

---

## LIQUIDITY ANALYSIS OF INNOVATIVE AND TRADITIONAL BUSINESSES IN POLAND

Monika Bolek<sup>1</sup>, Bartosz Grosicki<sup>2</sup>

*University of Lodz, Faculty of Economics and Sociology, Department of Industry and Capital Market, ul. Rewolucji 1905r., nr 41, 90-214 Lodz, Poland*

*E-mails: <sup>1</sup>mbolek@ki.uni.lodz.pl (corresponding author); <sup>2</sup>bgrosicki@uni.lodz.pl*

*Received 7 November 2012; accepted 3 December 2012*

**Abstract.** This paper analyzes the liquidity of Polish non-financial companies listed on the Warsaw Stock Exchange, dividing them into two groups: companies with the intangible to fixed assets ratio higher than the median, deemed to be innovative businesses, and companies with the intangible to fixed assets ratio lower than the median, deemed to be traditional businesses. Our results show that liquidity management is different in these two groups when analyzing the cash conversion cycle, the current and quick ratios, and liquid assets. The authors use data representing the Polish economy on the assumption that it can be considered a model one for other developing countries. Poland is at the beginning of this road, completing its systemic transformation after 20 years of efforts, as society has been building an innovation-based economy. Skills in the field of financial management will have to be developed as data analysis described in this paper reveals poor liquidity management. The authors will follow the development of the Polish economy (called a European tiger) to show how it has changed over time.

**Keywords:** liquidity, cash conversion cycle, innovations.

**Reference** to this paper should be made as follows: Bolek, M.; Grosicki, B. 2012. Liquidity analysis of innovative and traditional businesses in Poland, *Business, Management and Education* 10(2): 232–247.  
<http://dx.doi.org/10.3846/bme.2012.17>

**JEL classification:** G3, M2.

### 1. Introduction

Over the last twenty years, the most developed countries have shifted from product-based to technology-based economies. Poland's economy has just started changing and it may also be interesting while observing such a change. Innovation-based companies have more competitive advantages and the ability to grow in the future, globalized market. Innovation and technology can be measured in terms of a company's intangibles relative to other assets. Countries with low levels of intangibles are those with cheap labor and traditional economies, based exclusively on production. The developed economies of the world, especially the USA, have transferred their production processes to China. Europe has decided not to give up production process, in contrast to what the Americans

did. Such a situation is connected with social structure and employment management provided by political governments. At the beginning of its integration with the European Union, Poland was a place of production for the developed countries thanks to low costs and a large labor force. Now the situation is different, as an education-based transition has caused society to change from a labor-based to knowledge-based economy. This change will be realized very soon since more and more capital is provided to research and technology transfer based on business-science cooperation. It should be added that Poland is following the western model right now, being at the second stage of development after overturning communism. The third one will be connected with catching up with the Western economies and joining them in influencing the world.

The business situation right now is connected with the European Union funds that are influencing Poland's economy positively. As it was mentioned, there is little cooperation between business and science in Poland and technology transfer does not exist on a large scale. The European Operating Program called Innovative Economy (2007–2013) is to change this situation and support the creation of a transfer mechanism. Larger companies listed on the Warsaw Stock Exchange are not innovative in the sense of internal R&D or the use of new technologies. Poland's economy is called a European tiger, but this may change if businesses do not start investing in technology transfer. More and more young people who graduate from universities look for attractive jobs in the fields they are educated in. Technology transfer may change both the job market and the financial market.

Mauboussin and Kawaja (1999), who conducted detailed analysis of profitability ratios such as return on invested capital for the S&P 500 companies, found that the source of value creation for companies was shifting from physical to intellectual capital. This statement is helpful in forecasting how the Polish market will change if intellectual property plays a more important role in business. The question is how the country, having undergone transformation, will use this knowledge and how this will speed up the process of catching up with the Western economy. Intangible assets are those assets that are called intellectual property and include: patents, copyrights, trademarks, trade secrets, design rights and design patents, as well as research and development know-how, production/process information know-how, sales and marketing information, licenses, assembled work force/management, leasehold rights and other assets not having tangible or physical substance (Lyroudi, Rychter (Bolek) 2012). The higher the level of intangible assets the more different the innovation-based business becomes from a traditional one. Tim Cook, the president of Apple Corp., one of the leading technology-based companies in the world, states that IT products are similar to dairy products: when fresh they are premium class but their value drops very fast within one week, and after two weeks the fridge will stink. Thus, inventory in the warehouse may become the main problem for innovative (also technology-based) companies. For traditional businesses inventory may not be a problem.

