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## Implementation of service systems on the shop-floor level in financial service companies. Empirical evidence from Australia and Germany

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This article presents the practices of Australian and German financial service providers regarding the implementation of shop-floor control within different types of service systems. The results delivered in this article should serve as a guideline for future research to develop and adapt methods for shop-floor control in financial service systems. Interviews with 25 experts from the Australian and German financial services industry reveal novel insights into the practice of shop-floor control, suggesting that methods and concepts from manufacturing are only used to a limited extent for shop-floor control. Shop-floor control is mostly used to react quickly to unexpected deviations due to a low usage of forecasts and information systems. Thus, there seems to be improvement potential in the financial services industry in comparison with in the manufacturing industry in terms of shop-floor control. Further research within the production research area should use the empirical insights to test and adapt existing methods and to develop new ones, taking cultural differences into account.

**Keywords:** shop-floor control; service system implementation; financial services; service operations

### 1. Introduction

The implementation of service systems is a major challenge for financial service providers, as they are facing increasing worldwide competition (de Koning, Does, and Bisgaard 2008; Staikouras and Koutsomanoli-Fillipaki 2006). The financial services industry concentrates mostly on information representing money or related financial instruments (Hatzakis, Nair, and Pinedo 2010). Thus, financial service providers can be seen as information brokers that gather any kind of information to offer the best investment and lending options and related services. As such, operations in financial services differ fundamentally from those in manufacturing and other services. From a production perspective, the main characteristics are as follows: (1) financial services are fungible products (i.e. they can be transmitted, decomposed and assembled multiple times); (2) financial services are typically processed in high volumes and providers have to cope with a high heterogeneity of customers; and (3) financial services are mostly repeated interactions on almost identical issues (e.g. standing orders) but also on a variety of customer orders, due to the typically long-term customer relationships (Hatzakis, Nair, and Pinedo 2010; Nair and Anderson 2008).

In offering and processing financial services, providers rely heavily on customer input (Corrêa et al. 2007). Without the provision of information from the customer, service delivery is not possible (i.e. the storage of pre-produced services is not an option) (González and Guerrero 2004). As a consequence, financial service providers are fully dependent on the points in time regarding demand (Hatzakis, Nair, and Pinedo 2010). Therefore, forecasting should be applied to predict customer demand, though this is only possible to a certain degree (Leyer and Moormann 2012). Forecasting relies on observed patterns from the past. Thus, unexpected situations can occur, leading to a short-term increase or decrease in demand. A prominent example is the payback of fees charged for home loan products in Germany. After a court order at the end of 2014, suddenly hundreds of thousands of customers took the opportunity to approach their banks within a few weeks to get back the fees paid. The teams responsible for home loan processing faced an enormous unexpected workload. Other examples are the sudden fall of share prices with customers placing selling orders in the aftermath or a heavy hailstorm causing severe damage and leading to a high number of claims for insurance companies.

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In addition to the dependency on customer demand, customers provide information during the processing of financial services to heterogeneous degrees (Dadfar, Brege, and Semnani 2013). This degree of customer integration is different for each execution of a service (van Helsdingen, Kasper, and de Vries 1999). For example, customers have to provide information on their personal financial situations, provide documents regarding collaterals, make decisions on investment options, and sign contracts (Hatzakis, Nair, and Pinedo 2010). However, customers often do not behave as anticipated, as they submit incomplete forms or are on holiday when a signature is required, for example. As a result, the service delivery will be delayed or back loops will occur if the required information from customers is not available in time. In such cases, the processing of the respective customer order is interrupted and has to wait until the missing information is provided (Leyer and Moormann 2012).

In order to deal with such interruptions, financial service companies can apply shop-floor control activities. However, it is a major challenge to understand how the integration of customers affects shop-floor control (Leyer and Moormann 2012). Regarding the implementation of shop-floor control in the service systems (i.e. the organisational setting of a service process) of financial service providers, empirical evidence is insufficient (Chase and Apte 2007; Smith, Karwan, and Markland 2007; Taylor and Taylor 2009). Anecdotal evidence from the largest German bank suggests that having a service centre for its branches with close monitoring of processing by Information Technology systems and defining shop-floor rules for situations such as those mentioned above led to an increase in efficiency (Penger 2009). Interestingly, despite the high relevance of this research topic, previous academic work has, to the best of our knowledge, not looked at how shop-floor control is implemented in the service systems of financial services companies. In addition, cultural differences have an influence depending on the respective cultural background on management practices in general (Hofstede, Hofstede, and Minkov 2010). Specifically, shop-floor control performed on the team level is typically influenced by the behaviour of the employees involved (Dale et al. 1997). As managers make decisions within shop-floor control that influence the daily work practices of their subordinates, cultural differences are especially relevant in such settings (Minkov and Hofstede 2012). Therefore, this article aims to answer the following overall research question:

How is shop-floor control implemented within the service systems of different units of financial service organisations within different cultures?

