

Financial Institutions and Markets
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Lecture - 25
Risk Measures in Commercial Bank

So, after the discussion on the different Basel norms. So, in this session will be discussing about how the different type of risk, what we have discussed that are measured for the commercial banks. So, already we have discuss there are four type of risks; one is credit risk, you have market risk, you have operational risk and you have the liquidity risk. Depending upon the different norms the different type risk, which we were consider for measurement of the risk weighted assets, what the commercial banks are using.

We will be discussing today what are the different approaches, which are used to measure to this kind of risk and whether in the practical sense it is possible to measure all type of risk in a adequate way or in the perfect way or not.

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Then what are those approaches we use for the measurement of the risk. Particularly, we can start with the discussion with the credit risk whenever, according to Basel the credit risk can be measured using the standardized approach and they can use a foundation IRB approach, internal rating based approach, then you have an advanced IRB approach. There are different approaches which can be used to measure the credit risk for the commercial banks.

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Standardised Approach

- In determining the risk weights in the standardised approach, banks may use assessments by external credit assessment institutions.

$$\sum (\text{Risk Weight for Assets} \times \text{Book Value of Assets})$$

Handwritten notes in purple ink:

- AAA 10%
- BB 50%
- B+

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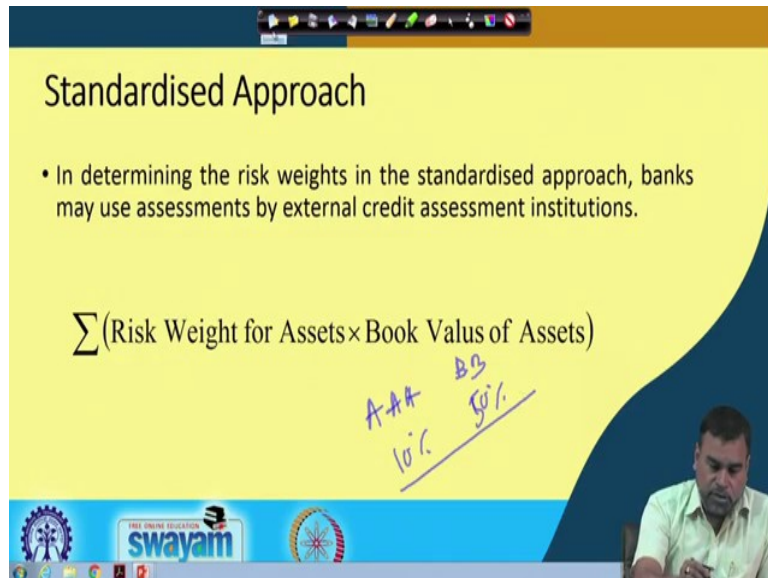
So, if you see how this particular approaches work. If you see the standardized approach, whenever the banks use the standardized approach to measure the credit risk, the banks basically may use the assessments by the external credit assessment institutions. On the basis of the different type of bonds or different type of assets what the commercial banks have, the different external agencies the credit assessment agencies, they have given the weights for that.

So, already the weights are calculated by the external agencies. So, the basic job of the commercial bank is to follow any of the particular external credit assessment institutions approach and they can use that thing for calculation of the credit risk of the commercial bank. So, how they calculate? They get that particular weightage from this.

Let for example, the commercial bank has triple A rated bond, there is a double B rated bond, that is a B plus rated bond like that. So, for different type of asset whenever we are talking about the risk weights, the risk weights are different.

Let for, if it is triple A rated bond the risk weight can be 10 percent, but is a double B rated bond, there may be risk weight will be 50 percent. So, depending upon the different type of asset the so, for higher the quality the risk weight maybe always less.

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Standardised Approach

- In determining the risk weights in the standardised approach, banks may use assessments by external credit assessment institutions.