Clients and products, invested capital and resources determine the character of a business in a competitive world. These characteristics are specific to innovation-based entities and liquidity will be affected by these phenomena in a special way. Clients of

innovation-based companies are always looking for more new products, so companies have to carry out a lot of projects and must have high levels of intangible assets. The capital invested in companies with an innovation profile will be more costly since such projects are more risky and investors will look for higher returns. We can expect intangibles to impact the capital structure, too. Resources will contain know-how represented in high levels of intangible assets. Liquidity management will be connected with low levels of receivables and inventory, but high levels of cash ready for new challenges. ROE and ROA will be higher than average. Dividends will not be paid, but reinvested.

Analyzing the problem of developing countries one can consider a business model connecting technical potential with economic value, as it is described in the paper by Chesbrough and Rosenbloom (2002) concerning the case of Xerox. We can analyze this model and try to apply it in an economy without a specific transfer mechanism established yet. At the beginning of transfer, technology does not have a specific value, which will not be determined until after commercialization. This model is the so-called architecture of revenues (Chesbrough, Rosenbloom 2002) that the company will realize. If there is not enough value created by a new technology, then it can be reduced (Rosenbloom, Spencer 1996). The business model concept has been developed in many works, e.g. by Chandler (1962), who observed diversification connected with imaginative response in the administration of enterprises. Developing or transforming countries (the latter name better fits post-communist Eastern Europe) are spoiled by a bureaucratic frame of mind. Ansoff (1965) presented a conscious plan to align the firm to perform in its environment.

Another problem of developing businesses is linked to excessively self-confident managers who assess the environment without consulting or professional market research. In 1959, E. Penrose identified managers as a source of growth arising from the ability to manage additional business. This problem should be also considered as one that occurred a long time ago but is relevant to the current situation of Eastern European companies. The position of a company on the market in the technological field helps it launch a new technology (Teece *et al.* 1993; Silverman 1999). Developing companies should take it into consideration and start building an advantage on the market with one technology first, and then diversify, rather than start with many different ones. Adaptation can be a better strategy than goal-focused planning (Mintzberg 1979, 1994) in such countries where limited information problem is surrounding the managers (Burgelman 1983a, b described a similar problem). The dominance of logic in decision-making based on specific rules can be considered when analyzing the question of actions and decisions in business (Prahalad, Bettis 1986) and looking for new opportunities. Logic-based behavior is described in many works of Abernathy *et al.* (1983), Henderson and Clark (1990), Christiansen (1997 – semiconductor equipment, disk drives), and Tripsas (1997 – typesetting). There is also a problem of spin-offs as technologies not suited to the mainstream production in the parent company. The causes of the difficulty are identified in such areas as the technology itself, the management process, or access to special resources, as it is shown in the following works: Henderson (1994 –

integrative capability investment), Tushman and O'Reilly (1997 – ambidextrous internal process), and Christiansen (1997 – complementary assets). A work by Chesbrough and Rosenbloom (2002) offers a business model for technology-based companies considering such inputs as technological characteristics and potentials, and converts them through customers and market into economic outputs. Chesbrough and Rosenbloom emphasize a lack of understanding of the meaning of the business model and claim that it is not only about making money, contrary to many books on the subject.

Recently, there has been an increased interest in liquidity and working capital management both in business and research. The Polish market, being a developing one, is affected by managers' lack of knowledge and experience and many companies are troubled by inadequate liquidity. Companies prefer more conservative working capital management to maintain liquidity ratios at higher levels even if investors prefer profitability over liquidity (Bolek, Wolski 2012). The proper management of a firm's liquidity may not only protect the firm from financial distress, but it can also offer it a competitive advantage, especially in innovation-based businesses, where products have shorter life cycles. The current and quick ratios have been recognized as the traditional measures of a firm's liquidity, but both are characterized as static and their appropriateness has been questioned by Largay and Stickney (1980) and Aziz and Lawson (1989). Other researchers have recommended more dynamic liquidity measures such as the cash conversion cycle (Hager 1976; Richards, Laughlin 1980), the net trade cycle (Bernstein 1983), the lambda (Emery 1984), and the net liquid balance (Shulman, Cox 1985).

Polish market research into liquidity has been presented in several papers; for example, Bieniasz and Czerwińska-Kayzer (2008) reported that the shorter the cash conversion cycle (CCC) the better the metrics of business performance as measured by the current ratio (CR) and quick ratio (QR), their study being based on the Polish market. Bolek and Wolski (2010) found that there is no relationship between the liquidity ratios CR, QR, AT and the CCC in the non-financial companies listed on the Warsaw Stock Exchange in Poland. According to Bolek and Wolski (2011), there is a positive relationship between liquidity (CR, QR, and AT) and profitability (ROA and ROE), but not between the CCC and ROE in the non-financial companies listed on the WSE. Lyrouti and Rychter (Bolek 2012) found that profitability affected the CCC negatively, company size was negatively related to liquidity, and cash flows were not related in a linear manner with the three liquidity measures (CCC, CR, and QR), but revealed a positive relationship with the most liquid assets (the variable C).