The results are intended to be a guideline for the development and adaptation of methods in production research to support shop-floor control in services. This article presents empirical evidence from two cultural backgrounds, namely the German and Australian financial services industries, gained through in-depth interviews with responsible experts. The reasons for choosing the countries are that they are both highly developed countries but show similarities and differences regarding the cultural dimensions defined by Hofstede, Hofstede, and Minkov (2010), which have a potential influence on shop-floor control.

The article has the following structure. Firstly, it outlines the theoretical background of shop-floor control and presents related work. Then, based on theory, research questions are deducted, which guide the analyses of the findings. Next, the research methodology is described in detail. In the subsequent section, the empirical results are analysed and discussed with reference to the research questions. In the conclusion, the main findings, the limitations of the article and directions for further research are highlighted.

## 2. Main elements of shop-floor control

### 2.1 Theoretical background

Manufacturing resource planning (MRP II) is a well-known and established framework within the manufacturing industry (Sheikh 2003). From a theoretical perspective, MRP II determines the necessary activities that enable manufacturers to plan and control all production resources in an efficient way. The framework covers all time horizons of these planning and controlling activities, as it includes strategic planning (i.e. long-term planning of the production volumes based on expected demand and sales), tactical planning (such as mid-term planning of the capacities and materials needed for production), and operational planning (i.e. short-term execution of production). In addition, MRP II supports manufacturers in regard to sourcing decisions (Sheikh 2003). In contrast, advanced planning systems is a more recently developed approach that builds upon the scarcity of resources relating to long-term, mid-term and short-term planning. Because the goals of each time horizon differ, the concept uses planning modules that consider these interdependencies (Neumann, Schwindt, and Trautmann 2002).

In both frameworks, shop-floor control comprises checks that determine whether resources are available; prioritisation of the usage of these resources; and submission of the requested lot sizes (Bassetto and Siadat 2009). In case of deviations from the production plan, corrective actions are taken, termed 'shop-floor control' (Neely, Gregory, and Platts 2005).

As outlined above, the integration of customers can cause time lags within service delivery processes. Thus, the schedule of service processing can be negatively affected (Leyer and Moormann 2012). A major difference between manufacturing companies and service providers is that inventory management enables the former to balance production and customer demand in the short term, whereas the latter cannot compensate for customer influence, as their services are usually non-storable (Sampson 2010). During the processing of a customer order, service processes consist of multiple interrelated activities, which increase the complexity of shop-floor control. Therefore, effective shop-floor control has to determine clear mechanisms at each step of service processing, which can be applied to react to such operational problems.

## 2.2 Mechanisms and concepts

The following typical mechanisms and concepts for shop-floor control within production systems can be found in the literature (Guide 1997; Soyuer, Kocamaz, and Kazancoglu 2007; Thürier et al. 2014):

- Scheduling of the respective order: scheduling is conducted when the order has been placed by the customer. It predefines the time at which employees have to perform work relating to specific customer orders with the four following mechanisms.
- Order release: before orders become available for employees to work on, they are stored according to certain criteria. Order release can be conducted before service delivery starts or before each activity.
- Sequencing of orders: customer orders are prioritised according to concepts such as the first-in-first-out rule or to other order characteristics, such as the importance of a customer. Concepts within this mechanism include 'first-in-first-out', 'shortest operating time' and 'earliest due date'.
- Sequencing of activities: if the sequence of activities that orders have to pass through is not fixed, the sequence can be rearranged for each order individually (e.g. 'shortest queue for an activity').
- Dispatching: order processing can be influenced by assigning another employee to a customer order or adjusting the point of time at which it is planned to perform the order. Examples of concepts include 'lowest workload' and 'highest specialisation of employees'.

## 2.3 Service systems

The applicability and effects of the described mechanisms and concepts depend mainly on the organisational setting of a process (Collier and Meyer 1998), also termed the 'service system'. Three prevalent possibilities for service systems can be found in the literature (Drolet, Abdunour, and Rheault 1996; Metaxiotis, Psarras, and Ergazakis 2003):

- Job shops: employees with similar functions are grouped within a designated local area. The orders flow between the different groups depending on which functions are needed for service delivery.
- Flow shops: employees are grouped in accordance with the sequence of the activities an order has to pass through. Each order of a specific kind is processed in the same manner consecutively.
- Cellular manufacturing: employees are grouped spatially corresponding to the functions, which are typically performed in a row. An order is completely or partly processed within one cell.

As the service system is decisive for the applicability of mechanisms and concepts, the following research question is formulated:

RQ1. Which mechanisms and concepts are used for shop-floor control in regard to the type of service system?

