Ministry of Science and Higher Education
Republic of Poland

eFinanse
financial internet quarterly

WORKING CAPITAL MANAGEMENT IN MANUFACTURING ENTERPRISES

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Summary

The paper presents different lengths of working capital cycle and cash conversion cycle in manufacturing companies in Poland in two sub-periods: 2001-2004 and 2005-2008. The conducted research shows that the working capital cycle is varied, related to the sector. In most sections it has a positive value and is longer than 18 days in the first analyzed period, while in the period of 2005-2008 it is longer than 35 days. This means that companies have enough working capital for an increasingly long period of time. The cash conversion cycle in the analyzed period also varied in particular years and sections. In most sectors it was longer than 30 days, which means that enterprises require additional financing in a period of more than one month. On the basis of conducted research we can conclude that the policy of working capital and cash management was appropriate, adjusted to the current economic situation of the country.

JEL classification: G32, L66
Keywords: working capital, cash conversion cycle, inventory conversion period, receivables conversion period, payables conversion period

Received: 8.04.2011 Accepted: 22.11.2011

Introduction

One of the major issues in enterprise operations is working capital management[4]. The significance of working capital results from its influence on providing appropriate level of financial liquidity. Bieniasz and Gołaś (2007) emphasize that a vital task of working capital management is to lower the risk resulting from tying up the funds in inventories and payables. On the other hand, Tyran (2005) claims that proper level of working capital allows the company easier acquisition of capital, which, in turn, enables it to take advantage of market investment opportunities and to react quickly to dangers related to conducted activity.

Possession of working capital is necessary to maintain continuity of the operating cycle, which covers a number of economic operations from the moment of spending cash on raw material purchase to the moment of obtaining financial means for the sales of finished products. Working capital constitutes a source of financing this part of the operating cycle which was not financed with current liabilities (Bieniasz and Gołaś, 2007). To evaluate the way of financing the operational cycle we use: working capital cycle and cash conversion

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[4] In this article we understand working capital as a difference between current assets and current liabilities. Working capital defined in this way is also known as net working capital.

cycle[5]. Working capital cycle informs us for how many days of sales we have working capital which guarantees continuity of sales or for how many days of sales there is a shortage of current assets financed with long-term means (Wędzki, 2009). On the other hand, cash conversion cycle indicates the time which passes from the moment of spending financial means on settling liabilities to the moment of receiving financial means from collected receivables (Sierpińska and Jachna, 2004). The length of this cycle can be determined after calculating of cycles that constitute it, that is the inventory conversion cycle, receivables conversion period and payables conversion period.

The article presents differences in the length of working capital cycle and cash conversion cycle and its elements in manufacturing companies in Poland. The research was conducted in two sub-periods: 2001-2004 and 2005-2008. The reason why we divided the time into those two periods was to demonstrate the influence of Poland's accession into European Union structures on working capital management.

Methodological aspects and source materials

Working capital is defined as the part of constant capital of a company which is involved in financing current assets. Therefore it is often described as "liquid reserve", whose size may reflect the financial liquidity (Zaleska, 2002) and the effectiveness of employed assets (Gołębiowski and Tłaczała, 2005). We can measure working capital through establishing: the value of working capital, the share of working capital in assets, working capital turnover and working capital life cycle.

In this paper working capital management in manufacturing enterprises was analyzed in comparison with the length of cash conversion cycle. Working capital cycle (CKO) allows us to assess for how many days we have or lack working capital. This ratio is calculated using the following formula:

$$CKO = \frac{KON \times 365}{PS}(days), \qquad (1)$$

where KON = working capital,
PS = sales revenues.

Companies may have different levels of working capital. A safe level of working capital is when the cash conversion cycle is closed in an enterprise. The idea of closed cash conversion cycle consists in the operational cycle (the sum of inventories cycle and receivables cycle) being shorter than the payables conversion period (Gołębiowski and Tłaczała, 2005).

The cash conversion cycle model (KG) concentrates on the length of period between disbursing cash and collecting cash by an enterprise (Birgham, 1996). This relation could be presented by the formula:

$$KG = R_Z + R_N - OS_Z(days), \qquad (2)$$

where R_Z = inventories conversion period,

[5] In the specialist literature this ratio is defined as cash cycle or cash conversion cycle. This article uses both terms interchangeably.