The objective of this paper is to determine for the non-financial companies listed on the Warsaw Stock Exchange if it is true that the higher the levels of their intangible assets, the shorter their cash conversion cycle, and the better their liquidity.

## **2. Model**

The main indicators of liquidity are the current ratio (CR) and the quick ratio (QR). The

latter does not take into account inventories (I). High current and quick ratios indicate a firm with a good liquidity position, but if they are too high the company will be over-liquid. A high CR or QR can be achieved by having either high levels of current assets (CA) or low levels of current liabilities (CL). They can be defined as:

$$CR = CA / CL, \quad (1)$$

$$QR = (CA - I) / CL. \quad (2)$$

The liquidity ratios represent the strategy of companies and the higher they are the more conservative the working capital management policy is.

The cash conversion cycle (CCC) has been considered a more appropriate liquidity measure, because it has dynamic features as compared to the traditional static measures (CR and QR), as it has been stated by many researchers, such as Richards and Laughlin (1980), Kamath (1989), Moss and Stine (1993), Lyroudi and McCarty (1993), Gallinger (1997), Lyroudi (2006), and others.

The CCC is a dynamic measure of corporate liquidity indicating the number of days it takes a firm to recover the cash it has spent in an operating cycle. A low CCC shows that the firm can recapture its cash from the sales of its products faster. The more cash the firm has, the more liquid it will be in the dynamic sense of liquidity. A high CCC shows that it takes the company longer to recover cash from operating processes, which indicates liquidity problems. A low CCC is connected to reducing inventories, faster receivables collection, and extended payment terms. A negative CCC shows that the firm's suppliers are financing its growth in sales, usually at zero cost, and that is why payables are included in the cost of goods sold and have no financing cost. Innovation-based companies should be characterized by a short CCC if they want to be successful with their products: they should shorten the time their money is invested in the sales cycle to have it available for R&D or promotion.

The CCC as a dynamic measure of liquidity can be a very helpful indicator for investors to assess the stocks they are considering investing in, as Mauboussin and Kawaja (1999) have shown. According to them, the CCC can be used as a measure to identify those companies that are replacing their tangibles with intellectual capital. Their analysis regarding S&P 500 companies has revealed that the CCC is lower in those companies that place more value on their intangible assets.

Based on the model developed by Richards-Laughlin (1980), the CCC is defined as the sum of the receivables conversion period (RCP) plus the inventory conversion period (ICP) minus the payment deferral period (PDP), that is:

$$CCC = RCP + ICP - PDP, \quad (3)$$

where: RCP = receivables conversion period = 360 / Accounts Receivable Turnover;

ICP = inventory conversion period = 360 / Inventory Turnover;

PDP = payment deferral period = 360 / Payables Turnover,

$$\text{hence: } CCC = (360AR / \text{Sales}) + (360\text{Inv.} / \text{CGS}) - (360\text{CL} / X), \quad (4)$$

where:  $X = \text{Costs of goods sold} + \text{Other expenses connected to sales} - \text{Depreciation}$ .

As it was stated, the lower the cash conversion cycle, the sooner the firm can recover its cash from the sales of its products and the more cash the firm will have, hence the more liquid the firm will be. If the CCC is long, it takes the company longer to recover cash. Thus, a long CCC would indicate a liquidity problem. The shorter the CCC in innovation-based companies, the faster they rotate their products and are able to sell their inventories and launch new products.

It is also important to remember that there must be a relationship between the current and quick ratios and the cash conversion cycle, but it may either be positive as Richards-Laughlin (1980) argue, or negative, as Lyroudi-McCarty (1993) have found. A shorter CCC can be obtained by decreasing the collection period of receivables or the average inventory, or by increasing the accounts payable period. If accounts receivable, which appear in the numerator of the CR, QR, and CCC, decrease, then all three should fall, as the inventory will. Furthermore, a reduction in both inventory and receivables may also suggest a reduction in working capital and short-term financing. If short-term financing drops, then the liquidity ratios and the CCC may or may not fall. Any change must depend on the relative magnitudes of change in short-term asset and liability changes. As suggested by Richards-Laughlin (1980), a change could occur only if receivables and inventories were totally financed with long-term funds. According to Lyroudi and McCarty (1993), the relationship of the CCC with the CR is negative, while it is positive only with the QR.

On the other hand, a higher CCC can be achieved by increasing the receivables conversion period or the inventory conversion period, or by decreasing the payment deferral period. So, if inventories are about to increase, and because they appear in the numerator of the CR, QR, and CCC, all three measures should rise (suggesting that the CR and QR indicate an improvement in a firm's liquidity position, while the CCC indicates exactly the opposite). In the case of an increase in accounts receivable, the same results would occur. Also, if payables decrease, because they appear in the denominator of the CR and QR, the two liquidity indicators would increase (suggesting an improvement in liquidity), while the CCC would also increase, due to a drop in the payment deferral period (suggesting a deterioration in liquidity), as it is stated by Lyroudi and Rychter (Bolek) (2012).