## 2.4 Implementation of shop-floor control

Regarding the implementation of shop-floor control in each setting (i.e. the service system), three dimensions have to be considered as follows:

- Responsibility for control: within shop-floor control, the responsible employee continuously observes the process routing of orders in a production system, which consists of all the processes necessary for the service delivery (Neely, Gregory, and Platts 2005). In case of a deviation from the defined goals, actions have to be taken to influence the process routing immediately. Responsibility can be assigned to either the manager's level, the level of operational employees, or to both (Radnor and Johnston 2013). Thus, the second research question is as follows:

RQ2. Who is responsible for shop-floor control in regard to the service system?

- Circumstances for changes: there is no single model available that fits every business situation, as these always depend on the context. In the case of shop-floor control, the context is customer demand (as argued regarding the dependency on customer orders), the existing backlog of customer orders, and the capacity to process orders (Leyer and Moormann 2012). These aspects lead to the third research question:

RQ3. Under which circumstances are the applied concepts changed in regard to the service system?

- Support of control: three aspects should be taken into account: firstly, the measures that reveal or, in the best case, predict the upcoming status of a process; secondly, an interval in which the information is reported to the responsible authority; and thirdly, a technical system that enables the authority to access all necessary information to act properly (Kumar and Zhao 1999). These aspects are combined in the fourth research hypothesis:

RQ4. How is shop-floor control supported in regard to the service system?

### 2.5 Impact of customer integration

As pointed out in the introduction, customer integration in terms of the dependency regarding demand and integration during service delivery has an impact on financial services processing and increases the need for shop-floor control actions. While the dependency on customer demand has been captured in the third research question, the impact of customer integration during service delivery is different. Despite being heterogeneous, some characteristics can be identified in order to differentiate customer integration to a certain extent. A number of differentiations can be found in the literature (Ostrom et al. 2010), but the perspective is of major importance to determine the relevance of the characteristics. From the perspective of shop-floor control, the following three main characteristics should be considered (Leyer and Moormann 2012):

- Type of customer involved (Nagel and Cilliers 1990): this covers the differentiation into internal and external customers, which provides more opportunities to influence the behaviour of internal customers and a reduced impact on demand behaviour due to dissatisfaction compared to external customers.
- Local geographic dependency on customers (Corrêa et al. 2007): if personal contact in a face-to-face setting is required, a representative of the financial service provider has to be present at the same time and the same place as the customer. Indirect contact (e.g. online or via telephone) is easier to manage and thus decreases the influence of customer integration on shop-floor control. Additionally, it has to be considered whether the processing takes place during the customer contact, afterwards, or is a mixture of both.
- Local geographic dependency on physical objects (Spring and Araujo 2009): in the case of documents (e.g. certified documents) to be delivered by customers, these objects have to be exchanged between the customers and employees involved.

Concluding, the last research question is formulated:

RQ5. What is the impact of customer integration on shop-floor control in regard to the service system?

### 2.6 Impact of cultural differences

Management control is influenced by the cultural setting in which a company is operating (Hofstede, Hofstede, and Minkov 2010). To make these influences tangible, Hofstede, Hofstede, and Minkov (2010) developed a widely accepted model consisting of six cultural dimensions (Minkov and Hofstede 2011): power distance, individualism, masculinity, uncertainty avoidance, long-term orientation and indulgence versus restraint (Hofstede, Hofstede, and Minkov 2010). Cultural differences are especially relevant in practices regarding employee empowerment (e.g. quality practices; Yoo, Rao, and Hong 2006), which is the case for shop-floor control. Managers have to deal regularly with decisions affecting the work behaviour of their subordinates. For such settings, the dimensions suggested by Hofstede, Hofstede, and Minkov (2010) are useful to analyse potential differences in the respective cultural setting. As a consequence, we analyse each research question in regard to cultural differences.

### 3. Related work

Research on shop-floor control of service processes is scarce (Smith, Karwan, and Markland 2007), while results from the related domain of improvement methods and techniques highlight important differences between the manufacturing and service sectors (Tickle et al. 2015). A literature search on this topic reveals a limited number of prior studies. Goodale and Tunc (1998) analyse tour scheduling and come to the conclusion that an optimal work schedule is dependent on incoming customer orders. An extension is made by Klassen and Rohleder (2002), who link demand and capacity decisions (i.e. how the amount of incoming orders can be influenced to meet internal capacity constraints). Adenso-Díaz and González-Torre (2002) propose the separation of activities according to customer types to calculate the minimum capacity needed. A more detailed forecast to match customer demand is made by Thompson and Goodale (2006), using the individual productivities of employees. These approaches neglect to deal with short-term interruptions due to customer integration (i.e. analysing possible actions if the forecast is not met). An exception can be found in the domain of information processing services. (Leyer and Moormann 2015) show with case study data from the financial services industry how customer integration can be simulated in a job shop and that the concept of 'longest cycle time' is superior. However, how shop-floor control should be conducted in financial services has not been the focus of prior work. Thus, the content of the research questions has not been addressed yet. Cultural differences have not been addressed either.