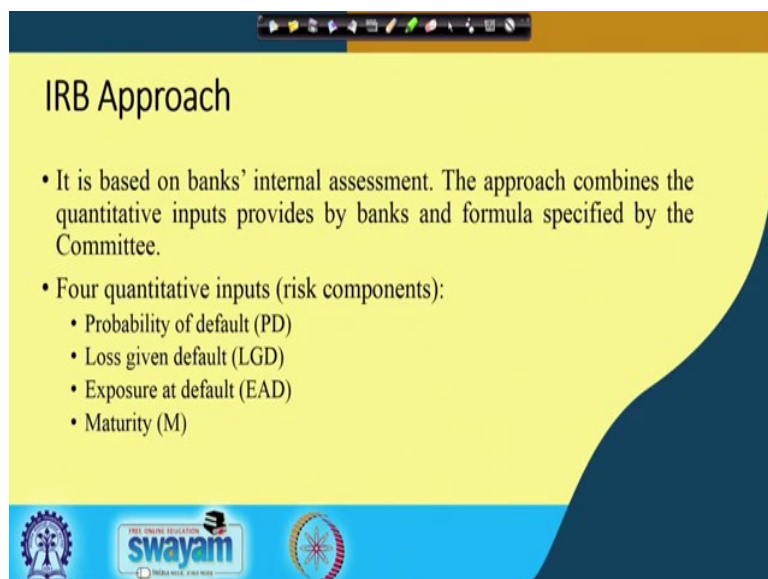
$$\sum (\text{Risk Weight for Assets} \times \text{Book Value of Assets})$$

Handwritten note: AAA 10% BB 50%

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So; that means, assignment of the risk towards the high quality asset is always lesser than the risk weights which are given to the low quality assets. So, once we have use those things, we have the assets which is already available with us. So, we can multiply that particular with weight with respect to the book value of the asset what the commercial bank has and finally if the risk weighted asset can be calculated or the credit risk of that particular bank can be calculated. So, this is the standardized approached, approach what the commercial bank can use.

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IRB Approach

- It is based on banks' internal assessment. The approach combines the quantitative inputs provides by banks and formula specified by the Committee.
- Four quantitative inputs (risk components):
 - Probability of default (PD)
 - Loss given default (LGD)
 - Exposure at default (EAD)
 - Maturity (M)

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Then we have another approach that is called the IRB approach in the IRB approach the bank basically calculate the credit risk on the basis of different inputs internally. The internal rating based approach is basically combines the quantitative inputs provided by the banks and formulas specified by the committee.

There is a committee which the bank can formulate and the bank can use that are already the Basel committee has recommended as given certain formula or bank can also use their own approach, to calculate this particular kind of inputs and those inputs can be used to calculate the credit risk of the commercial bank.

Then what are those input what the commercial banks need for the calculation of the credit risk, then it the probability of default, this should need the loss given default then the exposure at default then the maturity of that particular asset. So, if all those four dimensions are available then what the commercial banks can do? The commercial banks can use these particular inputs to calculate the credit risk the calculation of probability of default, loss given default and exposure of default little bit needs more statistical derivation.

So, we are not discussing in detail about this, but these are the inputs which are required to calculate the credit risk of the commercial bank, if they are going for the IRB approach and those kind of components can be generated by the bank itself or they can use the formula, which is specified by the Basel committee already.

So, once those things are considered, those data is available then you can use those data for calculation of the credit risk of that particular commercial bank or what is the probability that the loan may not be recovered or there is a probability that there is a counterparty default. So, those things are basically calculated, once those inputs are available with the banks.

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Market Risk

- Interest rate risk, Price risk and reinvestment risk
- Standardised method
 - the standards of the Committee
- Internal models
 - use banks' internal assessments
 - Value at Risk (VaR)

Systematic Risk

$$P = \frac{CF_t}{(1+r)^t}$$

Then we have another thing is the market risk. Already, if you remember in the beginning of the discussion, whenever we started this discussion about the different type of risk, what we have discussed, the market risk is basically systematic risk.

The market risk is basically a systematic risk. We have two types of risk; one is systematic and another one is unsystematic risk and already we have discussed that the systematic risk cannot be reduced through the diversification with, but unsystematic risk can be reduced by the diversification, because unsystematic risk is nothing, but the idiosyncratic risk, which is confined or specific to the specific entities, a specific organizations.

So, whenever we are discussing about the bank from the banking prospective, the market risk is nothing, but the interest rate risk, because once the interest rate changes, because of certain factors already we discussed in this particular course, that once the interest rate changes there is a probability the value of that particular asset will change, because every value is calculated on the basis of certain discounted way. So, interest rate change will affect the discount rate and as well as the cash flow. If the discount rate and cash flow, because the

value already we know that $P = \frac{CF_t}{(1+r)^t}$

So here, because of change in interest rate your cash flow may change your r may change, r is nothing, but the discount rate. So the, because of that if the value of that particular asset get changed. So, depend then; obviously, the particular total value the portfolio will change. If

the total value of the portfolio will change then what basically will happen the bank will be exposed towards more risk in terms of the interest rate fluctuations. Here, I just wanted to highlight certain things, that whenever we are talking about the interest rate risk.