### **3. Hypotheses**

The first hypothesis investigates the relationship ( $r$ ) between the CCC and the current and quick ratios. It tests for a negative relationship between the current and quick ratios and the CCC of the firm. If this hypothesis is not accepted, then there is a contradiction between the traditional current and quick ratio view and the CCC, since a high CR and QR and a low CCC indicate a good liquidity position of the firm. The authors examine

this problem on two groups of companies representing innovation-based and traditional businesses to compare the way they behave. A negative relationship is expected to hold between the CR and the CCC and between the QR and the CCC.

That is:  $r_{CCC,CR} < 0$  and  $r_{CCC,QR} < 0$ .

The second hypothesis examines the relationship between the CCC and each of its component variables to see how changes in accounts receivable or in accounts payable or in inventory levels affect the liquidity of the firm. It requires the CCC to be positively related to the receivables and inventory conversion period and negatively related to the payables deferral period. This analysis is also done for two groups of companies. A positive relationship is expected to hold between the receivables conversion period (RCP), the inventory conversion period (ICP) and the CCC and a negative relationship between the payables deferral period (PDP) and the CCC.

That is:  $r_{CCC,RCP} > 0$ ,  $r_{CCC,ICP} > 0$  and  $r_{PDP,CCC} < 0$ .

The third hypothesis examines the relationship between a firm's liquidity and its liquid assets. According to Deloof (2001), a firm should keep a low level of cash and marketable securities; hence there should be a negative relationship between the CCC and cash. A negative relationship is expected to hold between the CCC and cash and a positive one between the CR, QR and cash.

That is:  $r_{CCC,cash} < 0$ ,  $r_{CR,cash} > 0$ ,  $r_{QR,cash} > 0$ .

The fourth hypothesis states that technology-based companies are more liquid in the dynamic sense and less liquid in the static sense if they manage the working capital more efficiently than traditional business, which indicates an aggressive approach in working capital management.

That is:  $r_{CCCInnov} < r_{CCCTrad}$ ,  $r_{CRInnov} < r_{CRTrad}$ ,  $r_{QR,cashInnov} < r_{QR,cashTrad}$ .

The sample of observations in this study represents non-financial companies listed on the Warsaw Stock Exchange in the years 1997–2010.

#### **4. Results**

The median has been chosen as an appropriate measure to divide the sample into innovative and traditional businesses using the intangible assets/fixed assets (IA/FA) ratio as an indicator of business type. First, the sample was divided based on the median IA/FA ratio. Innovation-based companies are those for which the IA/FA ratio is higher than the median for all data (0.036 or 3.6% for all 2930 observations). The authors expect to find a difference in liquidity management between these two groups of companies. They will verify the hypothesis using a division into innovative and traditional businesses based on the median IA/FA ratio.

The first hypothesis investigates the relationship between the CCC and the liquidity ratios CR and QR. Analysis is conducted on both nominal change, denoted as  $t$ , and

percentage change, denoted as tp. In the case of the CCC, changes of variables are calculated as percentages (tpCCC), while in the case of CR and QR, being standardized ratios, changes are calculated in the nominal way (tCR, tQR).

To verify the hypothesis, correlation analysis was conducted, whose results are presented in Table 1.

**Table 1.** Correlation between the CCC, CR, and QR for innovative businesses  
(Source: created by the authors)

No	CCC	CR	QR
1	Pearson	0.037	0.033
2	Stat. significance (t-stat. value)	0.160	0.208
3	N	1465	1465

The results are not significant and we have to reject hypothesis one for innovative businesses because there is no negative correlation between the CCC and CR, QR, and the positive correlation is not statistically significant. Based on the results presented in table 2, the authors reject hypothesis one because a positive correlation is observed between change in the CCC and change in the CR and QR.

**Table 2.** Correlation between changes in the CCC, CR, and QR for innovative businesses  
(Source: created by the authors)

No	tpCCC	tCR	tQR
1	Pearson	0.068(sign. 95%)	0.068(sign. 95%)
2	Stat. significance (t-stat. value)	0.014	0.014
3	N	1307	1307

The more liquid the company is in the static sense the less liquid it is in the dynamic sense. This may be connected to the working capital level in a company and to the conservative approach affecting the CCC by too high inventory, receivables and cash. Excessively high levels of current assets may be the result of a conscious policy or a lack of integrated working capital management in innovative companies.