### 4. Methodology

#### 4.1 Research design

As research on shop-floor control in financial services has been limited up to now, a qualitative research approach was chosen, following Strauss and Corbin (1990). Due to the important role of employees in terms of being responsible for the shop-floor control of service processes, a thorough understanding of the employees' behaviour is crucial. A good way to gain such an understanding is through in-depth interviews (Hickey and Davis 2003). Similarly, Johnson (2002) states that in-depth interviews are the best approach if 'the knowledge sought is often taken for granted and not readily articulated by most' (p. 105). In the case of shop-floor control of service processes, this can be assumed, as experts have high knowledge in their field, but documentation of this knowledge is very limited.

The questionnaire was developed based on the theoretical background of Sections 2.1–2.5 and can be found in Appendix 1. Participants could answer the questions freely, and the interviewer took notes. The open format was chosen to ensure that the experts could report on their way of conducting control without naming the theoretical concepts. The reason is that practitioners usually know very well and intuitively how they do their work but are not necessarily aware of the underlying theoretical concepts.

#### 4.2 Participants and procedure

Participants for the interviews were chosen randomly by the criterion of being responsible for shop-floor control in their daily work. Industry contacts of the researchers at different companies were used to cover a broad range of financial service companies. Eleven experts of different functional areas within Australian banks and insurance companies and 14 experts within German banks and insurance companies were interviewed. Each in-depth interview can be regarded as a small case study, with the focus on exploration. As such, the focus was on theoretical sampling but not on statistical sampling, which typically requires four to ten interviews to cover a phenomenon sufficiently (Eisenhardt 1989). Table 1 provides an overview of the demographic data of the participants.

Participants had to have been in their current positions for at least two years to ensure sufficient experience on the subject. In their positions, the participants take actions either themselves (e.g. team managers) or set the dedicated guidelines (e.g. division managers). All participants reported their areas of responsibility. Thus, additional information on the whole companies was not reported, as the specific organisational units were of interest. However, we gathered information about whether participants were responsible for part of an end-to-end process or a complete end-to-end process. If the end-to-end process was not relevant for actions regarding shop-floor control (i.e. no consideration of other process-related teams), a functional focus was documented. Each respondent was assigned a number and a letter, using 'A' for Australian experts and 'G' for German experts. The number of subordinates measured as full-time equivalents (FTE) was 15 on average.

Each interview was conducted in an individual talk guided by two interviewers and was audio-recorded to make the content verifiable for others. The coding was conducted manually by both researchers. The answers and the coding were checked by a third researcher according to the audio recordings. If deviations between a documented answer and the audio-recorded answer were recognised, the interviewers and the third researcher had to agree on the final documentation and coding of the answer.

Table 1. Main demographic data of participants.

Number of respondent	Gender	Position	Responsibility in the organisational context	Functional area	Number of subordinates (FTE)	Type of customer
A1	M	Business improvement advisor	End-to-end focus	Claims processing	6	Internal employees
A2	M	State manager	End-to-end focus	Claims processing; sales	15	End customers
A3	F	Customer experience specialist	Functional focus	Supportive tasks	1	End customers; internal employees
A4	M	Senior leader	End-to-end focus	Supportive tasks; administrative tasks	5	Internal employees
A5	F	Leading business analyst	Functional focus	Supportive tasks; administrative tasks	6	Internal employees; internal process
A6	F	Team leader	End-to-end focus	Settlement and clearing of securities; administrative tasks	13	Another company
A7	F	Senior leader	Part of an end-to-end process	Supportive tasks	20	Internal employees
A8	M	Team leader	End-to-end focus	Claims processing	11	End customers
A9	F	Team leader	Part of an end-to-end process	Claims processing	15	Internal employees
A10	M	Team leader	Functional focus	Claims processing	8	End customers
A11	F	Team leader	Part of an end-to-end process	Supportive tasks; administrative tasks	10	Internal department
G1	F	Assistant manager	Functional focus	Administration of customer data	14	Internal department
G2	F	Assistant manager	Functional focus	Loan processing	24	Internal department
G3	M	Team manager	Part of an end-to-end process	Complaints processing	17	End customers
G4	F	Team manager	Part of an end-to-end process	Administration of customer data	26	End customers; internal department
G5	M	Team manager	Part of an end-to-end process	Settlement and clearing of securities	21	Another company; internal department
G6	M	Department manager	Functional focus	Administration of customer data	12	End customers; internal employees; another company
G7	M	Department manager	Functional focus	Customer support; claims processing	80	End customers; another company
G8	M	Team manager	Part of an end-to-end process	Administrative tasks	9	Another company
G9	F	Team manager	Functional focus	Administrative tasks	13	Internal department; internal employees
G10	M	Team manager	Part of an end-to-end process	Loan processing	10	End customer; internal department
G11	M	Team manager	Functional focus	Supportive tasks	8	Internal department; internal employees; another company
G12	M	Team manager	Part of an end-to-end process	Administrative tasks	20	Internal department
G13	M	Team manager	Functional focus	Customer support	4	End customers; internal employees
G14	M	Department manager	Functional focus	Supportive tasks	14	Internal department