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Market Risk

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 - Value at Risk (VaR)

Handwritten notes on the slide:

- bond
- Coupon
- Par value - Rs 1000
- Int. rate Risk
- Price Risk
- Reinvestment Risk

The interest rate risk has two component; one is your price risk and another one is the reinvestment risk. What does it mean? For example, the bank has issued a bond, one bond is there, bank has invested in the bond and there is a coupon involved in that bond. So, what is happening? For example, the par value will explain more, but here for example, the par value of the bond is 1000 rupees. The par value of the bond is the coupon is equal to 10 percent, par value of the bond is 1000 rupees, then what is happening? The coupon is paid annually, then what will happen that every year you will be getting 100 rupees.

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Market Risk

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 - Value at Risk (VaR)

Handwritten notes on the slide include:

- $P = \frac{100}{(1+r)^t}$
- $R = 10\%$
- $T = 10y$
- $CF = 100$
- 1.09
- 1.08
- $9\% \text{ rate} = 9\%$

So, if every year you are getting 100 rupees then what is happening, that 100 rupees already.

The price already you know. $P = \frac{CF_t}{(1+r)} + \frac{CF_t}{(1+r)^t} + \dots$ Let the term to maturity of the bond is 10 years then final year it is your c f 10 divided by 1 plus r to the power 10. So, this is the way it is calculated. So, what is happening, if this r is nothing, but the interest rate in the market or the discount rate.

So, in this example what we are doing 100 divided by 1 plus, let the market interest rate is 9 percent then this is 1.09 plus 100 divided by 1.09 to the power 2 so on and final year you will be getting back your par value, then you will be getting 1100 cash flow divided by 1.09 to the

power 10. $\frac{100}{(1+0.9)} + \frac{100}{(1+0.9)^2} + \dots + \frac{1100}{(1+0.9)^{10}}$ So, this is the way the price of the bond can be calculated, but once the particular 9 percent has changed then; obviously, what will happen? Let the 9 percent has decreased to 8 percent.

So, if it has become 8 percent value the bond will increase, that if the value of the bond will increase then what is happening the price risk will go down, because the value is increasing. So, in terms of price risk it is going to be down, but whenever this particular investor this 100 rupees what they get in every periodical basis whenever they want to reinvest that particular amount in the market, because the market interest rate has gone down, the reinvestment risk which basically will go up.

So, that is why the price risk and reinvestment risk do not go together. The price risk is increasing, the reinvestment risk will increase. If the price risk is increasing then the reinvestment risk will decline. So, because of that what is happening, the total value of the portfolio value or total capital value or total asset value of the particular bank is highly exposed towards the change in the interest rate in the market. So, that is why in general sense from the banking perspective, we call it the market risk.

So, now what is happening, there are different approaches Basel has recommended to calculate the market risk; one is your standardized method, another one is the internal method. One standardized approach they have given. This is the formula, this is the way the market risk you can calculate and another one is the internal models. You can also formulate on the basis of the banks, internal assessment and the method what they are calculating, they can use the value at risk method. What exactly the value at risk method is?

The value at risk method basically shows you how much maximum loss one particular organization can incur due to certain changes or due to interest rate changes, what is the maximum loss one particular organization can incur at a certain confidence or the significance level in a certain time period.

What is the maximum loss the organization can incur at a given confidence or significance level at a specific or given time period? I hope you understood, what do you mean confidence interval and significant level in the statistics. We use the confidence and significance level and if you are following a standard normal distribution then the values are basically fixed for example, if it is 10 percent we use the value 1.64, if it is 5 percent significance level, we call it, it is 1.96 like that.

So, here what we are trying to see using the value at risk, whenever the interest rate changes what is the maximum loss what that particular bank is going to incur due to the fluctuations in the interest rate, that you can calculate using the value at risk method and use that particular calculation to calculate the overall market risk, what that bank is basically expose towards. So, that is basically the standardized approach or the internal model the Basel has recommended.