R_N = receivables conversion period,
OS_Z = payables conversion period.

The cash conversion cycle defined in this way is influenced by three factors: inventories conversion period, receivables conversion period and payables conversion period. Specialist literature offers various formulas for calculating these periods (Bieniasz and Czerwińska-Kayzer, 2008). The disagreement over their calculation usually concerns the denominator in the formula. In the inventories conversion period we may often see the use of sales revenues or costs of goods produced, or cost of sales or operational costs. In the payables conversion period we often see sales revenues, costs of sales or operational costs. The ways in which these ratios were determined by various authors are presented in table 1.

Table 1: Formulas for calculating inventories conversion period (R_Z), receivables conversion period (R_N) and payables conversion period (OS_Z) by various authors

Authors using the formula	R_Z	Authors using the formula	R_N	Authors using the formula	OS_Z
Bieniasz, Gołaś (2007), Bień (2005), Dębski (2005), Gabrusewicz (2005), Hryszko (2002) Krzemińska (2000), Sierpińska, Jachna (2004), Szyszko, Szczepański (2003), Zaleska (2002),	$\frac{ZO \cdot 365}{PS}$	Bieniasz, Gołaś (2007), Bień (2005), Dębski (2005), Dobija (1997), Gabrusewicz (2005), Gołębiowski, Tłaczała (2005), Sierpińska, Jachna (2004), Szyszko, Szczepański (2003), Tyran (2005), Zaleska (2002), Wędzki (2006), (2009)	$\frac{N \cdot 365}{PS}$	Bieniasz, Gołaś (2007), Dębski (2005), Sierpińska, Jachna (2004), Zaleska (2002),	$\frac{ZB \cdot 365}{PS}$
Dobija (1997), Gołębiowski, Tłaczała (2005), Zaleska (2002),	$\frac{ZO \cdot 365}{KS}$			Dobija (1997), Gabrusewicz (2005), Sierpińska, Jachna (2004), Zaleska (2002),	$\frac{ZB \cdot 365}{KS}$
Sierpińska, Wędzki (2002), Tyran (2005),	$\frac{ZO \cdot 365}{KW}$			Richardson, Laughlin (1980),	$\frac{Z \cdot 365}{WO}$
Wędzki (2006), (2009),	$\frac{ZO \cdot 365}{KO}$			Wędzki (2006), (2009),	$\frac{ZB \cdot 365}{KO}$

Source: Own elaboration

ZO – total inventories, PS – sales revenues, KS – cost of sales, KW – production cost, KO – operational cost, WO – operational expenses, N – receivables, ZB – current liabilities, Z – liabilities minus short-term credit and loans

For the purpose of clarity of our analysis, particular ratios were calculated following Wędzki (2006, 2009), namely:

1) inventories conversion cycle, informing after how many days of activity the inventories will run out, was calculated according to the following formula:

$$R_Z = \frac{ZO \times 365}{KO}(days), \quad (3)$$

where ZO = total inventories,
KO = operational costs.

2) receivables conversion cycle, showing how many days an enterprise wants or has to credit its clients or other debtors in order to stimulate sales, was calculated according to the following formula:

$$R_N = \frac{NAL \times 365}{PS + VAT_N}(days), \quad (4)$$

where NAL = receivables,
PS = sales revenues,
VAT_N = VAT due.

3) current liabilities cycle, showing how many days the company is credited by its suppliers, was calculated according to the following formula:

$$OS_Z = \frac{ZB \times 365}{KO + IKO}(days), \quad (5)$$

where ZB = current liabilities related to deliveries and services up to 12 months, without credit or loans,
KO = operational costs,
IKO = other operational costs.

In order to present and compare the length of the working capital cycle and the cash conversion cycle as well as partial cycles, we used unpublished data from Central Statistical Office from 2001-2008, presenting the economic and financial situation of enterprises on the basis of their balance statements and profit and loss accounts[6]. In manufacturing sector, GUS surveyed between 14 and 16 thousand enterprises.
The survey presented here concerns working capital management in 23 sections of manufacturing industry in Poland[7].