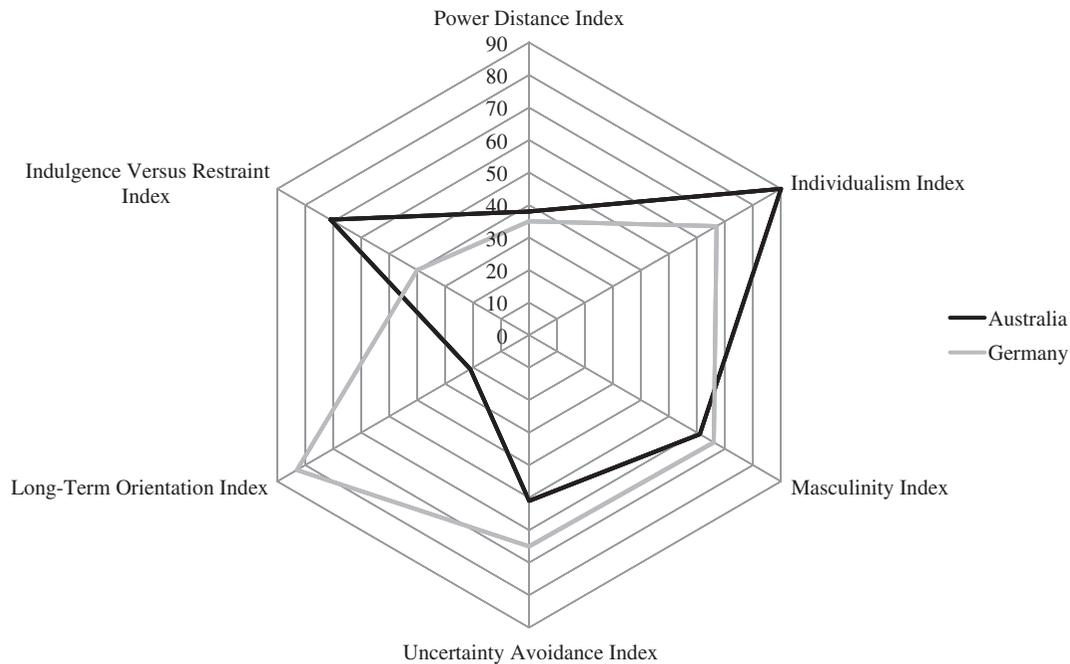


Figure 1. Manifestation of cultural dimensions for Germany and Australia, according to Hofstede, Hofstede, and Minkov (2010).

### 4.3 Analysis of cultural differences

To explain the differences and similarities between the German and Australian results, the cultural model developed by Hofstede, Hofstede, and Minkov (2010) is used. The model explains national cultural differences in terms of six dimensions, which are depicted in Figure 1 for Germany and Australia.

## 5. Results and discussion

### 5.1 Mechanisms and concepts of shop-floor control

All 25 respondents' areas of responsibility were clustered according to the three types of service systems (Table 2). RQ1 focuses on the mechanisms and concepts of shop-floor control used in practice. Table 2 reveals three main mechanisms being used. 'Dispatching' and 'sequencing of orders' were common in all settings, whereas 'scheduling' was widely used, except for in flow shops. 'Order release' was solely applied by one respondent, and only four Australian respondents reported the usage of 'sequencing of activities'. Overall, the managers in flow shops tended to use fewer mechanisms on average, followed by those in job shops and then those in cellular manufacturing. However, comparing the Australian and German results, there were no differences in the number of mechanisms used in job shops (2.4 in Germany and 2.3 in Australia). However, the number of mechanisms used in flow shops was 2.0 in Germany and 1.3 in Australia, whereas in cellular manufacturing, it was 3.1 in Germany and 1.3 in Australia.

Regarding the concepts used to prioritise orders and employees, the focus was mainly on four concepts (see Table 3). The 'earliest due date' concept was dominant, as it was applied by 19 of the 25 respondents. Another concept often used was the 'highest specialisation'. Nearly half of the respondents used the concepts 'first-in-first-out' and 'lowest workload'. Only one concept applied considered the actual status of the process to make a decision ('shortest queue for an activity'; A7 and G7), whereas the other concepts focused on employees or customer order characteristics.

Other concepts, such as 'bottleneck', 'lowest operating time', 'longest cycle time', 'result analysis', 'importance of customer', 'lowest cost for operations' and 'shortest queue for an activity', were not reported. Thus, the application of the recommended concept of 'longest cycle time' for a job shop (Leyer and Moormann 2015) for the observed service processes cannot be found in practice.