In the group of companies representing the traditional business model, with the IA/FA ratio lower than the median, the results are as follows. Comparing the statistical results of the liquidity ratios for traditional business, the CCC is lower, indicating that innovative companies are less liquid in the dynamic sense. On the other hand, the CR and QR are smaller with a higher standard deviation, which shows that in the static sense innovative companies are less liquid. Traditional businesses are characterized by a lack of the relevant correlation when we analyze the levels of CCC, CR and QR. The results are presented in Table 3.

**Table 3.** Correlation between the CCC, CR, and QR for traditional businesses  
(Source: created by the authors)

No	CCC	CR	QR
1	Pearson	0.000	0.000
2	Stat. significance (t-stat. value)	0.999	0.999
3	N	1465	1465

Rejecting hypothesis one for traditional businesses, it should be pointed out that in this group of companies there is no correlation whatsoever between the CCC, CR, and QR, while for the innovative sector this correlation is slightly positive, which shows that innovative companies manage liquidity with an understanding of the market needs.

The results of correlation analysis of changes in the ratios for traditional business are presented in Table 4.

**Table 4.** Correlation between changes in the CCC, CR, and QR for traditional businesses  
(Source: created by the authors)

No	tpCCC	tCR	tQR
1	Pearson	-0.006	-0.006
2	Stat. significance (t-stat. value)	0.811	0.812
3	N	1387	1387

Comparing the results for the innovative sector (with the IA/FA ratio higher than the median) we can observe lower averages, a negative rate of change, and higher standard deviations. Based on these data, we can expect different results for the group of traditional businesses. The correlation is negative, as it was expected, but the significance of these results is at a very low level and thus hypothesis one for traditional businesses should be rejected.

Hypothesis one is rejected for every scenario indicating a lack of negative correlation between the CCC, CR, and QR. A positive correlation was found for innovative companies, indicating a preference for higher liquidity both in the dynamic and static sense.

The second hypothesis is connected with the CCC and its components. The authors looked for the influence of every component of the measure expecting a positive relationship between the CCC and RCP and ICP, and a negative relationship with PDP.

Correlation analysis was conducted, with the results presented in Table 5.

**Table 5.** Correlation between the CCC and its components for innovative businesses  
(Source: created by the authors)

No	CCC	RCP	IDP	PDP
1	Pearson	0.114(sign. 99%)	0.993(sign. 99%)	-0.010
2	Stat. significance (t-stat. value)	0.000	0.000	0.710
3	N	1465	1465	1465

The CCC is positively correlated with the RCP and ICP. The influence of receivables decisions on the CCC is low, while inventory management influences the CCC at a level of 99%. The correlation with PDP is slightly negative (as was expected), but not significant from the statistical point of view. To confirm the above results, analysis based on changes in levels of ratios was conducted and is presented in Table 6.

**Table 6.** Correlation between changes in CCC components for innovative businesses (Source: created by the authors)

No	tpCCC	tpRCP	tpIDP	tpPDP
1	Pearson	0.167(sign. 99%)	0.211(sign. 99%)	0.133(sign. 99%)
2	Stat. significance (t-stat. value)	0.000	0.000	0.000
3	N	1307	1307	1307

All indicators are positively correlated with the CCC and the results are significant. It is interesting that changes in the PDP indicator positively influence the CCC, even though we expected the opposite result.

In the group of companies representing the innovative sector on the Warsaw Stock Exchange we can partially verify the hypothesis positively since a positive correlation was found, as expected, for the RCP and IDP, while for the PDP the negative influence was not significant. Liquidity management in innovative businesses can be discerned but not at a level sufficient to compete with international corporations. If some money that could be invested in R&D or promotion is tied up in the sales cycle, then some equity must be invested to finance working capital and the return is lower, since the invested capital is higher. Such companies may have trouble finding capital on the market to finance their investments.

For the group of companies representing traditional business the average values of the RCP, ICP, and PDP are lower for traditional businesses as compared with the innovative sector, while the standard deviation is higher. The results of correlation analysis can be different for companies with the IA/FA ratio lower than the median, and the results are presented in Table 7.

**Table 7.** Correlation between CCC components for traditional businesses (Source: created by the authors)

No	CCC	RCP	IDP	PDP
1	Pearson	0.997(sign. 99%)	0.060(sign. 95%)	-0.010
2	Stat. significance (t-stat. value)	0.000	0.021	0.696
3	N	1465	1465	1465

Receivables and inventory management are positively correlated with the CCC and the results are significant, while the payables deferral period is, as expected, negatively correlated, but the result is not significant. Comparing this result with that for the innovative sector, one can see that traditional businesses focus on receivables management while the innovative sector pays more attention to inventory management, because inventory management in the technological sector is connected with the product cycle

and is very short as new innovations are constantly being brought to the market. Even so, receivables management is also important and should be integrated with the liquidity and working capital management policy.

To confirm the above results the authors conducted analysis based on changes in ratios, with the results presented in Table 8.