[6] Balance results of economic entities in Poland in 2001-2008 GUS, Warszawa and unpublished data from GUS.
[7] The sections of manufacturing industry enterprises are: production of groceries and beverages (15), manufacturing of tobacco products (16), textile industry (17), manufacturing clothes and furs (18), production of leather and leather goods (19), production of wood and products made of wood, cork and straw (20), production of fiber, paper and paper products (21), publishing activity, printing and reproduction of information carriers (22), production of coke and oil refinery products (23), manufacturing chemical products (24), manufacturing rubber and plastic products (25), manufacturing goods of other non-metallic materials (26), production of metals (27), manufacturing finished metal products (28), manufacturing machines and appliances not classified elsewhere (29), manufacturing office machines and computers (30), manufacturing electrical machines and appliances (31), production of radio, television and telecommunication equipment and appliances (32), production of medical, precise and optical instruments, watches and clocks (33), manufacturing cars, trailers and semi-trailers (34), manufacturing other transportation vehicles (35), manufacturing furniture and other production activity (36) and waste processing (37).

To describe the structure and breakdown of analyzed cycles in particular sections of manufacturing industry, we used the following measures in our publication: position (arithmetic average ($\bar{x}$), quartile 1 (Q_1), quartile 2 – median (Q_2), quartile 3 (Q_3)), variation (variation coefficient based on median ($v(\%)$) and asymmetry (skewness A_{Sp}).

Working capital cycle in 2001-2008

Working capital management is evaluated using the working capital cycle. The longer it is, the better financial liquidity, as sales are supported from current assets financed on the long-term basis. If this cycle is negative, we lack current assets to maintain sales.

Table 2 shows the size of working capital cycle for manufacturing industry enterprises in 2001-2008. The data presented here shows that in analyzed sub-periods the length of this cycle varied considerably in particular sections and showed different directions of changes. In 2001-2004 the variation coefficient was very high (v=49-70%), while in 2005 - 2008 this variation decreased considerably (v=23-37%). In light of descriptive statistics, an average working capital cycle in 2001-2004 was between 11 and 24 days, while in 2005-2008 – from 34 to 37 days. In both sub-periods, the sample breakdown was characterized by left-hand asymmetry, which indicates that in more than half of sections the cycles were longer than the average cycle ($\bar{x} < Q_2$ $A_{Sp} < 0$). In the first analyzed period, the working capital cycle was from minus 105 days in 2002 (metal production) to 74 days (production of medical instruments). In the second period, the shortest cycle was minus 11 days in 2008, while the longest cycle lasted 70 days in 2007 (production of medical instruments).

The data presented here shows that in most sections the cycle had positive values. However, in 6 sections (that is 16, 19, 23, 27, 34 and 35) we observed negative values of the cycle, which clearly demonstrate that in these sections there was a high liquidity risk.

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Table 2: Working capital cycle (in days) in manufacturing industry enterprises in 2000-2008

Sections	2001	2002	2003	2004	2005	2006	2007	2008
15	9	11	12	13	18	21	21	18
16	37	28	20	9	-1	-7	-7	-11
17	1	4	6	19	33	40	45	49
18	25	26	29	34	44	44	53	61
19	-22	-22	-19	6	31	39	41	49
20	15	8	19	29	39	37	38	36
21	24	22	23	38	35	31	42	40
22	43	30	36	45	56	58	58	60
23	3	-4	3	28	46	33	33	22
24	32	29	31	39	52	55	59	59
25	34	36	34	36	38	37	38	42
26	28	29	35	38	41	53	54	56
27	-79	-105	-52	7	31	34	42	50
28	17	21	19	26	32	32	33	36
29	14	9	12	28	41	40	40	36
30	35	10	9	46	44	47	45	48
31	36	35	31	39	46	48	49	52
32	14	23	24	8	22	25	14	11
33	56	74	66	61	69	67	70	66
34	-6	-53	-43	-9	9	18	22	16
35	24	20	3	-16	8	7	3	2
36	10	14	16	18	26	31	25	22
37	13	9	10	16	27	21	40	35
Descriptive statistics								
$\bar{x}$	16	11	14	24	34	35	37	37
x_{min}	-79	-105	-52	-16	-1	-7	-7	-11
Q_1	9	8	8	11	26	28	29	22
Q_2	17	20	19	28	35	37	40	40
Q_3	33	29	30	38	44	46	47	51
x_{max}	56	74	66	61	69	67	70	66
v (%)	70	52	60	49	25	24	23	37
A_{Sp}	-2,05	-1,88	-1,01	-0,33	-0,23	-0,53	-0,74	-0,71