Concerning the service systems, the average number of concepts used increased slightly from job shops to cellular manufacturing in general. German managers used 2.3 concepts on average in job shops, 3.0 in flow shops and 4.3 in cellular manufacturing. Australian managers applied the most concepts in job shops (3.0 on average) and only 1.5 on average in cellular manufacturing, with flow shops being in the middle with 2.0 on average. Thus, it seems that the number of applied concepts is not dependent on the service system.

Table 2. Usage of mechanisms for shop-floor control.

Cluster	Average number of mechanisms used	Number of respondent	Scheduling	Order release	Sequencing of orders	Sequencing of activities	Dispatching		
Job shop	2.36	A3			X	X	X		
		A7	X		X				
		A8	X				X		
		G2	X			X	X		
		G5	X			X	X		
		G9	X				X		
		G10	X			X	X		
		G11	X				X		
		G12				X	X		
		G13	X						
		G14	X			X	X		
		Flow shop	1.57	A5			X		
				A6			X		
				A9	X				X
A10							X		
G1						X	X		
G3						X	X		
G4						X	X		
Cellular manufacturing	2	A1			X				
		A2			X	X			
		A4	X						
		A11					X		
		G6			X	X	X		
		G7	X			X	X		
		G8	X			X	X		

Summing-up the differences between the German and Australian respondents, the German team managers applied a higher number of mechanisms and concepts for shop-floor control than the Australian team managers did. This can be explained by the uncertainty avoidance index, which is higher for Germany. Using mechanisms and concepts leads to a more structured working environment and thus reduces uncertainty.

## 5.2 Responsibility for shop-floor control

The results reveal differences across the three service systems. Firstly, in job shops, shop-floor control was typically performed by operational employees. In some cases, the managers supported their subordinates in conducting shop-floor control (A3, A8, G2, G5 and G10). Only A8 did not allow employees to change concepts. Secondly, in flow shops, it was primarily the respondents themselves who were in charge of shop-floor control (except G1, for whom the higher management was in charge), with only two respondents involving their subordinates (A5 and A9). This seems to be in line with the high structural requirement for a flow shop. Thirdly, there was no significant trend for responsibilities in cellular manufacturing. However, three of the four mentions of higher management being in charge were assigned to cellular manufacturing. In general, the interviews revealed that from job shops via flow shops to cellular manufacturing, the responsibility for shop-floor control tended to shift from employees towards higher management. There were no differences between the Australian and German managers.

Regarding the frequency of holding team meetings to discuss issues of shop-floor control, there was a tendency in job shops towards having a higher number of regular meetings. Most of these respondents met at least on a weekly basis, whereas in flow shops and cellular manufacturing, monthly or irregular meeting intervals were equally common compared to more-regular meeting intervals. This may indicate that managers in flow shop and cellular manufacturing settings have a better overview of the current status of the process and, therefore, fewer meetings are needed. The Australian team managers tended to have more meetings and less individual working.

There are no differences between the two countries, which is compatible with the power distance index results. Australia and Germany are on the same level concerning the distribution of power (i.e. who is responsible for shop-floor control). A contradiction with the cultural model can be found regarding the individualism index. Obviously, German employees have greater individual freedom. Another explanation for this unexpected result could be that German team managers have defined more mechanisms and concepts and thus employees can decide more easily on their own.



### 5.3 Circumstances under which concepts have to be changed

RQ3 aims to identify circumstances under which concepts for shop-floor control have to be changed. In regard to our results, concepts were either changed on a daily basis (A1, A9, A10, G3–G7 and G10–G13) or were static and did not change (A2, A6–A8, A11, G1, G2, G8, G9 and G14). Only three respondents stated that they changed concepts irregularly (A3–A5), on average once a month. A distinction based on the service systems did not reveal any differences. When asking the respondents for factors that led to a change in the applied concepts, the following characteristics of customer orders were named as important factors: the mixture of products (e.g. standard or individual), customer importance (e.g. standard or prioritised), the general conditions (e.g. holiday or non-holiday period) and the incoming amount of orders (e.g. high or low). Half of the respondents did not change their concepts (A6–A9, A11, G1, G2, G8, G9 and G14), and thus, they did not mention any factors. If concepts were changed under certain circumstances, the decision was mostly affected by more than one single factor (11 of 15 respondents changing concepts). Overall, it seems as if there is no superior rule for changing the concepts. Most of the respondents said that they changed concepts based on customer demand but could not specify the circumstances conclusively. This may indicate the uncertainty of those in charge of shop-floor control.

Overall, there were no differences between the Australian and German managers in regard to concept changes. The similarities cannot be explained by Hofstede, Hofstede, and Minkov's (2010) theory, indicating that German team managers should be more focused on planning the circumstances and concepts for the future, as the long-term orientation index is high in comparison with that for Australian team managers. An explanation could be that shop-floor control is short term by definition, whereas a long-term orientation is more evident on the level of strategic planning.