So, the bank can go for already calculated formula what the Basel has given or they can use their own internal assessment to calculate this. There are different stock index approach and

other approaches or it can be used and as well as they can, because the stocks the particular banks beta also can be calculated. Already you know that what do you mean by the beta?

So, beta is basically the covariance between the return from the bank stock with the market return divided by the variance of the market return. So, this is the correlation between individual stock return of the bank with the market into standard deviation of the stock return into the standard deviation of the market return divided by the variance of the market return.

$$\beta = \frac{COV_{i,m}}{Var_m} = \frac{\rho_{\mathfrak{S}, \sigma_i \sigma_m}}{\sigma_m}$$

So, one standard deviation can be cancelled out the finally, you will find the correlation between market return and the individual stock of the bank into your sigma i m m will be cancelled sigma i by sigma m standard deviation of i f divided by standard deviation of f and another way also you can calculate it.

$$\rho_{i,m} \cdot \frac{\sigma_i}{\sigma_m}$$

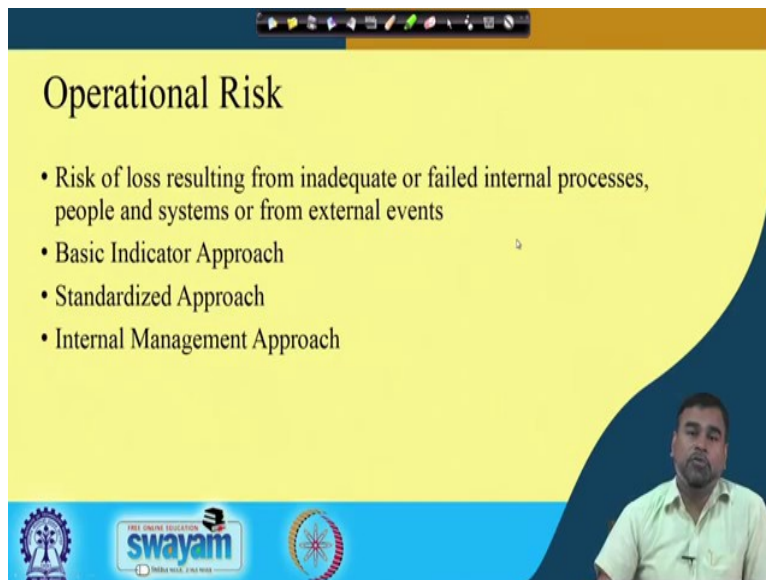
You can run regression the your depended variable is individual stock return of the bank is equal to a function of the market return and here I have already told you the market return can be any kind of market portfolio, it can be BSE 30 or BSE Sensex, it can be NSE nifty or also it can be any kind of stocks or any kind of index which are constructed on the basis of the bank stocks.

So, any kind of proxy you can use for the market portfolio then run the regression whatever slope coefficient you find. So, this is the way basically, you can specify the function

$R_i = \alpha + \beta R_m + u$ and here, we have beta, once the slope basically is the beta. This is basically also considered the market risk of that particular bank.

That is basically you called at the stock index approach, that can be applied to any company in that also that can be applied to the bank or you can use this all, those method value at risk and other method to find out the exposure towards the risk. Then we can move into the other type of risk, what the commercial banks always face.

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Operational Risk

- Risk of loss resulting from inadequate or failed internal processes, people and systems or from external events
- Basic Indicator Approach
- Standardized Approach
- Internal Management Approach

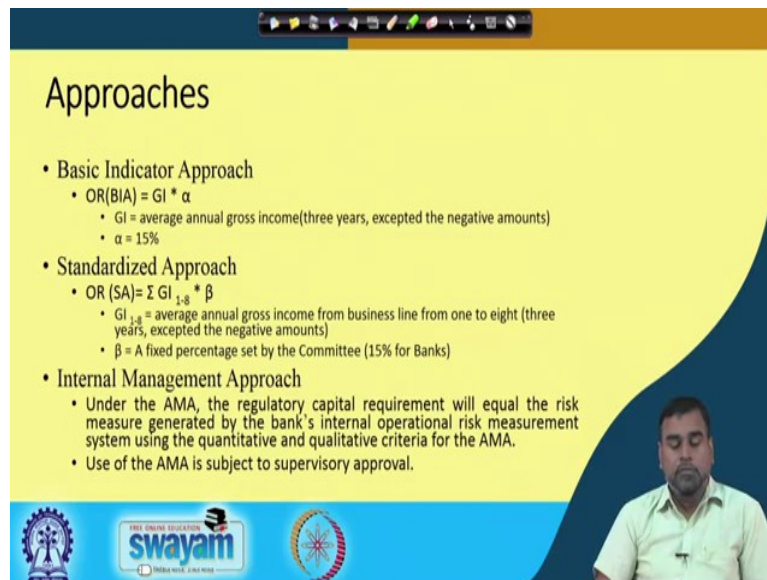
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And the most important type of risk in today's context is the operational risk. Very difficult to measure, but it has a very significant role, for the banks, because banks are highly exposed towards the operational risk. Then what do you mean by the operational risk? The operational risk is nothing, but the risk of loss resulting from an inadequate or failed internal process, people or the system or from the external events.