**Table 8.** Correlation between changes in CCC components for traditional businesses  
(Source: created by the authors)

No	tpCCC	tpRCP	tpIDP	tpPDP
1	Pearson	-0.002	0.006	-0.019
2	Stat. significance (t-stat. value)	0.955	0.833	0.490
3	N	1387	1387	1387

The average rates of changes are lower as compared with the innovation sector despite the RCP, and the standard deviation factors are higher with the ICP being lower. These results confirm that innovative businesses focus on inventory management as the standard deviation ratio is lower in this case. The results are not significant, which indicates a lack of correlation between changes in CCC components. The cash conversion cycle is positively correlated with the receivables conversion cycle and the inventory conversion cycle. A negative correlation between the CCC and the payables deferral period was found, albeit the result is not significant. These results hold for both the innovative and traditional sectors, but the correlation is higher for inventories in the innovative sector and for receivables in the traditional sector. The analysis based on changes in components was irrelevant, suggesting that the methodology based on ratio levels is better in this case. Hypothesis two can be partially confirmed indicating a difference in management of CCC components between innovative and traditional businesses.

The third hypothesis is connected with the relationship between the liquidity of a company and its liquid assets. As it was suggested by Deloof (2001), a company should keep a low level of cash and short-term investments and a negative correlation between the CCC and cash should be recognized as well as a positive relationship between CR, QR, and cash. Correlation for innovative companies is presented in Table 9.

**Table 9.** Correlation between liquidity factors for innovative businesses  
(Source: created by the authors)

No	Ratio	Statistic	Cash
1		Pearson	-0.015
2	CCC	Stat. significance (t-stat. value)	0.579
3		N	1438
4		Pearson	-0.009
5	CR	Stat. significance (t-stat. value)	0.726
6		N	1438
7		Pearson	-0.005
8	QR	Stat. significance (t-stat. value)	0.862
9		N	1438

None of the results are statistically significant. To confirm the results, analysis based on changes of factors was conducted. The results are presented in Table 10.

**Table 10.** Correlation between changes in liquidity factors for innovative businesses (Source: created by the authors)

No	Ratio	Statistic	tpCash
1		Pearson	0.022
2	tpCCC	Stat. significance (t-stat. value)	0.422
3		N	1307
4		Pearson	0.026
5	tCR	Stat. significance (t-stat. value)	0.343
6		N	1307
7		Pearson	0.027
8	tQR	Stat. significance (t-stat. value)	0.333
9		N	1307

None of the results are statistically significant. For innovative businesses, no relationship was found between liquid assets and liquidity ratios, which indicates a lack of liquidity management in this sector of companies. To compare the results with traditional businesses, next analysis was conducted. Correlation analysis for the liquidity factors are presented in Table 11.

**Table 11.** Correlation between liquidity factors for innovative businesses (Source: created by the authors)

No	Ratio	Statistic	Cash
1		Pearson	0.082*(sign. 95%)
2	CCC	Stat. significance (t-stat. value)	0.013
3		N	929
4		Pearson	0.037
5	CR	Stat. significance (t-stat. value)	0.254
6		N	929
7		Pearson	0.038
8	QR	Stat. significance (t-stat. value)	0.247
9		N	929

There is a significant and positive relationship between the cash level and CCC for traditional businesses, which means that an increase in cash and short-term investments is positively related to the CCC. This result is in contrast to Deloof’s findings indicating a lack of appropriate liquidity management in companies representing traditional business in Poland.

To confirm the above results, analysis based on changes in factors was conducted, and the results are presented in Table 12.

**Table 12.** Correlation between changes in liquidity factors for traditional businesses (Source: created by the authors)

No	Ratio	Statistic	tpCash
1		Pearson	0.000
2	tpCCC	Stat. significance (t-stat. value)	0.994
3		N	1387
4		Pearson	0.006
5	tCR	Stat. significance (t-stat. value)	0.834
6		N	1387
7		Pearson	0.005
8	tQR	Stat. significance (t-stat. value)	0.840
9		N	1387

None of the results are statistically significant. Unfortunately, statistical analysis of both the innovative and traditional sectors reveals unsatisfactory results since the only statistically significant result concerns the positive relationship between cash and the CCC for traditional businesses. Thus the third hypothesis should be rejected.

The fourth hypothesis states that technology-based companies are more liquid in the dynamic sense and less liquid in the static sense than traditional business, which is indicative of an aggressive approach to working capital management. The results of analysis based on descriptive statistics are presented in Table 13.

**Table 13.** The average values of liquidity ratios (Source: created by the authors)

No	Ratio	Innovative business	Traditional business
1	CCC	8583.13	7471.26
2	CR	2.72	4.49
3	QR	2.11	4.20

The CCC for innovative businesses is higher than for traditional ones, which means that, contrary to expectations, traditional businesses have a lower CCC and higher liquidity in the dynamic sense. The static liquidity indicators are lower for innovative businesses than for the traditional sector, as it was expected. The fourth hypothesis should be rejected, which confirms the results of hypothesis one.