### 5.4 Support for shop-floor control

The topic of RQ4 is the availability of information systems to support shop-floor control in service processing companies. Typical measures for shop-floor control within each service system type were 'time', 'quality' and 'cost', which is in line with the main indicators found for performance (Atkinson 1999). However, the respondents' focus was clearly on the time needed to perform activities in their areas of responsibility, rather than the whole cycle time, which would have been in the interest of customers. The other two measures, 'quality' and 'cost', could not be determined in more detail because diverse individual indicators exist with the respondents. Although the respondents were from banks and insurance companies, the 'risk' involved in a business process plays a minor role in shop-floor control, as only five of the respondents (A3, A5, A6, A9 and G7) used indicators related to risk.

Most of the respondents (64%) were able to access process status information on a daily basis. However, nine participants only received information weekly (A1, A10, G9 and G14), monthly (A3, G1 and G8) or irregularly (A2 and A9). Regarding forecast information, almost half of the participants received regular updates and knew their typical workloads in advance. The other experts had a rough understanding of incoming orders but did not have detailed information that could serve as a basis for planning.

The support of technical systems differed across the three types of service systems. In flow shops, process-oriented IT systems were more common (71.4%), such as workflow management systems. By contrast, in job shops (45.5% with process-oriented IT system support) and cellular manufacturing (28.6% with process-oriented IT system support), technical support was limited. In the latter two settings, IT systems were either not available or only offered limited functionality for employees (e.g. databases or selected calculations).

Overall, there were no differences between Australian and German results regarding RQ4. The similarities regarding the support for shop-floor control cannot be covered by the cultural model, as these criteria are more related to infrastructure supporting shop-floor control. It can be assumed that regarding the supporting factors, there is a general trend in financial service companies regarding IT systems, independent from the country. Both countries are highly industrialised, and thus, companies in general are on a similar level in regard to technical and organisational support.

### 5.5 Impact of customer integration

According to the three characteristics described in Section 2.5, we captured type of customer, way of contact, contact channel and dependency on physical objects in the interviews. There was no influence of physical objects, as every participant reported that any kind of document could be digitised; thus, we do not report on this characteristic. Table 4 provides an overview on the relevant characteristics of customer integration.

There is no clear tendency observable concerning the influence of customer integration. Every respondent reported heterogeneous customer integration without specific patterns in regard to the impact of customer integration on shop-floor control. Regarding the separation into internal and external customers, it can be observed that many participants

Table 4. Characteristics of customer integration.

Cluster	Number of respondent	Type of customer		Method of contact			Contact channel		
		External customer	Internal customer	Synchronous	Partly synchronous	Asynchronous	Personal	Indirect	
Job shop	A3	X	X		X		X	X	
	A7		X		X		X		
	A8	X			X			X	
	G2		X		X			X	
	G5	X	X			X		X	
	G9		X		X		X	X	
	G10	X	X	X	X			X	
	G11	X	X		X			X	
	G12		X		X			X	
	G13	X	X	X	X		X	X	
	G14		X		X		X	X	
	Flow shop	A5		X			X		X
		A6	X		X			X	X
		A9		X		X			X
A10		X			X			X	
G1			X		X			X	
G3		X			X			X	
G4		X	X		X			X	
Cellular manufacturing		A1		X		X		X	X
		A2	X			X		X	X
		A4		X	X			X	X
	A11		X		X			X	
	G6	X	X		X			X	
	G7	X			X			X	
	G8	X			X			X	

reported a mixture of internal and external customers. However, participants only saw a difference between the groups if they were responsible for a team as part of an end-to-end process (G5 and G10). Both G5 and G10 referred to differences in terms of increased coordination between internal customers and the team, as they cooperate closely. If there is a clear functional separation of teams, then information retrieval, coordination and expectations are similar for internal and external customers. This result is in line with and extends the results of Maleyeff (2009), who detects no differences between internal and external services regarding the number of functions and employees involved, as well as regarding the prevalence of information processing services.

A further aspect is the impact of the method of contact on shop-floor control actions. Those without a mixture of synchronous and asynchronous integration did not report on specific influences to be considered. In addition, no differences between the impact of direct or indirect contact could be observed. According to the cultural model, the individualism index could be applied to different customer behaviour (i.e. Australian customers could show higher heterogeneity in regard to customer integration). While German customers are expected to be on a lower individualism level and thus should be easier to handle within shop-floor control, we could not detect major differences. It seems that both Australian and German customers are on a level that is characterised by heterogeneity being too complex to be considered systematically in shop-floor control.