So, any kind of way it is if the, any kind of loss has been incurred by the banks due to certain kind of failure in terms of the process in terms of the people or in terms of the external events, which cannot be predicted before. So, then that particular bank is or that particular organization is exposed towards the operational risk.

So, there are three approaches for the Basel has recommended one is basic indicator approach, standardized approach, then internal management approach. These are the three different approaches which are recommended by the Basel committee to measure the operational risk of the commercial bank. And what are those approaches basically we always see.

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Approaches

- Basic Indicator Approach
 - $OR(BIA) = GI \times \alpha$
 - GI = average annual gross income (three years, excepted the negative amounts)
 - $\alpha = 15\%$
- Standardized Approach
 - $OR(SA) = \sum GI_{1-8} \times \beta$
 - GI_{1-8} = average annual gross income from business line from one to eight (three years, excepted the negative amounts)
 - β = A fixed percentage set by the Committee (15% for Banks)
- Internal Management Approach
 - Under the AMA, the regulatory capital requirement will equal the risk measure generated by the bank's internal operational risk measurement system using the quantitative and qualitative criteria for the AMA.
 - Use of the AMA is subject to supervisory approval.

So, you see if you go by the basic indicator approach according to Basel what this basic indicator approach is the operational risk in terms of basic indicator approach is here if you see $GI \times \alpha$. So, here what do you mean by the GI . GI is equal to the average annual gross income, basically three years, the expected negative amounts into α . α is fixed, which has been given by the Basel committee that is 15 percent ok.

Except this negative amount we do not consider, this is α is equal to 15 percent. So, then if you multiply that then, because of this α is basically shows the operational risk. So, because of this how much annual income is getting affected. So, that basically is one of the quantifiable indicator what the Basel has already recommended. Another approach they have given that is standardized approach.

So, here what is the standardized approach the same thing they the given that average annual gross income from business line from 1 to 8, that is again three years average multiplied by the β . So, again we also the β is fixed by the 15 percent little bit GI is different, but again the β component, because from the bank prospective it is 15 percent for the retail companies, it is different for other companies, it is different on the basis of the nature of the business, the β value gets changed.

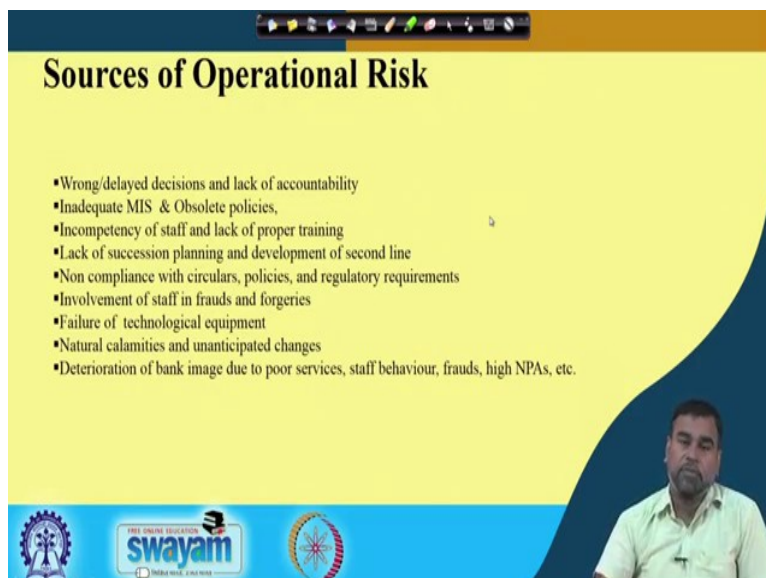
So, that β value was recommended by the Basel committee, only you have to calculate the average annual gross income from the business line from 1 to 8 for the 3 years. It is not the total annual income. It is the average annual gross income from business line from 1 to 8 and

then finally, what you can do you have to define those business lines and 1 to 8 business lines whatever income we are generating, that has to be considered for this analysis and you multiply with respect to that multiplier that is beta, that basically, give you that what kind of way the particular bank is getting affected, because of the operational risk.

