what steps MSB's should take to implement fast and successfully.

7. Implementation of business operation / GHG emission reduction programmes

However, MSB's face severe challenges with implementation. A number of these are identified in the analysis of research carried out by Young (2010) which was described earlier in this paper. The challenges he presents include:

- Lack of internal expertise (Condon, 2004; Hillary, 2003; Roberts et al., 2006)
- Lack of relevant (sector- and/or size-specific) information resources and supporting services (Condon, 2004; Hillary, 2003; McKeiver and Gadenne, 2005; Roberts et al., 2006)
- Time pressures and short planning horizons (Condon, 2004; Jenkins, 2004; Hillary, 2003; McKeiver and Gadenne, 2005; Roberts et al., 2006; Seidel et al., 2009)
- Ad-hoc or minimal systems (Jenkins, 2004; Lee, 2009), esp. in relation to strategic decision making (Condon, 2004; Lee, 2009; Seidel et al. 2009; Will, 2008)
- Low awareness of environmental impacts and risks (Condon, 2004; McKeiver and Gadenne 2005; Seidel et al. 2009)
- Perception of higher costs and financial risk (Hillary, 2003; Jenkins, 2004) / Unclear cost benefit ratio (Roberts et al., 2006)
- Financing difficulties (Condon, 2004; Lee, 2009; McKeiver and Gadenne, 2005; Seidel et al., 2009)
- Low interest (Hillary, 2003) or limited enforcement (Jorgensen and Knudsen, 2006) from customers
- Barriers in down-stream supply-chains (Jenkins, 2004; Roberts et al., 2006)

At first sight the list above looks daunting and it is clear that without specialised external assistance it will be very difficult for MSB's to overcome the challenges. Even though specialised assistance is generally available, MSB's will have difficulties identifying this assistance, building confidence in it, selecting optimum solutions or being ready to allocate the appropriate level of funding that implementation may require.

On the other-hand, there is clearly a very large opportunity. As described earlier in this paper, MSB's form a very large part of the business landscape not only in Poland but throughout the EU. Assisting them with their Supply-Chain Business Operations will also have significant GHG emission reduction impact. This is a general society benefit not only for today but for future generations. The question must therefore be raised;- which groups or organisations within society could best help MSB's achieve these goals in a realistic and concrete manner?

An option for this are Universities and Higher Education Establishments which by basing on their two fundamental roles being the:

- Didactic(Teaching) Role.
- Research Role.

They have a very strong potential not only to work with MSB's on improving their Business Operations and, at the same time, helping their Business Operation become more environmentally sustainable. Universities and Higher Education Establishments have credibility and "name recognition" within EU societies. Moreover, they are faced by a "declining core market" through a declining general birth rate leading to a decline in the student population[4]. Faced by this situation the question must be raised (almost in marketing terms) what additional services Universities and Higher Education Establishments could provide, based on their two fundamental roles, which could benefit society as a whole and which would draw in a very concrete way on their skills, talents, knowledge base, resource base, their competency sets and their research / teaching facilities.

How to realise this potential is obviously a question for discussion but at "first glance", Universities and Higher Education Establishments could do this either via more traditional methods such as:

- Course content and specialised diploma courses.
- Research (e.g. Doctorates combining Environmental & Business Operations issues).
- Issue raising within academic and non-academic circles.

[4] This subject is commented on by a number of authors and journalists (for instance: Nuthall, 2008; *Demographic decline…*, 2007; Vasagar, 2012; O'Malley, 2012).

An alternative would be to setup (or help setup) Competency Centres or "Centres of Expertise" on a regional basis. These Competency Centres / "Centres of Expertise" could provide:

- Business, Management Accounting and Sustainability skills drawing on Best Practice literature.
- Knowledge & "Best Practice" Training / Courses / Work-shops.
- Funding Information (e.g. EU Grant Availability - drawing on their internal experience of EU Funding Implementation)
- Validated tool-kits (Sustainability and Business Practice Spread-sheets, Roadmaps, Templates etc.)
- Forums for Business Advice and Support.
- Centres for networking and "best practice" transfer.
- Project base (and potential revenue stream) for Masters and Doctorate Students

Obviously the more the subject is considered the more areas / ideas will come up which can then be implemented in a viable and sustained manner.

Funding may be an obvious limitation but bearing in mind aspects such as:

- SME / MSB Focus.
- Business Operations Improvement.
- GHG emissions reduction / Environmental Sustainability Improvement.
- Regional Focus.

One can imagine assistance being available from a number of Regional or EU Funding Programmes(or even private industry or funding sources) whilst, given the contacts and experience Higher Education Institutions have in this area, gaining access to them should be realistically possible. Thus, by slightly "moving across" the historical operating model of Universities and Higher Education Establishments, areas can be developed which provide very strong value both to society and to the Business Community and which, in addition, could help provide additional value streams.

8. Concluding remarks

This paper presents the size / significance of the SME / MBS Business Community within Poland and the EU, indications of the Environmental Impact of this community, reasons MSB's are reluctant to implement GHG emission reduction programmes in their Supply-Chains and ideas for overcoming this reluctance by improvements in Financial and Business Operations which at the same time result in GHG emissions reduction. As can be seen from this paper, the scope and potential for GHG emission reduction within MSB's is very wide as also is the scope and benefit for Business Improvement. However MSB's face severe challenges in implementing Business Operation / GHG emissions reduction improvements. Even when there is a legislative requirement, MSM's often face a combination of a lack of appropriate internal resource, the need to focus on day-to-day operational and financial issues and a lack of clarity as to the concrete financial and operational benefits of operating in a more environmentally sustainable manner

In this situation, bearing in mind the traditional didactic / research roles of Universities and Higher Education Establishments, and combining this with a wider societal responsibility, these institutions are ideally placed to assist MSB's realise concrete improvements in Supply-Chain Business Operation / GHG emissions reduction. Moreover, faced by a decline in student numbers[35], assisting MSB's solve the challenges faced by GHG emissions reduction as well as helping MSB's become more efficient from a business perspective, could provide Universities and Higher Education Establishments with new ways in which their value to society at large can be seen, developed, appreciated and funded. At "first glance" this looks like a very positive "win-win" scenario both for the Universities and Higher Education Establishments, the MSB's and for society at large where the "win-win" is built on the foundation of the skills, knowledge base, resources, infrastructure, research and teaching facilities traditionally available within Higher Education Institutions.