### 5.6 Benefits of shop-floor control actions

As reported, Australian managers use fewer mechanisms and concepts than German managers do, but the German participants did not report the benefits of doing so. Benefits were mainly reported by those who received sufficient information and who were faced with high volatility in customer demand. Thus, they benefitted from knowing in which situation which of the concepts available would suit best. A9 and A11, for example, reported positive results due to a visualisation of forecast information on a dashboard being visible to everybody in the team. Those who mentioned a change of concepts under predefined circumstances reported a positive impact on handling daily workloads (A6, A7 and G10). A6, A8, A11 and G2 were able to match the forecast information with the current process status on a daily basis, had high transparency, and, as a consequence, applied one concept of shop-floor control only. The results of increased shop-floor control actions were not only achieved from an internal perspective but also A6, A7, G2, G6 and G7 reported

a positive effect on customer satisfaction because they were able to increase the average quality and processing time. Additionally, G3 mentioned the benefits of shop-floor control actions regarding the shift and holiday planning of employees, as the actions allowed these to be planned better and thus allowed managers to consider employee wishes better while being able to cope with incoming orders. In comparison, A2 and A9 reported uncertainty due to irregular information on the process status but did not know how to react to deviations from the forecast. Overall, we can state that the benefits of shop-floor control are independent from the cultural setting.

## 6. Conclusion

The results reveal that the execution of shop-floor control lags far behind its possibilities. An indication for this shortcoming is the uncertainty of respondents regarding when shop-floor control is actually needed and which conditions require a change of concepts in shop-floor control. Moreover, forecasts of upcoming work were only performed in half of the cases studied. Today's shop-floor control in financial services is mainly done on an ad hoc basis. This limits its potential benefits, as the more possibilities to react to certain circumstances are limited, the later the decisions can be made.

The following implications for practice can be deduced from the results:

- Environments have to be created that facilitate the operative control of financial service processes through enhanced foresight and predefined rules. Financial service providers in Germany in particular should put more emphasis on this topic.
- For business processes organised in job shops, IT systems should be developed or implemented to enable continuous shop-floor control.
- Financial service companies should consider whether it is possible to implement a flow shop for processes. Such a setting allows for the best effects regarding shop-floor control if detailed forecasting is conducted (Chen et al. 2015).
- When applying cellular manufacturing, financial service providers need to define the competencies for shop-floor control clearly. Besides the individual responsibilities of each employee, cellular manufacturing requires the predefinition of rules for specific circumstances under which mechanisms and concepts should be changed.

Regarding the theoretical implications, the empirical results show that, in general, the theoretical ideas from manufacturing can be applied to financial services as well. Thus, existing methods and algorithms have to be analysed in regard to their applicability in service systems. The patterns of shop-floor control described in theory (Sections 2.2 and 2.4) can be similarly found in our results. However, as the evidence shows, there is a gap between the theoretical capabilities and the practical implementation in financial service companies in both countries. Customer integration has to be taken into account when applying concepts of scheduling. However, no specific rules for characterising the impact of heterogeneous customer integration on shop-floor control could be deduced from our findings. In conclusion, existing methods and algorithms should be tested and adapted to the analysed types of service systems. Overall, cultural differences should be considered to ensure optimal shop-floor control in the respective service system.

Regarding the interpretation of our results, the following limitations have to be considered. The investigations were based on a limited number of in-depth interviews. Nevertheless, this format has proven to be a good starting point if there is only limited research available on a certain topic. This is the case with shop-floor control within the financial services industry. Through the inclusion of results from two different countries and different companies, the bias regarding a specific tendency of answers was reduced. Furthermore, one could argue that those affected by shop-floor control should have been interviewed as well. On the other hand, the team managers appeared to have a better overview, which seemed to be more suitable for our purposes.

Further research could focus on customer-induced influences on shop-floor control. Furthermore, there is still a lack of knowledge in terms of which circumstances lead to changes in the applied concepts. Thus, more investigations are necessary. Moreover, other cultural contexts should be analysed to develop a more solid understanding of cultural differences.

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## Appendix 1. (Questionnaire for shop-floor control in financial service providers)

### DEMOGRAPHIC DATA

- (1) What is your current position?
- (2) For how many fulltime equivalents are you responsible for?
- (3) Which functional area are you responsible for?

### DESCRIPTION OF THE PROCESS OR DEPARTMENT

- (4) Short description of the process/department
- (5) Characterisation of the service system

### CUSTOMER INTEGRATION

- (6) Who is the customer of your process?
- (7) How is the customer contact taking place?

### SHOP-FLOOR CONTROL

- (8) Which options do you use within shop-floor control?
- (9) Who has the authority for conducting shop-floor control?
- (10) What is your primary concept for controlling the process and which ones do you use?
- (11) Is the common approach to control daily work always the same or different?
- (12) If applicable: How often do you change the concept?
- (13) Do you discuss the daily work amount with your employees? In a group? And how often?
- (14) What are the influencing factors for the usage or change of a concept? This refers to the factors that influence your daily decisions on how to control daily work.
- (15) How do you measure the performance of your process? Are there certain KPI's used for this purpose?
- (16) What measures do you use for shop-floor control of your process?
- (17) Is there a technical system providing you with status information about the process?
- (18) How often do you get information about the status of the process?