You can use the internal management approach. Under this approach the regulatory capital requirement we recall the risk measures generated by the banks internal operational risk measurement system, using both the quantitative and qualitative criteria, but whenever you are using your own criteria to measure the operational risk, which is more practical in nature, whenever you are doing it you need the approval from the supervisory bodies in the context of India, we have to take the approval from RBI that what are those different approaches or different indicators you are using or any commercial bank is using to measure the operational risk of the commercial bank.

So, this is basically your internal management approach. So, whenever we are using internal management approach, it is very much required to understand, what are those different sources through which the operational risk arise and what are the reasons that the banks are exposed to the different type of operational risk.

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Sources of Operational Risk

- Wrong/delayed decisions and lack of accountability
- Inadequate MIS & Obsolete policies,
- Incompetency of staff and lack of proper training
- Lack of succession planning and development of second line
- Non compliance with circulars, policies, and regulatory requirements
- Involvement of staff in frauds and forgeries
- Failure of technological equipment
- Natural calamities and unanticipated changes
- Deterioration of bank image due to poor services, staff behaviour, frauds, high NPAs, etc.

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So, if you see the different sources of operational risk, there are many. One is wrong and delay decisions and lack of accountability. It is mostly we have, we can say that ethical

practices. There are some unethical practices if some employees will follow, that also lead to any kind of loss to the organization in the future. Already we have the examples.

There are, whether it is a financial fraud or non financial fraud in Indian market, also we have certain frauds which have taken place that is also part of the operational risk or any decision which needs immediate attention, which has a policy decision from within the bank has to be taken, to increase the efficiency of the operations.

If there is a delayed in the decision, it has a time value impact, there is a lack value impact that also finally, will affect the total overall performance of the banking system and finally, the operation risk may arise. Second is inadequate MIS; that means, management information system and obsolete policies. There are certain policies which are not at all existing or there are some new things, which have come into the existence in terms of accounting rules of, accounting standards and all this things.

Let the banks are using the old standards or old policies for their operations and they do not have proper I T system, which is in place which can increase the efficiency, then also this total efficiency gets affected and, because of that that is a loss of the value of the total profit or total kind of business what the banks are doing.

So, because of that also they are exposed to the more operational risk incompetency of staff, some staffs are efficient they may do the job in a less time and there are some staffs which are incompetent they may not understand the integrity of the operations, integrity of the complexity of that particular mechanism. So, in that context what is happening that also lead to inefficiency or lack of the proper training.

They may not have actually trained to make this particular thing possible in a small time period and as well as with a less time period, they can increase that particular or provide that kind of services to the customers. Lack of succession planning and development of second line if any kind of authorities is going to be retired like CEO, CFO and all this things and how the succession planning of that particular employees is made, whether adequate for suitable person is placed in that or not and whether really he is trained enough to make that particular business or not.

So, those things can also increases the operational risk of the bank. Non compliance with circulars policies and regulatory requirements you know that a for everything there is a

penalty if you are not able to comply all those kind of guidelines what RBI is giving or any central bank is giving, then you have to be imposed by high penalty and that also leads to the increase in the operational risk of the commercial bank.

Involvement of staff in frauds and forgery in Indian context also we have seen like PNB cases and some other cases where the frauds and all this things have taken place, because of that that has also the loss in terms of the market value of that particular company and as well as other things failure of the technological equipment. Sometimes you might have gone to the bank you say that this system is down, there is no internet and all this things.