## 5. Conclusions

This paper presents the results of a study on liquidity of Polish companies. Transformation from a social-based system to a capital-based one can be considered complete 20 years after the shift took place. Now it is time to move from a business model based on cheap labor to one based on technology if the country is to catch up with the Western world. Such a change is irrevocable since Poland participates in strategic EU programs.

Liquidity management is expected to be different for technology-based and traditional businesses, but it is problematic for both groups of companies as is shown in this paper and many other analyses. At an early stage of development it is very difficult to manage liquidity in an integrated system, so managers should realize this skill as one of the more important ones if they want to develop and compete with international corporations, raising their companies' rates of return and value. Poland, being an example of a country in transition, shows a lack of fundamental knowledge in the field of liquidity management both in the innovative and traditional sectors. If the country is to be an European economic tiger, a change in this field is necessary as more aggressive working capital management is crucial for innovation-based companies.

The significance of statistical analysis in some areas of liquidity management of companies listed on the Stock Exchange in Warsaw, allows to formulate the following conclusions:

1. Leading technology companies better manage liquidity than traditional business companies,
2. Technology based companies manage inventory better than the traditional businesses,
3. Businesses based on new technologies lead a more dynamic management policy on legal and intellectual assets,
4. Management of liquidity among companies listed on the WSE requires improvements in all areas if they are to be more competitive.

In addition, it can be concluded that the differences related to the management of inventory is related to the specificities of the sector, while the management of receivables, cash and liabilities is related to the specifics of the market.

## References

- Abernathy, W.; Clark, K.; Kantrow, A. 1983. *Industrial Renaissance*. Basic Books, New York.
- Ansoff, H. I. 1965. *Corporate strategy – an analytical approach to business policy for growth and expansion*. New York: McGraw-Hill.
- Aziz, A.; Lawson, H. G. 1989. Cash Flow Reporting and Financial Distress Models: Testing of Hypotheses, *Journal of Financial Management*, Spring, 55–63.
- Bieniasz, A.; Czerwińska-Kayzer, D. 2008. Płynność finansowa a wskaźniki aktywności, *Stowarzyszenie ekonomistów rolnictwa i agrobiznesu. Roczniki Naukowe*, Tom VIII, Zeszyt 1.
- Bieniasz, A.; Czerwińska-Kayzer, D. 2008. Cykl środków pieniężnych i jego przydatność w określaniu płynności finansowej oraz sprawności działania przedsiębiorstwa, *Stowarzyszenie ekonomistów rolnictwa i agrobiznesu. Roczniki Naukowe*, Tom IX, Zeszyt 3.
- Bolek, M.; Wolski, R. 2011. Związek cyklu konwersji gotówki ze wskaźnikami płynności przedsiębiorstw notowanych na GPW w Warszawie. Zarządzanie finansami firm – teorie i praktyka, *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu*. Wydawnictwo Uniwersytetu Ekonomicznego we Wrocławiu 158: 28–37.