Source: Own elaboration

Cash conversion cycle in 2001-2008

As we mentioned before, a supplement in evaluation of working capital management is cash conversion cycle, which shows for how many days, apart from short-term liabilities, the company needs extra funds to finance current assets. The shorter the cash conversion cycle, the better for the enterprise, as financial costs of activity decrease and the money engaged in current assets returns faster.

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The data presented in Table 3 shows that the cash cycle in the first analyzed period in manufacturing industry enterprises equaled on average between 29 and 36 days, while in the second period from 31 to 39 days. The shortest cycle was in 2002 in the section of companies producing metals (-45 days). Negative cycles were only observed in two sections in the first period, namely in production of leather and leather goods and in production of metals. In other sections cash conversion cycle was positive, which indicated the need for additional sources of financing activities.

The sections with short cash conversion cycles are: leather goods production (from minus 5 to 50 days), producing coke and oil products (from 14 to 32 days), producing cars and trailers (from 6 to 37 days) and processing waste (from 19 to 37 days). The longest cash conversion cycle (91 days) was observed in 2001 in the section producing other transport vehicles. Also long cash conversion cycles characterized enterprises belonging to the section producing medical and precise instruments (49 – 75), producing electrical machines and equipment (from 43 to 69 days).

Table 3: Cash conversion cycle (in days) for manufacturing industry enterprises in 2000-2008

Sections	2001	2002	2003	2004	2005	2006	2007	2008
15	37	35	34	32	33	32	34	35
16	38	25	20	19	10	5	14	12
17	21	22	20	32	46	46	51	67
18	41	42	36	37	47	45	50	57
19	0	-5	-4	14	24	31	38	50
20	39	30	38	42	51	48	47	51
21	44	40	35	33	35	39	43	43
22	40	29	33	31	31	32	33	35
23	20	14	16	19	29	29	32	30
24	57	53	45	43	47	48	52	54
25	51	51	47	47	47	46	44	51
26	54	51	52	47	51	48	39	45
27	-29	-45	-13	14	29	33	34	36
28	39	35	29	32	37	36	36	36
29	42	33	28	35	41	42	40	41
30	45	33	20	35	33	38	38	38
31	69	59	48	44	45	43	46	52
32	32	22	13	20	38	37	33	18
33	71	75	57	49	53	50	50	52
34	25	6	8	12	15	15	16	8
35	91	68	47	17	27	19	10	9
36	30	32	30	30	31	33	34	37
37	23	20	19	18	29	22	37	35
Descriptive statistics								
$\bar{x}$	31	29	31	36	36	37	39	31
x_{min}	-45	-13	12	10	5	10	10	-45
Q_1	22	19	19	29	32	33	35	22
Q_2	33	30	32	35	37	38	38	33
Q_3	46	41	40	47	45	45	51	46
x_{max}	75	57	49	53	50	52	67	75
v (%)	36,9	36,3	32,4	25,4	18,4	16,1	22,0	36,9
A_{Sp}	-1,09	-0,57	-0,07	-0,44	-1,02	-0,95	-0,56	-1,09

Source: Own elaboration

The presented data points at considerable differences between sections and between sub-periods. The variation coefficient in 2001-2004 ranged from 32% to 37%. In the second period, however, it had much lower value, namely from 16% to 37%, which indicates lower degree of variation of cash conversion cycles. The asymmetry ratio in the analyzed periods had negative values, which indicates left-hand asymmetry. This means that in the analyzed sample, longer than average cash conversion cycles appeared more frequently (that is above 30 days). The presented data points at an increasing 'financial gap', which may mean that

enterprises prolong the inventories conversion cycle, finance clients with increasingly longer periods, or use the trade credit less.

Extending cash conversion cycle, coupled with extending working capital cycle, proves that manufacturing industry companies finance some of their current assets with long-term capital.