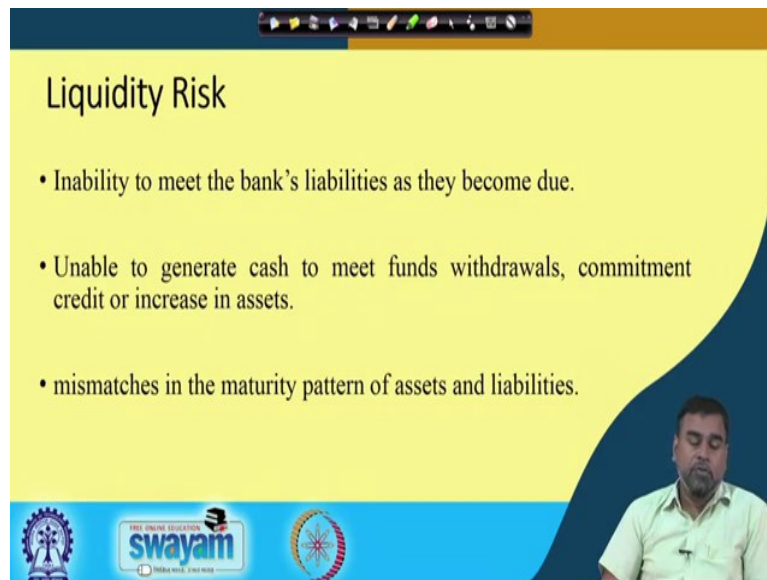
So, that will also decline this performance and, because of that the bank is more exposed towards the operational risk. Then natural calamities, a non anticipated changes that can be a theft. There can be anything any kind of crisis which may taken place which is beyond the control of the human being. So, that also will lead to the operational risk deterioration of banks image the brand value of the bank has gone down due to the poor services, behavior of the staff or the frauds or any kind of news related to the NPAs and all this things.

So, if those kind of thing has a filling among the customer, this bank is not good, that bank is good, because the services in that particular bank is good that bank is providing, better customer services. The work is done in a better way and work is done by taking less time to complete your work and other banks may be the process is lengthy or they are not that much attentive towards a customer requirements or customer needs. So, in that context also that lead to the operational risk.

So, if you observe all those points are highly subjective. So, measuring those kind of variables using a internal based approach is really a tedious job for the commercial bank and that is why operational risk is basically arise due to more on the behavioral factors or some factors which is uncertain and really difficult to measure from the banking perspective, but it is a very significant role for the total profit or the efficiency of the commercial bank.

So, because of that the importance of the operational efficiency or operational risk, in this banking system has gone up by many faults and people are much more concentrated or much more now, trying to analyze how the operational risk can be measured, considering all those sources what we discussed just now and try to find out how much the total gross income of the bank or gross profit of the bank is getting affected due to the more exposure towards this operational risk. So, this is the idea about the operational risk.

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Liquidity Risk

- Inability to meet the bank's liabilities as they become due.
- Unable to generate cash to meet funds withdrawals, commitment credit or increase in assets.
- mismatches in the maturity pattern of assets and liabilities.

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Then we can move to another type of important risk that is the liquidity risk which was introduced in the Basel three. What do mean by the liquidity risk? Liquidity risk arises, because if the bank is unable to meet the banks liability as they become due, whenever you have to pay this money, if you are not able to pay then customers demand is not entertain or could not be possible.

Then that leads to liquid risk unable to generate cash to meet the fund withdrawals, commitment, credit or increase in assets, you do not have enough cash. Whenever anybody goes to withdraw their money what about they have deposited with the bank is not able to pay them or they have committed to provide the loan to somebody, but they could not provide that loan that leads to the liquidity risk and mismatches in the maturity pattern of the assets and liabilities.

Because if you observe the liabilities are mostly short term and the assets are mostly long term. So, the banks, there is basically you called the inter temporal gap with the commercial bank. So, the bank always try to match that asset and liability using the different methods, but sometimes if the bank is not able to match this assets and liabilities then they are exposed to more liquidity risk.

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Approaches

Working Funds Approach

- Owned funds
The liquidity requirements will be nil.
- Deposits
 - (i) Volatile funds
 - (ii) Vulnerable funds
 - (iii) Stable funds.The liquidity requirements depend on the maturity profile
- Float funds
The liquidity requirements is highly sensitive

Cash Flows Approach

- Estimate anticipated changes in deposits.
- Estimate the cash inflows by way of loan recovery
- Estimate the cash outflows by way of deposit withdrawals and credit accommodations.
- Forecast these for the end of each period.
- Estimate the liquidity needs over the planning horizon.