- Bolek, M.; Wolski, R. 2010. Mierniki płynności a rentowność przedsiębiorstwa, *Ekonomika i Organizacja Przedsiębiorstwa* 9(728): 44–52.
- Bolek, M.; Wolski, R. 2012. Profitability or Liquidity: Influencing the Market Value-The Case of Poland, *International Journal of Economics and Finance* 4(9): 182–190.  
<http://dx.doi.org/10.5539/ijef.v4n9p182>
- Burgelman, R. 1983. A model of the interaction of strategic behavior, corporate context, and the concept of strategy, *Academy of Management Review* 8: 61–70.
- Burgelman, R. 1983. A process model of international corporate venturing in a diversified major firm, *Administrative Science Quarterly* 28: 223–244. <http://dx.doi.org/10.2307/2392619>
- Chandler, A. D. 1962. *Strategy and Structure: Chapters in the History of American Industrial Enterprise*. MIT Press, Cambridge, MA.
- Chesbrough, H.; Rosenbloom, R. 2002. The role of business model in capturing value from innovation: evidence from Xerox Corporation's technology spin-off companies, *Industrial and Corporate Change* 11: 529–555. <http://dx.doi.org/10.1093/icc/11.3.529>
- Christiansen, C. 1997. *The Innovator's Dilemma*. Harvard Business School Press, Boston, MA.
- Emery, G. 1984. Measuring Short-Term Liquidity, *Journal of Cash Management*, July/August: 25–32.
- Hager, H. C. 1976. Cash Management and Cash Cycle, *Management Accounting*, March: 19–21.
- Henderson, R. 1994. The evolution of integrative capability: innovation in cardiovascular drug design, *Industrial and Corporate Change* 3: 607–630. <http://dx.doi.org/10.1093/icc/3.3.607>
- Henderson, R.; Clark, K. 1990. Architectural innovation: the configuration of existing product technologies and the failure of established firms, *Administrative Science Quarterly* 35: 9–30.  
<http://dx.doi.org/10.2307/2393549>
- Kamath, R. 1989. How Useful are Common Liquidity Measures?, *Journal of Cash Management*, January/February: 24–28.
- Largay, J. A.; Stickney, C. P. 1980. Cash Flows Ratio Analysis and the W. T. Grant Company Bankruptcy, *Financial Analysts Journal*, July/August: 51–54. <http://dx.doi.org/10.2469/faj.v36.n4.51>
- Lyrouti, K.; Lazaridis, J. 2000. *The Cash Conversion Cycle and Liquidity Analysis of the Food Industry in Greece*, presentation at the 2000 European Financial Management Association, Annual Meeting, Athens, Greece, June.
- Lyrouti, K.; McCarty, D. 1993. An Empirical Investigation of the Cash Conversion Cycle of Small Business Firms, *Journal of Small Business Finance* 2(2): 139–161.
- Lyrouti, K.; McCarty, D.; Lazaridis, J.; Papanikolaou, V. 1999. *An Empirical Investigation of Liquidity: The Cash of UK Firms*, Presentation at the 1999 Financial Management Association's Annual Meeting, Orlando, Florida, U.S.A. October.
- Lyrouti, K.; Papadopoulos, D.; Lazaridis, J. 1999. A Comparison of Traditional and Contemporary Liquidity Measures: The Case of Utilities and Mining UK Industries, in *Proceedings of the International Conference Preparing the Manager of the 21st Century*, December, in Thessaloniki, Greece, 87–102.
- Lyrouti, K.; Rychter (Bolek), M. 2012. An investigation of the companies' liquidity and the factors affecting it: The case of Poland, in *Multinational Finance Society Annual Conference*.
- Mauboussin, M. J.; Kawaja, S. G. 1999. Atoms, Bits and Cash, *Credit Suisse First Boston Corporation Report*, 1–29.
- Mintzberg, H. 1979. *The Structuring of Organizations: A Synthesis of the Research*. Prentice-Hall, New York.

- Mintzberg, H. 1994. *The Rise and Fall of Strategic Planning: Reconceiving the Roles for Planning, Plans, Planners*, Free Press. New York.
- Moss, D. J.; Stine, B. 1993. Cash Conversion Cycle and Firm Size: A Study of Retail Firms, *Managerial Finance* 19(8): 25–34. <http://dx.doi.org/10.1108/eb013739>
- Penrose, E. 1959. *The Theory of the Growth of the Firm*. Basil Blackwell, London.
- Prahalad, C. K.; Bettis, R. A. 1986. The dominant logic, a new linkage between diversity and performance, *Strategic Management Journal* 7: 485–511. <http://dx.doi.org/10.1002/smj.4250070602>
- Richards, V. D.; Laughlin, E. J. 1980. A Cash Conversion Cycle Approach to Liquidity Analysis, *Financial Management*, Spring, 32–38. <http://dx.doi.org/10.2307/3665310>
- Rosenbloom, R. S.; Spencer, W. J. 1996. *Engines of Innovation: Industrial Research at the End of an Era*. Harvard Business School Press, Boston, MA.
- Shulman, J. M.; Cox, R. A. K. 1985. An Integrative Approach to Working Capital Management, *Journal of Cash Management*, November/December: 64–67.
- Teece, D. J. 1982. Towards an economic theory of the multiproduct firm, *Journal of Economic Behavior and Organization* 3: 39–63. [http://dx.doi.org/10.1016/0167-2681\(82\)90003-8](http://dx.doi.org/10.1016/0167-2681(82)90003-8)
- Teece, D. J.; Rumelt, R.; Dosi, G.; Winter, S. 1993. Understanding corporate coherence: theory and evidence, *Journal of Economic Behavior and Organization* 22: 1–30.
- Tripsas, M. 1997. Surviving radical technological change through dynamic capability: evidence from typesetter industry, *Industrial and Corporate Change* 6: 341–379. <http://dx.doi.org/10.1093/icc/6.2.341>
- Tushman, M.; O'Reilly, C. 1997. *Winning Through Innovation*. Harvard Business School Press, Boston, MA.

**Monika BOLEK**, PhD, is an assistant professor at Economic and Sociology Faculty of Lodz University in Poland. Her research is focused on corporate finance and capital market.

**Bartosz GROSICKI** is a PhD student in the Faculty of Economic and Sociology of Lodz University in Poland. His research is focused on working capital management in hospitals.