Components of cash conversion cycle in the analyzed period

Our analysis so far had shown that working capital and the speed of cash conversion are influenced by: inventories, receivables and payables conversion periods. Table 4 presents the descriptive statistics concerning the length of these cycles in manufacturing industry enterprises.

Table 4: Inventories, receivables and payables conversion periods (in days) in manufacturing industry enterprises in 2001-2008

Statistical measures	2001	2002	2003	2004	2005	2006	2007	2008
Inventories conversion period								
$\bar{x}$	46	42	40	39	42	41	42	44
x_{min}	20	21	18	17	22	19	20	23
Q_1	36	32	32	30	35	34	37	35
Q_2	43	42	38	38	40	39	40	44
Q_3	52	51	48	45	48	47	47	49
x_{max}	124	65	62	63	68	68	69	73
v (%)	18,3	22,3	20,9	19,6	16,5	15,7	12,7	16,4
A_{Sp}	2,86	0,17	0,38	0,28	0,36	0,52	0,44	0,54
Receivables conversion period								
$\bar{x}$	64	61	59	55	57	55	54	56
x_{min}	20	13	11	10	14	14	14	26
Q_1	56	54	54	50	52	50	49	49
Q_2	65	63	61	58	59	58	57	58
Q_3	73	68	69	65	65	62	62	67
x_{max}	91	99	87	77	83	75	70	69
v (%)	12,9	11,1	11,9	12,9	11,3	9,9	11,4	15,4
A_{Sp}	-0,84	-0,64	-1,24	-1,23	-1,18	-1,45	-1,45	-0,75
Payables conversion period								
$\bar{x}$	70	75	75	67	66	64	63	66
x_{min}	29	32	35	33	36	33	35	28
Q_1	63	60	60	55	53	52	51	54
Q_2	70	67	71	64	65	62	62	63
Q_3	85	86	90	75	75	71	67	69
x_{max}	131	145	137	142	137	137	138	144
v (%)	15,7	19,6	21,2	15,6	16,4	15,3	13,0	11,6
A_{Sp}	0,52	1,06	0,80	1,51	1,58	1,91	1,89	1,44

Source: Own elaboration

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In the interpretation of the **inventories conversion period,** we do not give extreme values, as it is typical for particular sections. The data presented in Table 4 shows that on average, the inventories conversion period was from 39 to 46 days. The shortest period of inventories conversion lasted 17 days in 2004 and concerned waste processing enterprises. Other short inventories conversion periods could be observed in enterprises producing tobacco goods (20-42 days), publishing companies (26-31 days), producers of radio and TV equipment (25-39 days) and cars and trailers (23-36 days). On the other hand, the longest inventories conversion period of 124 days was observed in 2001 in the section of enterprises producing other transport vehicles. This is rather an exceptional case, as generally for the whole period of 2002-2008 the maximum values reached 62-73 days. Moreover, other units with quite long inventories conversion period were: enterprises producing medical and precise instruments (48-64 days), clothes and furs (54-64 days) and leather and leather goods (53-73 days). It is worth noticing that variation in these cycles was quite big. In other sections, inventories conversion periods were quite similar, which can be confirmed by the variation coefficient amounting to 18-22% in the first and 13-16% in the second period. Moreover, the manufacturing industry was dominated by enterprises with below the average inventories conversion period, that is 40 – 50 days ($\bar{x} > Q_2$ $A_{Sp} > 0$). The data shows that in 2001-2004 the inventories conversion period was shortened in comparison to the prior period. The following years saw the situation change – the inventories conversion period was prolonged. This was particularly visible in 2008, when in nearly every section we could observe this period was prolonged by 1-3 days.

Another cycle is **receivables conversion period,** whose length depends on many factors, making it difficult to determine the commonly acceptable normative values. Some authors do try to determine the extreme values, though. According to Sierpińska and Jachna (2004), it is estimated in Poland that for manufacturing industry enterprises the length of the receivables conversion period should be around 60 days, while Wędzki (2006) claims that receivables should be collected after 45 days.