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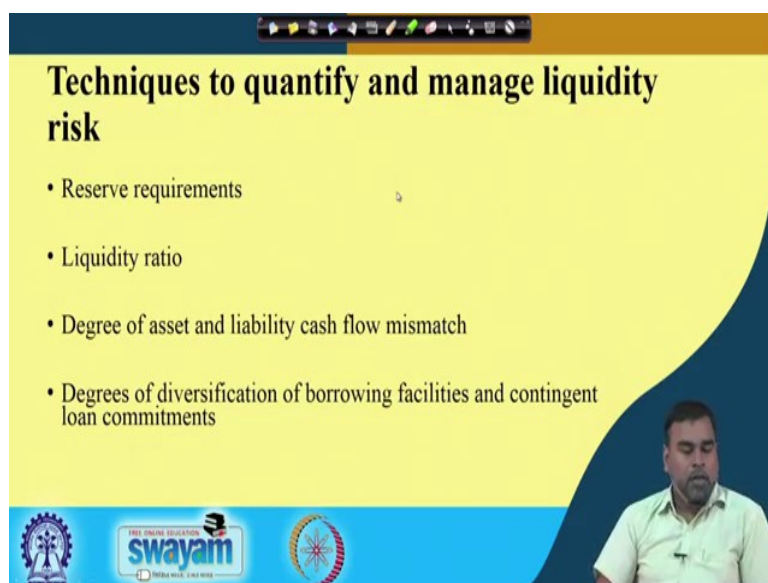
So, there are basically different approaches, we use to understand and to estimate this liquidity risk or to manage this liquidity risk. we have working funds approach, we have cash flow approach, we have to first understand how much is the own funds, then the liquidity requirement will be nil.

When the deposits we have to see how much is volatile, how much is very much vulnerable, and how much are the stable. Then the liquidity requirement will depend upon the maturity profile. The float funds in that case then liquidity requirement is highly sensitive like your current account in all this things.

So, in this context what we have to do, we have to estimate the anticipated changes in the deposits by looking the past data, estimate the cash flows by way of loan recovery, estimate the cash outflows by way of deposit withdrawals and credit accommodation, forecast all these variables in the end of each period and find out the estimate and try to calculate the liquidity needs in a particular planning horizon.

Every commercial bank has a policy to calculate how much liquidity they need in a particular time span and accordingly that much amount of money at that amount of cash has to be kept with them by that the liquidity requirements of the commercial, of the customers can be fulfilled and as well as the commercial bank will be less exposed towards the liquidity risk or they can manage this liquidity risk.

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Techniques to quantify and manage liquidity risk

- Reserve requirements
- Liquidity ratio
- Degree of asset and liability cash flow mismatch
- Degrees of diversification of borrowing facilities and contingent loan commitments

So, in this context how they can manage this? they can first see that, what is the reserve requirements, they have over the period they have to estimate that one. Then already this Basel committee has recommended to different ratios or can also use their own different ratios, current ratio and all these things. They have to see or net stable funding ratio and liquidity coverage ratio has to be estimated periodically, to see that whether we are really able to manage that liquidity risk or not, and degree of asset and liability mismatch.

How much is the mismatch we have, what are the possible strategies we can adopt to match that asset and liability that plan bank has to do and the degree of diversification of borrowing facilities and contingent loan commitments. If they have committed something, but they feel that they are not able to do that then for that whether they may do that or they may not do that, but before that they have to ensure what kind of contingency plan they have in their hand.

So, if you see all those things the regular forecasting of the liquidity requirements and maintaining the adequate amount of liquidity ratio, within the commercial bank can reduce the liquidity risk and by that the commercial banks are able to manage that and as well as the fulfill the customers' requirements. So, this is what basically the overview of the different type of risk, what the commercial banks face and as well as how those particular risk are measured or may be analyzed from the Basel accord prospective or Basel norms prospective.

So, this is about the different issues which has related to the commercial bank and we have just discussed about the different themes or different major things, which are related to this, but in depth discussion maybe if somebody will study the commercial banking or management of commercial banking they will read more about the methods and all this things or quantification method and all. That is beyond of scope of this particular subject.

But this is the overall idea what you can generate on yourself to understand the banking as a aggregate prospective or we can say that, the prospective which can encourage the more discussion on this and this is what about the commercial banking and further we will discuss, will be discussing about some other important institutions which work in the financial system and more particularly with reference to India.

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Please go through this particular references, for this particular session. Thank you.