Bibliography

Condon, L. (2004). Sustainability and Small to Medium Sized Enterprises – How to Engage Them. *Australian Journal of Environmental Education* 20(1): 57-67.

Department of Energy and Climate Change (DECC), Department for Environment, Food and Rural Affairs (DEFRA) (2012). *2012 Guidelines to Defra / DECC's GHG Conversion Factors for Company reporting*. Available at: https://www.gov.uk/government/publications/2012-guidelines-to-defra-decc-s-ghg-conversion-factors-for-company-reporting-methodology-paper-for-emission-factors. Accessed 3 July 2013.

European Commission (2003). *Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises (2003/361/EC)* (Official Journal of the European Union" no. L124, 20.05.2003).
European Commission (2013). *Enterprise and Industry SBA Fact Sheet 2012 Poland*. Available at: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/countries-sheets/2012/poland_en.pdf. Accessed 3 July 2013.
Eurostat (2011). *Trade Statistics 2011*. European Commission. Available at: http://ec.europa.eu/trade/policy/countries-and-regions/statistics/index_en.htm. Accessed 3 July 2013.
Eurostat (2013). *Industry Statistics 2013*. European Commission. Available at: http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database. Accessed 3 July 2013.
Fleischer, D. (2010). *Green Teams: Engaging employees in sustainability*. GreenBiz Reports.
Hillary, R. (2004). Environmental management systems and the smaller enterprise. *Journal of Cleaner Production* 12(6): 561-569.
Jenkins, H., A critique of conventional CSR theory: An SME perspective. *Journal of General Management* 29(4): 37-57.
Lee, K.-H. (2009). Why and how to adopt green management into business organizations? *Management Decision* 47(7): 1101-1121.
McKeiver, C.; Gadenne, D. (2005). Environmental Management Systems in Small and Medium Businesses. *International Small Business Journal* 23(5): 513-537.
McKinnon, A. (2010). *European Freight Transport Statistics: Limitations. Misinterpretations and Aspirations*. Report prepared for the 15'th ACEA Scientific Advisory Group Meeting. Brussels.
Renssen, van S. (2012). The final carbon frontier. *Nature Climate Change* 2(11-14). Available at: http://www.nature.com/nclimate/journal/v2/n1/abs/nclimate1340.html. Accessed 3 July 2013.
Roberts, S.; Lawson, R.; Nicholls, J. (2006). Generating Regional-Scale Improvements in SME Corporate Responsibility Performance: Lessons from Responsibility Northwest. *Journal of Business Ethics* 67(3): 275-286.
Seidel, M.; Seidel, R.; Tedford, D.; Cross, R.; Wait, L.; Hämmerle, E. (2009). Overcoming Barriers to Implementing Environmentally Benign Manufacturing Practices: Strategic Tools for SMEs. *Environmental Quality Management* 18(3): 37-55.
Sessa, C.; Enei, R. (2009). *EU transport demand: Trends and drivers*. European Commission Directorate General Environment.
White, C.; Stewart, E. (2008). *Aligned for Sustainable Design: An A-B-C-D Approach to Making Better Products*. Business for Social Responsibility and IDEO.
Will, M. (2008). Talking about the future within an SME? Corporate foresight and the potential contributions to sustainable development. *Management of Environmental Quality* 19(2): 234-242.
Young, G. (2010). *Opportunities and challenges related to SME implementation of EMSs*. Available at: http://synapsechronicles.com/wp-content/uploads/2010/05/Opportunities-and-challenges-related-to-SME-implementation-of-EMSs.pdf. Accessed 3 July 2013.

Zrównoważony rozwój w łańcuchu dostaw: Redukcja emisji gazów cieplarniach w łańcuchu dostaw średnich przedsiębiorstw

Streszczenie:

Średniej wielkości przedsiębiorstwa (ang.: Medium Sized Businesses – MSB's) stanowią znaczną część przedsiębiorstw w Polsce i Unii Europejskiej, przy czym wiele z nich funkcjonuje w sektorach przemysłowym i komercyjnym. Z tego względu w istotnym stopniu przyczyniają się do emisji gazów cieplarnianych. Jednak wśród przedsiębiorstw tych panuje znaczny opór przeciw kwestiom dotyczące zrównoważonego rozwoju oraz gazów cieplarnianych.
Niniejszy artykuł przedstawia sposoby umożliwiające przekonanie średnich przedsiębiorców, że pozytywne podejście do zagadnień zrównoważonego rozwoju oraz gazów cieplarnianych może przynieść trwałe korzyści dla biznesu. Opisano, jak środowisko akademickie może przyczynić się do tego procesu poprzez wspieranie średnich

przedsiębiorców w funkcjonowaniu w sposób bardziej przyjazny środowisku przy jednoczesnym osiąganiu konkretnych korzyści biznesowych i operacyjnych.

Słowa kluczowe: średnie przedsiębiorstwa, redukcja gazów cieplarnianych, opór przeciw kwestiom zrównoważonego rozwoju, doskonalenie łańcucha dostaw / działań biznesowych, rola instytucji w ramach wyższej edukacji