The data presented in Table 4 shows that average length of the receivables conversion period in manufacturing industry enterprises in the analyzed period ranged from 54 days in 2007 to 64 days in 2001. The shortest period of collecting receivables was 10 days (2004) and concerned tobacco industry companies. Also short receivables conversion periods could be observed in enterprises manufacturing coke and oil products (24-30 days), producing metals (40-57 days) and processing waste (33-56 days). The longest receivables conversion period was 99 days (2002) and concerned enterprises manufacturing other transport vehicles. Also, long receivables conversion periods could be observed in enterprises producing medical and precise instruments (68-92 days), office machines and computers (61-90 days) and machines and equipment not classified elsewhere (59 – 73 days).

The data presented in Table 4 indicates that enterprises generally collect receivables in the period of 60 days. The conducted analysis shows that in 2007, when we could generally observe shorter receivables conversion periods, 50% of sections had the period shorter than 57 days, while in 2002, in which the periods were on the whole longer, 50% of sections had the periods shorter than 65 days. It shows that we can treat a 60-days receivables conversion period as an optimal norm for Polish enterprises. We should also emphasize that enterprise aim at shortening the time of tying up their resources in receivables. The longest receivables conversion period was 99 days in 2002, while in 2008 it amounted to 69 days.

Enterprises are not only offering, but also using trade credit. The measure of the length of current liabilities payment is the **payables conversion period.** The longer this period, the better, as enterprise indicate smaller need for working capital. However, in a well-functioning enterprise, the payables conversion period should not be prolonged unnecessarily, but it should rather be synchronized with the operational cycle.
The research shows that in manufacturing industry enterprises in 2001-2008 the payables conversion period ranged on average from 63 to 75 days, while in 2001 and 2003 50% of enterprises had payables cycles shorter than 71 days, and in 2006 and 2007 it was shorter than 62 days. The shortest payables conversion period was observed in 2008 in waste processing section (28 days) and in 2001 in tobacco industry section (29 days). Other sections with relatively short payables conversion periods include: grocery manufacturers (42-46 days), waste processing (28-55 days), manufacturing coke and oil products (31-44 days). The longest payables conversion periods were observed in enterprises producing other transport vehicles (96-144 days), metals (101-145 days), leather (83-125 days) and machines and equipment (77-101 days).
The data presented in Table 4 shows that payables conversion periods were shortened in 2005-2008 as compared to the period 2001-2004, although settling liabilities happened in the period of over 50 days. The lower quartile in the first period ranged from 55 to 63 days, while in the second period – from 51 to 54 days. The obtained results also indicate average variation between particular sections of enterprises as far as payables conversion period was concerned (v=13-21%).

Conclusions

The size of working capital is determined by many factors, among which we can find the level of inventories, receivables or current liabilities. Working capital can be measured on the basis of the working capital cycle. Analysis based on this measure should be supplemented with cash conversion cycle, recognized to be one of the best measures of working capital management efficiency and determinants of enterprise financial liquidity. This may be true, as it relates particular working capital elements to cash flow and transforms the amounts of elements into more comprehensible conversion cycles.
The conducted research indicates that the length of working capital cycle and cash conversion cycle remarkably differentiated manufacturing industry sections. Generally, working capital cycle had positive values and was longer than 20 days. On the other hand, cash conversion cycle also had positive values and in most sections it was longer than 30 days, which points at the need for borrowed capital for a period of over one month. This situation was influenced by cash flow cycle subperiods, such as:

1) inventories conversion period, which varied and depended on specific section. Research showed that there were more sections with shorter inventories conversion periods, which indicates proper policy of inventories management,
2) receivables conversion period was also quite varied. Research showed that enterprise aimed at shortening it, but still the average receivables conversion period was around 60 days. This length of the period is considered optimal in Polish economy,
3) the length of payables conversion period shows quite big variation, usually tending to reach periods of 60-70 days.

Summing up, the policy of working capital management in 2001-2004 and 2005-2008 was varied, related to the specific section. The research shows that in 2001-2004 both the working capital cycle and the cash conversion cycle were shorter than in the second analyzed period. This means that in 2005-2008 enterprises showed greater need for additional sources of finance. Longer cash conversion cycle and longer working capital cycle indicate that manufacturing industry enterprises financed some of their current assets with long-term capital. Such policy of working capital management may be regarded as appropriate as it decreases the risk of losing financial liquidity.

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